
September 1997

AIR FORCE DEPOT MAINTENANCE

Information on the Cost-Effectiveness of B-1 and B-52 Support Options





**United States
General Accounting Office
Washington, D.C. 20548**

**National Security and
International Affairs Division**

B-277724

September 12, 1997

The Honorable Don Nickles
United States Senate

Dear Senator Nickles:

This report responds to your request for information about programmed depot maintenance of five B-1B aircraft under contract with Boeing North American, Inc., and Boeing's proposal to reengine the B-52 fleet. Specifically, you asked us to compare the cost of performing depot maintenance on five B-1B aircraft at Boeing's Palmdale, California, facility to the estimated cost of performing similar work at the Oklahoma City Air Logistics Center. You also asked us to analyze the differences between Boeing's proposal (and associated projected savings) to reengine the B-52 fleet and the subsequent Air Force analysis and projected costs of implementing the proposal.

As you requested, we briefed your staff on the results of our work on May 15, 1997. This report summarizes and updates the information presented in that briefing.

Background

The Department of Defense (DOD) spends about \$13 billion—5 percent of its \$250 billion fiscal year 1997 budget—on depot maintenance activities.¹ Over \$4 billion of this amount is spent on Air Force systems and equipment. Most of the Air Force's depot maintenance work is performed at five depots that are located at its five air logistics centers.²

In 1990, the Air Force determined it could not meet the full depot maintenance requirement for 23 B-1B aircraft per year at the Oklahoma City Air Logistics Center without adding personnel or offloading other aircraft workload to contractors. The center awarded a sole-source contract to Rockwell International Corporation,³ the B-1B manufacturer, to perform programmed depot maintenance on about 5 aircraft per year, leaving 18 aircraft to be repaired at the air logistics center. At the time, the

¹Over \$1 billion of this amount is procurement funding (rather than operation and maintenance funding) for contractor logistics support, interim contractor support, and some software maintenance.

²Two of the air logistics centers—Sacramento and San Antonio—were identified for closure during the 1995 base closure and realignment process.

³The Boeing Company acquired several Rockwell Aerospace and Defense businesses, including the North American Aircraft Division of Rockwell International in December 1996.

Air Force anticipated that contractor support would decrease and eventually the entire annual B-1B workload would be repaired at the center. The original depot maintenance contract (1-year contract with 4 option years) expired at the end of fiscal year 1995. At that time, the Oklahoma City Air Logistics Center was ready to assume the entire workload. However, because of uncertainties surrounding the 1995 base closure and realignment process and the resulting need to maintain two sources of repair, a contract extension was awarded to Rockwell for fiscal year 1996. Subsequently, the Air Force awarded an additional contract extension for five aircraft for fiscal year 1997, with an option for the same number in 1998.

In June 1996, Boeing North American, Inc., submitted to the Air Force an unsolicited proposal for reengining 94 aircraft in the B-52 fleet. Boeing proposed modernizing the B-52 fleet by replacing the current TF-33 engines with a commercial engine through a long-term leasing agreement, and providing fixed-cost, privatized maintenance based on the number of hours flown each year. Boeing initially projected reengining cost savings of about \$6 billion, but later revised the projected savings to \$4.7 billion to reengine 71 B-52s. In the fiscal year 1997 Department of Defense Appropriation Act conference report, Congress asked the Secretaries of Defense and the Air Force to examine the costs, technical risks, schedule, cost savings, and procurement policy implications of leasing new engines for the B-52 fleet compared with (1) maintaining the current engines and (2) purchasing new engines.

Results in Brief

In fiscal years 1995 and 1996, the Air Force paid twice as much for each B-1B aircraft repaired under contract as the Oklahoma City depot estimated it would have cost that depot to repair the same aircraft.⁴ The Air Force paid approximately \$19 million for five aircraft repaired by Rockwell in each of the 2 fiscal years, compared to about \$9 million estimated for similar repair of five aircraft in the depot each year. In 1996, when the Oklahoma City depot had the capability to repair the 5 aircraft that were contracted out in addition to the 18 it already repaired each year, the B-1B program office considered allocating the entire annual requirement to the depot. Confronted with this situation and other factors,

⁴While B-1B data used in this report generally refers to the price charged the customer rather than cost data reflected in the Center financial data, Oklahoma City Air Logistics Center financial data indicates that the Center performed B-1B maintenance for less than the customer was charged for fiscal years 1995, 1996, and thus far in 1997.

the contractor reduced the B-1B contract price from \$18 million to \$11 million—about 39 percent.⁵

We estimate that in fiscal years 1997 and 1998 the Air Force could have saved approximately \$5.3 million by consolidating the B-1B depot maintenance work at the Oklahoma City Air Logistics Center. This is \$4.5 million more than the Air Force projected it could save over that same period if the five aircraft repaired at Boeing were consolidated with B-1B's being repaired at the Oklahoma depot. The two factors most significantly influencing this difference are the impact of overhead savings at the Boeing facility and at the depot.

Boeing's unsolicited proposal to reengine the B-52 fleet would cost the Air Force approximately \$1.3 billion rather than save approximately \$4.7 billion as Boeing projected. An Air Force team formed to study Boeing's proposal analyzed the lease and purchase alternatives and concluded that both options are cost prohibitive compared to maintaining the existing TF-33 engines. On April 15, 1997, DOD reported to Congress that implementing Boeing's reengining proposal is not cost-effective. Risks such as the length of the lease, termination liability, and indemnification made Boeing's proposal unacceptable. Additionally, the Institute for Defense Analysis projected that implementing the Boeing proposal would cost the Air Force \$1 billion. Faced with continuing pressure to modernize the fleet, the Air Force is currently exploring alternatives for modernizing all TF-33 engines. The Air Force has awarded contracts to three engine manufacturers to explore modernization options and expects to develop a rank-ordered list of alternatives by January 31, 1998.

Agency and Contractor Comments and Our Evaluation

The Air Force, Office of the Secretary of Defense (OSD), and Boeing provided comments to our draft report. Specifically, in oral comments, Air Force officials said the Air Force was unable to reconcile its analysis with our analysis. The following provides a summary of the differences between the Air Force and our estimates:

- Our estimate of \$7.9 million programmed depot maintenance costs for the depot was \$600,000 more than the Air Force estimate. We based our estimate on price data projected for the depot for a work package

⁵These figures reflect the negotiated contract price, which does not include over and above costs. Over and above costs are associated with work that is discovered during the course of performing overhaul maintenance and repair that is within the general scope of the contract, not covered by the line items for basic work, and necessary to satisfactorily complete the contract.

comparable to the Boeing B-1B aircraft.⁶ Oklahoma City financial data shows that the depot accomplished B-1B programmed depot maintenance workloads during fiscal years 1996 and 1997 for less than the price charged the customer.

- Our \$5.4 million estimate for contractor overhead savings reflects Boeing's reassessment of potential cost avoidance for other B-1B programs resulting from continuing to perform programmed depot maintenance on the five B-1B aircraft at the Palmdale facility. The Air Force estimate of \$8 million did not reflect this reassessment.
- The Air Force's estimates for Oklahoma City reflected overhead savings of \$1.5 million for only 1 year. Since a 2-year overhead cost avoidance was used for the contractor, we used a comparable time period for the depot and estimated a savings of \$3.1 million. Further, using more current financial management information, a reassessment of the overhead savings to other Oklahoma City workloads from adding five B-1B aircraft to the depot would be \$4.1 million over the 2-year period, rather than \$3.1 million as previously estimated.
- For property disposal, we used actual contract data, rather than an estimated amount as used by the Air Force. The resulting cost difference was \$0.3 million.

After accounting for these differences in cost and savings, we estimated net savings of \$5.3 million by accomplishing the repairs in the Oklahoma City depot versus the Air Force's estimate of \$800,000.

OSD questioned our use of maximum potential capacity as an indicator of excess capacity at the Oklahoma City depot. Officials stated that to measure capacity and project excess capacity, DOD uses criteria established in the DOD Maintenance Capacity and Utilization Measurement Handbook. They noted that maximum potential capacity, which is not recognized by the handbook, is determined using a theoretical and historical basis that is frozen in time and does not reflect current force structure, tasking requirements, or the downsizing of equipment and facilities since the 1995 Base Realignment and Closure (BRAC) process.

We recognize that measuring capacity based on the handbook procedures provides a different perspective of capacity utilization than using maximum potential capacity. It also requires updating projections made during 1995 to account for increases and decreases in facilities and equipment. However, capacity measurement based on the handbook

⁶Since B-1B aircraft at the Oklahoma City depot includes some tasks not accomplished at Boeing's Palmdale facility, the depot's standard work package is larger than the contractor's work package.

criteria constrains equipment and facility utilization by the availability of personnel to operate the equipment. In preparing for the BRAC process, DOD recognized that this measure does not reflect facility and equipment utilization and that using it would obviate an analysis of the potential for more cost-effectively using existing equipment and facilities. As DOD and the BRAC Commission concluded in BRAC 1995, using the capacity measure cited in the DOD handbook understates the potential for improving equipment and facility utilization through the consolidation of similar workloads. For example, using this criteria, in 1996 the Oklahoma City depot operated at 91-percent capacity utilization with only 9-percent excess capacity, while hundreds of pieces of industrial equipment stood idle or were greatly underutilized, and buildings and sections of buildings were unused. Using maximum potential capacity, which more accurately reflects the potential for facility and equipment utilization, the Oklahoma City depot was operating at 55 percent of its capacity in 1996. We continue to believe that maximum potential capacity more accurately reflects facility and equipment utilization at this activity.

Evaluation of Contractor Comments

Boeing officials made several observations regarding our B-52 reengining information. For example they noted that we did not perform any independent analysis. Our scope and methodology reflects that fact. Our objective was to review Boeing's proposal and subsequent Air Force analysis to determine the basis for the differences between the two. Boeing officials also said that we did not give proper attention to the fact that the Institute for Defense Analyses (IDA) study shows significant savings if operational benefits are included. Our report specifically mentions IDA's views that requirements for tanker support could be reduced by reengining the B-52 fleet.

Concerning the currency of our information, Air Force officials told us that its analysis of Boeing's most recent estimate of B-52 reengining costs was \$100 million more than the estimate we reviewed. Since the most recent estimate was higher than the estimate we reviewed, it would not have changed our conclusion concerning the cost-effectiveness of B-52 reengining.

Scope and Methodology

In conducting our work on the B-1B issue, we obtained information from and interviewed officials of the Oklahoma City Air Logistics Center, Tinker Air Force Base, Oklahoma; the Air Force Audit Agency, Wright-Patterson Air Force Base, Ohio; and the Defense Contract Management Command

and the Defense Contract Audit Agency, Seal Beach, California. We also interviewed and obtained information from officials of Boeing North American Aircraft Division, Seal Beach and Palmdale, California. To develop our comparison of the cost of having aircraft repaired under contract by Boeing to the cost of repairing the aircraft at the depot, we asked Oklahoma City Air Logistics Center personnel to estimate their cost of performing programmed depot maintenance on the aircraft, identified by specific tail number, scheduled to be repaired by Boeing during fiscal years 1997 and 1998. We also asked center personnel to calculate the impact on the center's overhead rates of bringing the aircraft into the depot for repair. We reviewed the Oklahoma City calculations and determined them to be reasonable based upon actual cost data and overhead savings estimates that were developed using the same procedures used in supporting our prior reviews.⁷

To develop information on Boeing's B-52 reengining proposal and the Air Force's analysis, we obtained information and interviewed officials at Air Force Headquarters, Washington, D.C.; the Oklahoma City Air Logistics Center, Tinker Air Force Base, Oklahoma; Air Force Materiel Command Headquarters, Wright-Patterson Air Force Base, Ohio; Boeing Defense and Space Group, Wichita, Kansas; and the Institute for Defense Analyses, Alexandria, Virginia. We did not prepare our own analysis of Boeing's proposal. Rather, we reviewed Boeing's proposal and subsequent Air Force analysis to determine the basis for the differences between the two.

While both the B-1B and B-52 analyses used price rather than cost information, the Oklahoma City Air Logistics Center financial data indicates the depot showed a profit for both of these programs in fiscal years 1996 and 1997.

We conducted our review between November 1996 and July 1997 in accordance with generally accepted government auditing standards.

We are sending copies of this report to the Secretaries of Defense and the Air Force; the Director, Office of Management and Budget; and interested

⁷Air Force Depot Maintenance: Privatization-in-Place Plans Are Costly While Excess Capacity Exists ([GAO/NSIAD-97-13](#), Dec. 31, 1996) and Depot Maintenance: Uncertainties and Challenges DOD Faces in Restructuring Its Depot Maintenance Programs ([GAO/T-NSIAD-97-111](#), Mar. 18, 1997, and [GAO/T-NSIAD-97-112](#), Apr. 10, 1997).

congressional committees. Copies will be made available to others upon request. If you have any questions, please contact me at (202) 512-8412. Major contributors to this report are listed in appendix I.

Sincerely yours,

A handwritten signature in black ink that reads "David R. Warren". The signature is written in a cursive style with a long horizontal flourish extending to the right.

David R. Warren, Director
Defense Management Issues

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Abbreviations

AWACS	Air Warning and Control System
BRAC	Base Realignment and Closure
DOD	Department of Defense
GE	General Electric
IDA	Institute for Defense Analyses
OSD	Office of the Secretary of Defense

B-1B Programmed Depot Maintenance

GAO Background

- Air Force could not initially meet the depot maintenance requirement for 23 B-1B aircraft.
 - Sole source contract awarded to Rockwell for fiscal year 1991 (with 4 option years).
 - All contract options exercised through fiscal year 1995.
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In 1990, it was not practical for the Air Force to meet the depot maintenance requirement of 23 aircraft per year in its organic depot. In fiscal year 1990, the Air Force awarded a 1-year time and materials contract with 4 option years to Rockwell International, the original B-1B manufacturer, to perform depot maintenance on the aircraft that could not be repaired in the depot. All options were exercised on the original contract through fiscal year 1995. The number of aircraft repaired by Rockwell during this period varied from two to seven per year. According to the Air Force, the contract was awarded on a sole-source basis because Rockwell was the only firm with the skilled technical expertise, facilities, support equipment, and certified technicians capable of working on the B-1B's complex egress system. This system contains over 700 parts that work together to ensure a safe ejection process for the four flight crew members.¹ At the time the contract was awarded, the Air Force anticipated that over time contractor support would decrease and become unnecessary. The Oklahoma City Air Logistics Center currently repairs about 18 of the 23 aircraft required per year. For fiscal year 1996, the Air Force awarded a 1-year contract extension to Rockwell International. In extending the contract, the Air Force cited uncertainties surrounding the 1995 base closure and realignment process and the resulting need to maintain a second source of repair for the B-1B.

¹This is a very complex repair wherein the tolerance for components is extremely narrow and parts must pass inspection at each step of the supply/installation process. There is a zero mistake allowance for life support systems.

GAO Contractor B-1B Repair Estimated to Be More Costly

- The Air Force paid twice as much per aircraft repaired by Boeing (formerly Rockwell) when compared to estimated costs of performing the same repairs in the depot.

Briefing Section I
B-1B Programmed Depot Maintenance

In fiscal years 1995 and 1996, the Air Force paid twice as much per B-1B aircraft repaired under contract as the cost estimated by Oklahoma City depot officials to repair the same aircraft at the depot. The Oklahoma City estimates were based on actual costs for performing repairs at the Center for the same tasks included in the contract work package. The Air Force paid approximately \$19 million for five aircraft repaired by Rockwell in each of the 2 fiscal years, compared to about \$9 million estimated by Oklahoma City depot officials for the same work.

GAO Depot Ready to Assume Entire B-1B
Workload

- As of 1996, Oklahoma City Air Logistics Center was capable of assuming the entire B-1B depot maintenance workload.
 - Depot officials planned to augment the second shift to reduce flow days to accommodate five additional B-1Bs.
 - In fiscal year 1999, B-1B programmed depot maintenance requirements will decrease from 23 to 18 aircraft per year.
-

Briefing Section I
B-1B Programmed Depot Maintenance

As of fiscal year 1996, the Oklahoma City Air Logistics Center had the capability to accomplish the full B-1B depot maintenance workload of 23 aircraft without hiring additional employees. Depot officials plan to augment the second shift with 95 additional employees to decrease the flow days² on other aircraft. This would accommodate 5 additional B-1B aircraft for a total of 23. In fiscal year 1999, the B-1B depot maintenance schedule will be extended from 4 years to 5 years, reducing the yearly depot maintenance requirement for B-1B aircraft to 18 aircraft per year (the depot's current annual workload).

²Flow days refers to the number of days required to move an aircraft through the entire depot repair process.

GAO Potential Competition From Depot
Contributed to Boeing Lowering Price

- Potential competition from Oklahoma City Air Logistics Center and changes in the work requirements contributed to Boeing lowering its price for fiscal year 1997.
 - Boeing reduced its negotiated contract price from \$18 million in fiscal year 1996 to \$11 million in fiscal year 1997 (about 39 percent) for B-1B programmed depot maintenance.
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Briefing Section I
B-1B Programmed Depot Maintenance

Boeing reduced its contract price for B-1B depot maintenance by about 39 percent for fiscal year 1997 (from about \$18 million to about \$11 million).³ The reduction in Boeing's price can be attributed to differences in the condition of the aircraft to be repaired in 1997, changes in work requirements, and Boeing's efforts to reduce its costs in light of the Air Force's assertions that the air logistics center was ready to assume the entire B-1B workload.

³These figures reflect the negotiated contract price, which does not include over and above costs. Over and above costs are associated with work that is discovered during the course of performing overhaul, maintenance and repair that is within the general scope of the contract, not covered by the line items for basic work, and necessary to satisfactorily complete the contract.

GAO Air Force Cited Uncertainty and Need
for Second Source of Repair

- The Air Force extended the contract with Boeing for fiscal year 1997 (with an option for 1998).
 - Justification cited uncertainties surrounding the recommended closure and possible privatization-in-place at other air logistics centers and the need to maintain a second source of repair for 2 more years.
-

Briefing Section I
B-1B Programmed Depot Maintenance

In their "Justification for Other Than Full and Open Competition," dated October 1996, Air Force officials cited uncertainty over depot workloads associated with BRAC decisions and privatization-in-place. Air Force officials decided that due to the uncertainty and resulting difficulty in forecasting the future ability to meet B-1B depot maintenance needs, it was necessary to maintain a second source for depot maintenance for 2 more years. The Air Force negotiated a firm-fixed price contract extension with Boeing for fiscal year 1997, with an option for fiscal year 1998.

GAO Air Force Comparison Showed Little
Difference in Cost

- Air Force comparison based on data available at the time showed relatively little difference in cost.
 - Our analysis based on updated information showed that the Air Force could save \$5.3 million in fiscal years 1997 and 1998.
-

Briefing Section I
B-1B Programmed Depot Maintenance

The Air Force analysis, prepared in July 1996, based on the best information available at the time indicated that it would cost about \$800,000 more over the 2-year period to have the five B-1B aircraft repaired under contract with Boeing than at the depot. This reduction in the cost difference between the Oklahoma City depot and the contract price combined with the desire to maintain two sources of repair resulted in the Air Force's decision to award the contract extension to Boeing. Our analysis, prepared in June 1997, incorporates updated information and shows that the Air Force could have saved approximately \$5.3 million in fiscal years 1997 and 1998 by having the five B-1Bs repaired within the depot.

GAO Comparison of Air Force and GAO Analysis

Cost elements	Air Force analysis (June 1996)	GAO analysis (June 1997)
PDM cost difference	\$7.3	\$7.9
Impact on contractor overhead rates	(8.0)	(5.4)
Impact on depot overhead rates	1.5	3.1
Property disposal for fiscal year 1996	(1.0)	(1.2)
Property disposal for fiscal year 1998	1.0	0.9
Total	\$0.8	\$5.3

We estimate that the Air Force could have saved a total of \$5.3 million in fiscal years 1997 and 1998 by consolidating the B-1B depot maintenance workload at the Oklahoma City Air Logistics Center, compared to the Air Force's estimate of \$800,000. We compared the contract cost of depot maintenance for 10 aircraft, by aircraft tail number, scheduled for repair at Boeing in fiscal years 1997 and 1998 to the Oklahoma City depot's estimated cost of doing similar work. Boeing provided us an updated estimate of potential costs that would be applied to other Boeing B-1B programs if the 5 B-1B contract repair aircraft were repaired at the Oklahoma City depot rather than at Palmdale. The updated estimate reduced from \$4 million to \$2.7 million per year the potential costs on other programs (or \$5.4 million over the 2-year period) compared to \$8 million shown in the Air Force analysis. Further, the Air Force's analysis included the impact on overhead rates at the depot for fiscal year 1998 only, while we included the impact on overhead rates for both fiscal years in our analysis.

GAO Boeing's Price Still Exceeds Price at
Oklahoma City Air Logistics Center

- Even with Boeing's reduced price, the Air Force could have saved a total of approximately \$5.3 million in fiscal years 1997 and 1998 if B-1B PDM work had been consolidated in the depot.
 - Boeing's reduced price still exceeds the depot price by an average of \$847,000 per aircraft in fiscal year 1997 and \$747,000 per aircraft in fiscal year 1998.
-

Briefing Section I
B-1B Programmed Depot Maintenance

Even after reducing their price by 39 percent, the price of repairing five B-1B aircraft per year at the contractor facility still exceeded the estimated price of doing the same work at the Oklahoma City depot. The contract price exceeded the depot's estimated price of performing similar work by an average of about \$847,000 per aircraft in fiscal year 1997 and about \$741,000 per aircraft in fiscal year 1998. While this data reflects the price charged not the cost of performance, the Oklahoma City depot's financial data indicates that the depot accomplished B-1B repair work for less than the projected price in 1995, 1996 and 1997, indicating the cost was less than the price.

GAO Price Differences Result From a
Variety of Factors

- Differences in contract and depot prices are attributed to a variety of factors, including higher labor hour rates, higher standard hours, inefficiencies of such a small workload, and contractor's profit.

Briefing Section I
B-1B Programmed Depot Maintenance

Program officials told us that the differences between the contract and depot prices can be attributed to a variety of factors, including higher labor hour rates, higher standard hours, and the inefficiencies of such a small workload. In addition, the contractor builds a profit into the negotiated contract price.

GAO **Second Source Locations Add to Cost
of Depot Repair Programs**

- We have previously reported that performing the same work at two locations results in additional costs to the government.

Briefing Section I
B-1B Programmed Depot Maintenance

In our report on the Navy's decision to discontinue F/A-18 repairs at the Ogden Air Logistics Center,³ we commented that additional costs to the government are incurred when the same work is performed at two depots. As a result of DOD's recognition of the advantages of single-siting depot maintenance workload, it has consolidated numerous depot maintenance workloads that had previously been split among two or more depot activities. For example, in response to declining requirements and criticisms for maintaining duplicate sources of repair, the Department of Defense (DOD) has consolidated engine maintenance of each of the military services at a single location.

³Depot Maintenance: The Navy's Decision to Stop F/A-18 Repairs at Ogden Air Logistics Center (GAO/NSIAD-96-31, Dec. 15, 1995).

Reengining May Prove Too Costly

GAO Boeing Projects Reengining Proposal Will Save Air Force Billions

- Boeing proposed reengining the B-52s, replacing the TF-33 engines with commercial engines in June 1996.
 - Boeing planned to replace the TF-33 engines with leased commercial engines and provide full "power-by-the-hour" support.
 - Boeing's unsolicited proposal projected cost savings of about \$6 billion (later revised to \$4.7 billion).
-

Briefing Section II
Reengining May Prove Too Costly

In June 1996, Boeing presented an unsolicited proposal to the Air Force for reengining the B-52 fleet. Boeing's proposal included modernizing the B-52 fleet by replacing the TF-33 engines with the Allison/Rolls commercial RB-211 engine through a long-term leasing agreement and providing a fixed-cost, privatized maintenance concept through a "power-by-the-hour" arrangement. Under this arrangement, the contractor would provide fixed-cost, privatized maintenance based on the number of hours flown each year. The proposal also included an option to purchase rather than lease the engines. The Boeing proposal projected cost savings of about \$6 billion for reengining 94 B-52s. Boeing later revised its estimated savings to \$4.7 billion based on the Air Force's plans to maintain the B-52 fleet at 71 aircraft.

GAO Air Force Determined Reengining
Proposals Not Cost-Effective

- Air Force analysis concluded that reengining would cost \$1.3 billion. Costs and other risks such as termination liability made Boeing's proposal unacceptable.

Cost of lease option - \$9.9 billion

Cost to retain TF-33 - \$8.6 billion

- Air Combat Command agreed that the proposal was not cost-effective.
-

The Air Force analyzed the lease and purchase alternatives and concluded that both options are cost-prohibitive compared to maintaining the current engine. Maintaining the existing TF-33 engines would cost \$8.6 billion (in then-year dollars) over the remaining life of the program. The Air Force team formed to study the proposal estimated that implementing Boeing's proposal would cost \$9.9 billion (in then-year dollars). Implementing Boeing's proposal would result in a net cost of approximately \$1.3 billion. In addition, other risks such as the length of the lease, termination liability, and indemnification also made Boeing's proposal unacceptable. On April 15, 1997, DOD reported to Congress that implementing Boeing's reengining proposal was not cost-effective. The Air Combat Command, the end-user of the B-52, agreed that while Boeing's proposal would provide operational and logistical benefits, it was not affordable as structured.

Subsequent to this report to Congress, Boeing revised its proposal. Air Force officials told us that the Air Force analysis of a more recent Boeing estimate of B-52 reengining costs determined that the cost of the revised proposal was \$1.4 billion—\$100 million more than the previous estimate. In a July 9, 1997, letter to the Chairman of the Senate Armed Services Committee, the Air Force Chief of Staff stated that the Boeing B-52 reengining proposal proved to be \$1.4 billion more expensive than maintaining and, in the future, enhancing the TF-33 engines. It also noted that the proposed termination liability for the program was unaffordable. The letter concluded that based on this data, the Air Force will not reengine the B-52.

GAO Differences Can Be Attributed to Four Factors

- Differences between Boeing's \$4.7 billion savings and Air Force's \$1.3 billion cost estimates can be attributed primarily to four factors:
 - fuel inflation rate--\$1.1 billion
 - OSD inflation rate--\$1.7 billion
 - engine removal rate--\$1.3 billion, and
 - engine unit repair costs--\$1.1 billion.
-

Four factors account for about 86 percent of the difference between the Boeing and Air Force estimates: fuel inflation rates, Office of the Secretary of Defense (OSD) inflation rates, total engine removal rates, and engine unit repair costs. Boeing used a fuel inflation rate of 4.8 percent in developing its proposal. Using the OSD fuel inflation rate as the baseline, the Air Force team projected a most probable fuel inflation rate of 3.09 percent. The different fuel inflation rates account for about \$1.1 billion of the difference in the Boeing and Air Force estimates. In estimating the inflation rate, Boeing considered the OSD-approved factor, but added 1 percent in its calculation. The Air Force used the OSD factor, resulting in a difference of \$1.7 billion between the two estimates.

Differences in the engine removal rate for the Boeing and Air Force estimates accounted for approximately \$1.3 billion of the total difference between the two estimates. In calculating the total engine removal rate, Boeing used TF-33 replacement rate data for the last 6 years. This data included engines that were brought into the depot early for the engine rejuvenation modification program. Air Force officials stated that using removal rate data for only 6 years when the removal rate for part of that period was artificially high because of this modification program, did not provide an accurate projection of the engine removal rate. To get a more accurate projection, Air Force officials used a statistical average based on 26 years of historical data. This data also included engines that had been through the rejuvenation program.

To estimate the cost for maintaining the existing TF-33 engines for the remaining life of the B-52 program, Boeing surveyed commercial engine manufacturers to determine their price to overhaul the TF-33 engine. The Air Force did not agree with the contractor's approach. Air Force officials told us that only 14 percent of the TF-33 engines returned to the depot require a complete overhaul and there is a different cost for less than a complete overhaul. The Air Force analysis of unit repair costs for the TF-33 used actual sales rate data for the TF-33 engines in fiscal year 1997, excluding engines modified through the engine rejuvenation program. The Air Force estimate for repair costs of the TF-33 was about \$1.1 billion less than the Boeing estimate.

GAO Institute for Defense Analyses Projects
Costs Similar to Air Force Estimate

- The Institute for Defense Analyses (IDA) projects that implementing the Boeing proposal would cost the Air Force \$1 billion.
 - IDA also explored the potential for reducing the size of the tanker fleet as a result of reengining the B-52s, but the Air Force disagrees with that assessment.
-

Preliminary briefings prepared by IDA show that it estimates that implementing Boeing's proposal will cost the Air Force about \$1 billion in then-year dollars.¹ IDA projected some savings when it considered potential reductions in the number of tanker aircraft needed to support the reengined B-52 fleet. IDA projected that reengined B-52s would be able to fly for longer periods without refueling, thereby reducing the requirement for tanker support. However, the Air Force disagrees with IDA's tanker analysis. The Air Force's position is that the tanker fleet is overstressed and any potential reductions in the number of tankers required to support B-52s will simply relieve some of the stress on the tanker fleet. We did not assess the validity of IDA's tanker analysis or the Air Force response for this report. However, we have previously examined the services' air refueling needs and reported that demands on the tanker fleet have not diminished since Operation Desert Storm.² We also noted that the drawdown of U.S. forces from overseas bases has added to air refueling requirements because of the need to refuel U.S.-based tactical aircraft to enable them to reach overseas destinations, perform their missions, and return.

¹The IDA study will not be finalized until late summer.

²U.S. Combat Air Power: Aging Refueling Aircraft Are Costly to Maintain and Operate (GAO/NSIAD-96-160, Aug. 8, 1996).

GAO Air Force Now Exploring Other
Alternatives

- Under continued pressure to modernize the fleet, the Air Force is now exploring other options.
- Air Force preparing an engine roadmap study to develop and evaluate propulsion system modernization alternatives for the TF-33 engine.

Briefing Section II
Reengining May Prove Too Costly

Faced with continuing pressure to modernize the fleet, the Air Force has begun exploring other alternatives. For example, it recently began preparing an engine roadmap study to develop and evaluate modernization alternatives for the TF-33 engine. This study, which is not limited to the B-52, will allow engine manufacturers to present alternatives for modernizing the TF-33. Options may include modifying the existing TF-33 engines, reengining all aircraft equipped with the TF-33, and revising the current maintenance concept. The expected cost of the study is about \$950,000.

GAO Three Engine Manufacturers
Participating in Roadmap Study

- Air Force awarded contracts to Pratt & Whitney, GE, and Allison/Rolls to explore options for modernizing all aircraft equipped with the TF-33 engine.
 - Study includes 4 airframes--B-52, E-3, E-8, and C-135 (about 342 aircraft).
 - Expected completion--January 1998.
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Briefing Section II
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The Air Force awarded contracts to three engine manufactures—Pratt and Whitney, General Electric (GE), and Allison/Rolls Royce—in June 1997. The engine manufacturers are to include all aircraft equipped with TF-33 engines in their study. This will encompass 4 different airframes—B-52, E-3, E-8, and C-135—for a total of about 342 aircraft. The engine manufacturers are to submit their alternatives by November 30, 1997. The Air Force evaluation is expected to be completed by January 31, 1998, resulting in a rank-ordered listing of all alternatives.

GAO Other Studies on Reengining Aircraft
With TF-33 Engines

- Recent Air Force studies on reengining E-3 and B-52 aircraft showed that reengining is not a cost-effective option for these aircraft.
 - Reengining the KC-135 aircraft proved to be the most cost-effective option available to alleviate tanker shortfalls.
-

Other studies conducted by the Air Force on reengining aircraft have shown that reengining is not a cost-effective option. For example, the Air Force completed a study on reengining the E-3 aircraft in September 1996. This study concluded that reengining was not cost-effective and recommended rejuvenating the TF-33s to ensure airworthiness for the life of the Air Warning and Control System (AWACS) program. As discussed earlier in this report, the Air Force's B-52 study, completed in April 1997, concluded that Boeing's proposal would cost \$1.3 billion and, although it offered some operational and logistical benefits, is simply not cost-effective.

In some situations, reengining has proven to be the most cost-effective option. For example, in the 1970s, the Air Force initiated a program that has resulted in reengining 406 KC-135 aircraft with the CFM-56 engine to give the aircraft greater fuel efficiency and extend its range to alleviate tanker shortfalls. Additionally, we reported in 1992 that replacing the TF-33 engine on the RC-135 aircraft offered significant savings.³

³Intelligence Programs: New RC-135 Aircraft Engines Can Reduce Cost and Improve Performance (GAO/NSIAD-92-305, Aug. 25, 1992).

GAO Eliminating TF-33 Workload Will
Increase Cost and Excess Capacity

- Preliminary analysis shows that removing the TF-33 workload from the depot would increase the depot's overhead rates by about \$4.42 per labor hour.
 - In addition, removing 1 million direct labor hours of TF-33 work from the depot, without bringing in work to replace it, would increase excess capacity at the Oklahoma City depot.
-

Briefing Section II
Reengining May Prove Too Costly

Removing the TF-33 workload (about 1 million hours) from the Oklahoma City Air Logistics Center workload would result in increasing the depot's overhead rates by about \$4.42 per labor hour in fiscal year 1998. This would increase the operations and maintenance cost to customers for the remaining workload performed by the depot by about \$31 million annually. In addition, the loss of 1 million direct labor hours of workload at the Oklahoma City Air Logistics Center would further increase its excess capacity. The center's excess capacity is already projected to be 41 percent by 1999. The removal of 1 million direct labor hours would increase the center's excess capacity to almost 50 percent⁴ using maximum potential capacity and projected workload for fiscal year 1999.

⁴This estimate is based on maximum potential capacity using workload projections for 1999, excluding the potential movement of workloads from the San Antonio Air Logistics Center.

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