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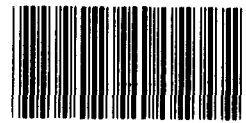
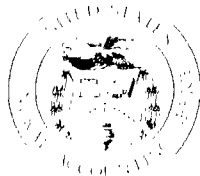
United States General Accounting Office

Briefing Report to the Chairman,
Committee on Armed Services, House of
Representatives

June 1990

NAVY MAINTENANCE

Improvements Needed in the Aircraft Engine Repair Program



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

National Security and
International Affairs Division

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June 18, 1990

The Honorable Les Aspin
Chairman, Committee on
Armed Services
House of Representatives

Dear Mr. Chairman:

In response to discussions with your office, we reviewed the Navy's aircraft engine repair program. Our specific objectives were to determine whether (1) charges for engine repairs were supportable and reasonable and (2) opportunities existed for reducing labor and material costs. This briefing report summarizes the results of our work, which were provided to your staff during a meeting earlier this year.

Background

Five Naval Aviation Depots overhaul most of the engines that power the Navy's airplanes and helicopters. In fiscal year 1989, the depots performed depot level maintenance on over 2,200 engines. This work generated revenues of about \$243 million, or about 14 percent of the depots' revenues from all programs.

The depots are industrial fund activities operating under the Naval Air Systems Command (NAVAIR). Industrial fund activities, established by the Department of Defense with the approval of the Congress in 1949, use working capital funds rather than annual appropriations to finance the cost of goods and services provided to customers. The customers use annual appropriations to reimburse these activities for work performed. The financial goal of industrial fund activities is to break even, that is, to cover costs without experiencing a gain or loss.

The Navy's operating forces are the depots' primary customers for the engine repair program. On the basis of the needs of these forces, NAVAIR determines engine depot maintenance requirements and administers the repair program.

Subject to NAVAIR review and approval, the depots develop prices for each type of engine repair. Prices are to be based on a labor standards program that indicates how many labor hours each type of repair should require. These labor hour estimates are to be multiplied by each depot's estimated hourly operating cost to arrive at a labor price. Estimated material costs are to be added to the labor price to determine a

total repair price. Ideally, this pricing process should result in the depots' being reimbursed at a level that approximates the actual cost of the repairs.

Results in Brief

Our review indicated that the Navy did not provide sufficient management review and controls to ensure that engine repair prices were reasonable in view of actual labor hour and material expenditures. As a result, the depots charged their customers \$101 million more for labor and material during fiscal years 1987, 1988, and 1989 than was justified by actual expenditures.

We found that the Navy had not taken full advantage of opportunities to lower labor costs by examining significant differences in the labor hours charged customers by different depots to perform the same repair tasks on the same type of engine. Further opportunities exist to lower material costs by requiring all depots to limit material orders to the maximum quantities of parts required for each engine repair.

Navy officials concurred with the results of our review and indicated that the Navy actions planned or already underway reflect a commitment toward correcting the problems identified.

Excessive Charges for Engine Repairs

Rather than breaking even on engine repairs, as intended by the industrial fund concept, the depots charged customers \$35.8 million more for labor and \$65.6 million more for material than was justified by actual expenditures during fiscal years 1987, 1988, and 1989. The excessive charges were caused by limited management oversight and review and by problems in the process the depots used to develop labor hour and material estimates.

For example, the labor hour portion of repair prices often was based on outdated or unsupported labor standards. Further, inaccuracies existed in other factors, such as repair frequency and planned efficiency data, used by the depots to arrive at the final labor hour estimate charged to customers. As a result, the labor hour estimates used for pricing often bore little resemblance to the number of labor hours actually used in the past to perform the work.

Similarly, the process used to determine the material portion of the repair prices also resulted in material estimates that did not approximate historical material costs. Since fiscal year 1984, material estimates

have been developed by applying a percentage adjustment to the previous year's material estimate regardless of any changes in actual material requirements for individual engine types. As a result, engine material estimates in most cases differed significantly from actual material expenditures.

Although responsible for the review and approval of depot labor hour and material estimates, NAVAIR has not performed a detailed review of the proposed estimates for the past 4 years.

Opportunities for Reducing Labor Costs for Dual-Sited Engine Repairs

Significant differences existed in the labor hour estimates developed by different depots to perform the same repair tasks on dual-sited engines (engine models repaired by two depots). Such differences can present opportunities for reducing labor costs if the processes or methods used to accomplish a task by the less costly depot can be adopted by the more costly depot. Lower labor costs, in turn, can reduce customer charges and ultimately reduce customer appropriations that fund the engine repair program.

While recognizing that such opportunities exist, NAVAIR has not taken full advantage of this method of reducing labor costs for engine repairs. In many cases, one depot charged up to twice as many labor hours as another depot to accomplish the same repair tasks such as engine induction, disassembly, reassembly, testing, and preservation and packing. Such differences existed largely because NAVAIR had not (1) ensured that the depots were complying with existing guidance to coordinate when developing labor hour estimates for dual-sited engines, (2) followed up on past depot study recommendations for obtaining greater consistency in the repair of dual-sited engines, and (3) ensured that significant labor variances for common repair tasks were analyzed with a goal of sharing more efficient repair processes whenever possible.

Opportunities for Reducing Material Costs in the Engine Repair Program

Additional opportunities exist for reducing material costs for engine repairs. Material initiatives at two depots appeared successful in reducing material costs by restricting material orders to no more than the maximum quantity of parts required for each engine repair. Our tests at the three depots without this initiative showed that from 10 to 25 percent of the material requisitions reviewed was for material exceeding maximum usage quantities or for material not usable at all on the engine charged for the material. While the benefits from improved

controls over material have been long recognized, NAVAIR management has been slow to implement material initiatives at all depots.

New Navy Initiatives Appear to Address Issues

After we brought the issues identified during our review to their attention, NAVAIR officials began taking steps to address the issues. For example, to ensure the reasonableness of engine repair prices, greater management emphasis was placed on implementing planned improvements to the depots' labor standards program. Management teams were formed to study ways to improve the process for developing labor hour estimates. In addition, NAVAIR initiated a new review process that requires justification for proposed labor hour estimates that differ significantly from historical labor hour expenditures. The impact of this new review will be first seen in the labor estimates to be used in the fiscal year 1992 budget submission. NAVAIR also initiated changes in developing material cost estimates so that they will be better matched with historical usage rates.

To take advantage of opportunities for reducing labor and material costs for engine repairs, NAVAIR initiated efforts to better coordinate dual-sited engine repairs to ensure that the most efficient processes are used at both depots performing the same engine repairs. In addition, NAVAIR endorsed the material initiative to limit material orders to the maximum quantities required for each engine repair. However, a specific plan to implement the material initiative at all depots had not been developed at the time of our review.

Conclusions and Recommendations

We believe that the depots' engine repair prices should more accurately reflect the actual number of labor hours and material costs required to accomplish repairs. We also believe that opportunities exist to reduce labor and material costs in the engine repair program.

To ensure that corrective actions are fully implemented, we recommend that the Secretary of the Navy direct the Commander, NAVAIR, to report on the status of these actions periodically until they are fully implemented. This report should specifically include, but not be limited to, comments on the status of efforts to

- improve the labor standards program to ensure that labor hour estimates for engine repairs are valid;

- improve the accuracy of factors, such as repair frequency and planned efficiency data, used to arrive at the final labor hour estimate charged customers;
- consider historical labor hour expenditures in developing labor hour estimates for future years;
- ensure that the depots comply with guidance to coordinate development of labor hour estimates for dual-sited engine repairs so that the most efficient repair processes are used at both depots; and
- implement a material initiative at all depots that limits material orders to the maximum quantities of parts required for each engine repair.

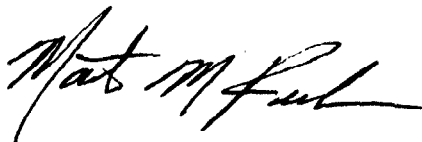
Agency Comments

As requested, we did not obtain official agency comments on this report; however, we did discuss the results of our work with Defense and Navy officials. The officials concurred with our conclusions and recommendations. They said that the actions already taken or planned reflected a commitment toward correcting the problems identified.

We are sending copies of this report to the Chairmen, Senate Committee on Governmental Affairs, House Committee on Government Operations, Senate Committee on Armed Services, and Senate and House Committees on Appropriations; the Director, Office of Management and Budget; and the Secretaries of Defense and the Navy.

Appendix I provides further details on the results of our work; appendix II sets forth our objectives, scope, and methodology; and appendix III lists the staff members who made major contributions to this report. If you have any questions about the matters discussed in this briefing report, please call me on (202) 275-6504.

Sincerely yours,



Martin M Ferber
Director, Navy Issues

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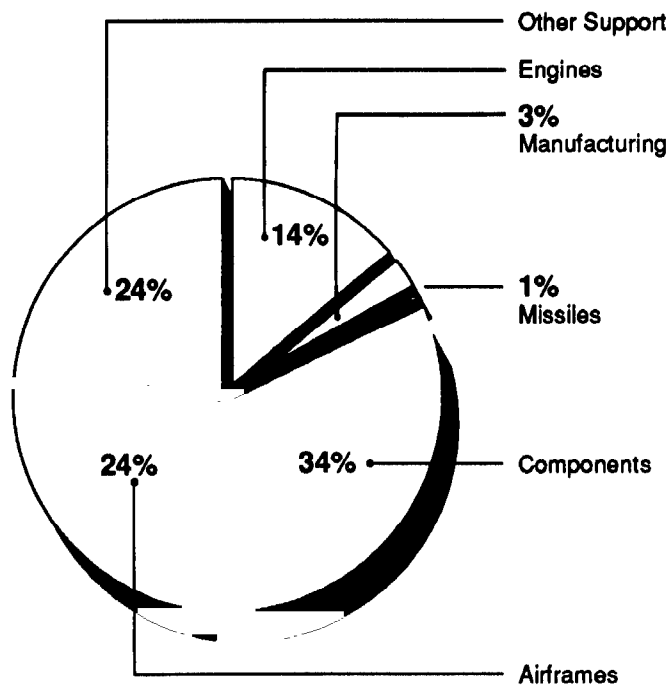
Abbreviations

GAO	General Accounting Office
NADEP	Naval Aviation Depot
NAVAIR	Naval Air Systems Command

Engine Repair Costs Can Be Reduced

The Naval Aviation Depots (NADEPS) are industrial fund activities operating under NAVAIR. They perform depot-level maintenance on engines, airframes, aircraft components, and missiles. On the basis of total revenues, the engine repair program accounted for about 14 percent of the workload in fiscal year 1989. Figure I.1 shows a percentage breakdown of the NADEP workload by major activity.

Figure I.1: NADEP Workload for Fiscal Year 1989

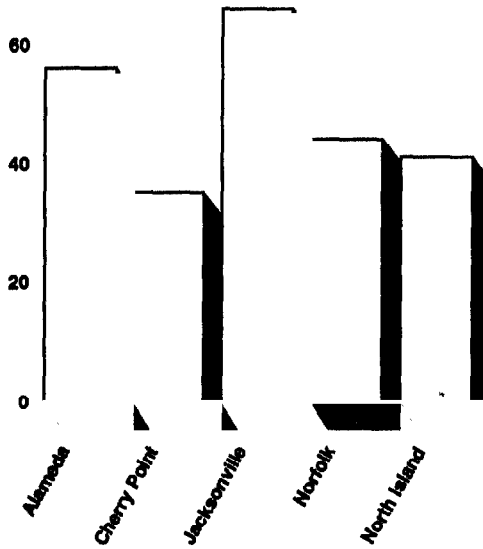


Five of the six NADEPS participate in the engine repair program. In fiscal year 1989, engine repairs accounted for revenues of about \$243 million at the five NADEPS. Figure I.2 shows the engine repair revenues for each NADEP.

Appendix I
Engine Repair Costs Can Be Reduced

Figure I.2: Engine Repair Program
Revenues, Fiscal Year 1989

80 Dollars in Millions



Some types of engines are repaired at only one NADEP. Other types are dual-sited or repaired at two NADEPs. Table I.1 provides details on the types and quantities of engines repaired at each NADEP.

**Appendix I
Engine Repair Costs Can Be Reduced**

Table I.1: Primary Engine Workload by NADEP

NADEP	Primary engines	Dual-sited	Number repaired in fiscal year 1989	Aircraft using engine
Alameda	J-52	Yes	169	A-4, A-6
	T-56	Yes	93	P-3, C-130
	TF-34	Yes	70	S-3
	501	No	30	C-131
Cherry Point	T-58	Yes	200	H-3, H-46
	F-402	No	58	AV-8B
	J-79	No	56	F-4
	T-76	No	91	OV-10
	T-400	No	87	H-1
Jacksonville	F-404	Yes	115	F-18
	J-52	Yes	290	A-4, A-6
	TF-34	Yes	44	S-3
	TF-41	No	85	A-7
Norfolk	T-56	Yes	104	P-3, C-130
	TF-30	No	229	F-14
	J-57	No	13	F-8
North Island	F-404	Yes	235	F-18
	T-58	Yes	151	H-3, H-46
	T-64	No	129	H-53

Excessive Charges for Engine Repairs

The engine repair program generated revenues of about \$850 million for the NADEPs from fiscal years 1987 to 1989. The revenues were not reasonable in view of actual labor and material expenditures. Instead of breaking even on engine repairs, as intended by the industrial fund concept, the NADEPs charged customers \$101 million more for labor and material than was actually used for engine repairs. Table I.2 shows the excessive labor and material charges for each NADEP.

Table I.2: Excessive Labor and Material Charges, Fiscal Years 1987 to 1989

Dollars in millions

NADEP	Labor	Material	Total
Alameda	\$4.7	\$4.9	\$9.6
Cherry Point	7.1	12.8	19.9
Jacksonville	17.2	13.9	31.1
Norfolk	2.8	17.0	19.8
North Island	4.0	17.0	21.0
Total	\$35.8	\$65.6	\$101.4

Excessive charges in the NADEPS' engine repair program have been caused by a lack of management review of NADEP labor hour estimates prior to incorporating the estimates into the budget and by problems in the process used to develop labor hour and material estimates. Problems in the process used by the NADEPS to develop engine repair labor hour estimates included (1) the use of outdated, unsupported labor standards, (2) inaccurate estimates of the frequency of repair operations, and (3) lack of criteria and support for estimates of plant efficiency.

The process used to develop material cost estimates has not been based on historical material usage since 1984. Instead of a historical basis, the material estimate has been developed by applying a percentage adjustment to the previous year's material estimate regardless of any changes in actual material requirements for individual engine types. As a result, engine material estimates in most cases differed significantly from actual material expenditures.

Although responsible for the review and approval of NADEP labor hour and material estimates used to determine repair prices, NAVAIR has not performed a detailed review of the proposed estimates for the past 4 years. For the most part, estimates proposed by the NADEPS were incorporated directly into the budget. Internal reorganizations and staffing problems were blamed for the lack of management oversight.

Opportunities for Reducing Labor Costs

Significant differences existed in the labor hours charged customers by different NADEPS to perform the same repair tasks on the same engine type. Although NAVAIR guidance requires the NADEPS to coordinate their efforts in developing labor hour estimates for dual-sited engine repairs, such coordination generally has not occurred.

One notable exception concerned the repair of a T-56 engine module dual-sited at Alameda and Norfolk. In this case, Norfolk reviewed Alameda's more efficient repair process for the T-56 rear bearing support assembly. Although Alameda's process was not completely adopted, Norfolk made some process changes and it projects the changes will save \$108,000 annually in reduced labor costs.

Table I.3 shows two examples of differences in the hours charged in fiscal year 1990 for the same repairs on the same type of engine.

**Appendix I
Engine Repair Costs Can Be Reduced**

Table I.3: Examples of Differences in Charges for the Same Engine Repair

Example 1: J-52-P8B Major Repair	Alameda	Jacksonville	Difference
Labor hours for core elements			
Induction process	44	30	14
Disassembly	19	49	30
Final assembly	42	89	47
Test	52	44	8
Preservation and packing	10	7	3
	167	219	52
Labor hours for subassemblies	763	521	242
Total standard labor hours	930	740	190
Planned efficiency	88%	82%	6%
Total hours charged to customer	1,056	903	153
Example 2: T-58-GE10 Repair	Cherry Point	North Island	Difference
Labor hours for core elements			
Induction process	5	25	20
Disassembly	9	7	2
Final assembly	36	24	12
Test	10	16	6
Preservation and packing	14	1	13
	74	73	1
Labor hours for subassemblies	227	290	63
Total standard labor hours	301	363	62
Planned efficiency	87%	88%	1%
Total hours charged to customer	345	413	68

Opportunities for Reducing Material Costs

Material initiatives at the Norfolk and Alameda NADEPs appear successful in reducing material costs by restricting material orders to no more than the maximum quantity required for each engine repair. The Norfolk NADEP estimated annual material savings of \$3.8 million from its initiative limiting engine material orders.

Our tests at the three NADEPs without such an initiative showed that from 10 to 25 percent of the material requisitions reviewed was for material exceeding maximum usage quantities or for material not usable at all on the engine charged for the material. Table I.4 summarizes the results of our tests for material orders exceeding maximum quantities required for engine repairs done at the five NADEPs.

Table I.4: Excess Material Orders for Engine Repair Work

NADEP	Initiative in place	Number of orders reviewed	Orders exceeding maximum required		
			Number	Percent	Value
Alameda	yes	45	3	6.6	\$857
Norfolk	yes	45	1	2.2	58
Cherry Point	no	146	17	11.6	17,783
Jacksonville	no	125	31	24.8	126,328
North Island	no	125	13	10.4	24,954

New Navy Initiatives Appear to Address Issues

After we briefed NAVAIR officials on the initial results of our review, NAVAIR undertook an internal review to look at the same areas. This internal review confirmed to NAVAIR that the issues we identified warranted management attention. In response, NAVAIR has taken or has planned the following actions to address the issues.

- Management emphasis has been given to implementing improvements to the NADEPs' labor standards program and new guidance for the program should be issued by the end of June.
- Management teams were formed to study ways to improve the process the NADEPs used to develop labor hour estimates for engine repairs.
- A new NAVAIR review process was implemented, which will analyze proposed labor hour estimates in light of historical labor hour expenditures. This new review process should help ensure that labor hour charges closely approximate actual labor hour requirements for the repairs. The impact of this review will be first seen in the labor estimates to be used in the fiscal year 1992 budget submission.
- In coordination with the Navy Comptroller, NAVAIR changed the process used to develop material cost estimates so that the estimates will better approximate actual material costs.
- New emphasis was being placed on the need to coordinate dual-sited engine repairs to ensure that the most efficient processes are used at both NADEPs performing the same repairs. Labor hour estimates for dual-sited engines also will be reviewed for consistency during the new NAVAIR review process.
- NAVAIR has endorsed the material initiative to limit material orders to the maximum quantities required. However, a specific plan to implement the material initiative at all NADEPs had not been developed at the time of our review.

Objectives, Scope, and Methodology

Our objectives were to determine whether (1) charges for engine repairs were supportable and reasonable and (2) opportunities existed for reducing labor and material costs. We interviewed officials and reviewed relevant documents at NAVAIR headquarters, Washington, D.C.; Naval Aviation Depot Operations Center, Patuxent River, Maryland; and the five NADEPS in Alameda, California; Cherry Point, North Carolina; Jacksonville, Florida; Norfolk, Virginia; and North Island, California.

To review the supportability and reasonableness of engine repair pricing, we reviewed the two principal determinants of repair prices: labor hour estimates and material estimates. Specifically, to determine whether the labor and material estimates charged customers approximated actual labor and material expenditures, we compared the number of labor hours and the amount of material charged customers with the number of labor hours and material actually used, according to the Navy's management reports, for fiscal years 1987 through 1989. In addition, to test for accuracy and compliance with Navy guidance, we analyzed the procedures the NADEPS used to develop labor hour and material estimates for engine repairs.

Throughout the review, we also identified the internal controls used in the engine program to ensure reasonable repair prices and to help provide management oversight.

To evaluate opportunities for reducing labor costs, we focused on differences in the labor hour estimates for the same repair tasks on dual-sited engine repairs. To do this, we selected and reviewed the labor hour estimates for the repair of three dual-sited engines: the T-56 engine repaired by Alameda and Norfolk, the T-58 engine repaired by Cherry Point and North Island, and the J-52 engine repaired by Alameda and Jacksonville. These engines were selected because they represented a stable and sizable workload at the NADEPS for the past several years.

For the selected dual-sited engines, we compared the NADEPS' description of work for the major repair tasks, analyzed the differences in the labor hour estimates made by each NADEP for the same repair tasks, and discussed with NADEP managers and engineers possible reasons for significant differences in labor hour estimates for the same tasks. We also reviewed the results from past Navy efforts to reduce the cost of dual-sited engine repairs.

To assess opportunities for reducing engine material costs, we reviewed the results from recent material initiatives at the Alameda and Norfolk

NADEPS. Although differing slightly in the procedures used, both initiatives attempted to reduce material costs by limiting material orders to the maximum quantities of each part that could be used on a given engine. To assess the benefits from these initiatives, we made tests at each NADEP visited to determine whether excess material was being ordered. We then compared the test results at Norfolk and Alameda with the test results at the other NADEPS that did not have the material initiative.

Our review was made in accordance with generally accepted government auditing standards and was performed between June 1989 and May 1990.

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