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# General Accounting Office

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## Improved Management Of Maintenance Manuals Needed In DOD

DOD is experiencing increasing difficulty in managing its burgeoning maintenance manuals. Each military service has been independently designing and developing its own systems for issuing its manuals and attempting to correct manual problems. These individual service activities and costs have been duplicated and results have not been satisfactory.

To correct these conditions, GAO recommends assigning management responsibility to one office within each service and to one office in DOD which would have overall responsibility for managing manuals throughout DOD. DOD agreed and promised corrective action.



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UNITED STATES GENERAL ACCOUNTING OFFICE  
WASHINGTON, D.C. 20548

LOGISTICS AND COMMUNICATIONS  
DIVISION

B-165961

The Honorable Harold Brown  
The Secretary of Defense

Dear Mr. Secretary:

This report describes longstanding problems that the Department of Defense has had in managing its maintenance manuals and suggests improvements. The Department agreed with our conclusions and recommendation.

The report contains a recommendation to you on page 29. As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the House Committee on Government Operations and the Senate Committee on Governmental Affairs not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

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

Sincerely yours,

A handwritten signature in cursive script, reading "R. W. Gutmann".

R. W. Gutmann  
Director

D I G E S T

The Department of Defense (DOD) spends an estimated \$20 billion annually to maintain weapons systems and equipment valued at hundreds of billions of dollars. Maintenance manuals provide instructions indispensable for repairing and maintaining this equipment or "hardware."

The Air Force, for example, spends about \$70 million a year to issue about 4,000 new manuals and 36,000 changes, revisions, and supplements. Currently, the military services have a total of over 131,000 aviation manuals alone, containing about 13 million pages. The manuals, sometimes called technical orders or technical manuals, generally include books, microfilm, and microfiche. (See p. 1.)

( DOD has allowed each of the services to manage its own programs and design and develop independently its own systems for issuing and updating its manuals. As a result, there has been duplication in products and in expenditures. ) (See p. 22.)

Although GAO concentrated its review on aircraft manuals, it also gathered information on manuals used for other DOD systems, such as missiles and ships. GAO believes the basic issues concerning aircraft maintenance manuals apply to all DOD maintenance manuals. (See p. 4.)

GAO found that maintenance manuals often were not easy to use, not current, and not accurate. Earlier DOD studies identified the same deficiencies. These deficiencies prevent maintenance staff from doing their jobs in an effective and efficient manner

which, in turn, can adversely affect equipment readiness and reliability and could affect safety of equipment and personnel. (See p. 5.)

Each of the services independently spent millions of dollars to develop and to try new methods for handling manuals. However, the new methods either were unsuccessful or only partially successful in meeting services' needs. (See p. 10.)

For example, the Air Force developed a microfilm system for use in aircraft maintenance about 1 year after the Navy had started developing a similar system. Both services experienced similar problems with color and photo illustrations and oversize pages, but they did not attempt to solve them by working together. Currently the services are doing studies and tests which have the potential for further duplication. (See pp. 15 and 23.)

Unlike the Navy and Air Force, the Army established a centralized management program for its maintenance manuals and assigned responsibility to one command. (See p. 27.)

Considerable research and testing to find the most effective and efficient maintenance manual system should be encouraged. With funds and personnel scarce, efforts should be closely managed to prevent duplication and redundancy within and between services.

DOD could improve maintenance manual management by giving one office in each service management responsibility for all manuals within that service, similar to the Army's central manager, and by giving one office in DOD overall DOD-wide responsibility for maintenance manual program policy and oversight. This could improve the use of funds and materials and bring about efficiencies and economies not realizable at present. (See p. 22.)

The potential for savings from improved manuals is significant. The Air Force, which spends in excess of \$3.6 billion a year on maintenance, estimated it could avoid costs of \$108 million annually by improving manuals so that maintenance personnel would spend less time searching for information and removing aircraft parts that are not defective. (See p. 6.)

At the conclusion of GAO's review, the Secretary of Defense had a reorganization study underway at the request of the President. The study's objective was to improve the efficiency and responsiveness of DOD's organization and management by identifying and eliminating unnecessary overlap, fragmentation, and operating redundancies. (See p. 28.)

Maintenance manuals are a logical choice for reorganization to accomplish this objective. All maintenance manual programs in each service should be placed under one office in each service and under the overall management of one office in DOD. (See p. 28.)

#### RECOMMENDATION

The Secretary of Defense should assign responsibility for the management of all maintenance manual programs to one office at the DOD level. That office should have the authority to provide overall program policy and guidance to minimize duplication of efforts and direct research, development, testing, and evaluation efforts to change or improve technical manual programs. As a prerequisite to placing overall responsibility in one office, however, a central manager should be established in each of the military services, similar to the Army's central manager, with management responsibility over all manuals within each service. (See p. 29.)

#### AGENCY COMMENTS

DOD officials agreed with GAO's findings, conclusions, and recommendation and promised corrective action, although they were undecided at that time concerning specific corrective measures to be taken. They advised GAO of several efforts planned or underway which they hoped would improve maintenance manuals, such as assigning the Army DOD-wide responsibility for developing uniform standards and specifications to be used in preparing maintenance manuals.

While these efforts appear to be a step in the right direction, the corrective action should include, as a prerequisite, adoption by the Air Force and Navy of the Army's single command control over maintenance manuals. However, a need would still exist at the DOD level for overall program policy setting, guidance, and monitoring. (See p. 29.)

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ABBREVIATIONS

DOD	Department of Defense
GAO	General Accounting Office
OSD	Office of the Secretary of Defense

## CHAPTER 1

### INTRODUCTION

{ The Department of Defense (DOD) spends over \$20 billion annually to maintain systems and equipment valued at hundreds of billions of dollars. It also spends hundreds of millions of dollars to procure, distribute, and update maintenance manuals. The Air Force, for example, spends an estimated \$70 million a year to issue approximately 4,000 new manuals and 36,000 changes, revisions, and supplements. The manuals, sometimes called technical orders, generally include books and microforms, such as microfilm and microfiche. Further, more important considerations, such as an effective national defense and the safety of personnel, coupled with the multi-billion dollar investment in military hardware and hardware maintenance, make it quite apparent that manuals must be accurate, timely, and readily understood.

The increasing complexity of DOD aircraft and weapons systems in recent years has resulted in a corresponding increase in the number, complexity, and cost of manuals. For example, the Navy's A-3 aircraft, built around 1955, required about 69,000 pages of technical information, while the F-14, built around 1975, required about 380,000 pages. In 1978 the military services had over 131,000 aviation maintenance manuals containing about 13 million pages as follows.

<u>Service branch</u>	<u>Number of manuals</u>	<u>Number of pages</u>
Air Force	<u>a/102,000</u>	10,000,000
Navy (note b)	26,300	2,600,000
Army	<u>3,400</u>	<u>500,000</u>
Total	<u>131,700</u>	<u>13,100,000</u>

a/Predominately aircraft manuals.

b/Includes Marine Corps.

As aircraft and weapons systems became more complex and the maintenance data to support them multiplied, the manpower, storage space, and costs to maintain the paper data became prohibitive. Of more concern, however, was the difficulty of assuring that paper data distributed to users was complete, accurate, and maintained to current specifications.

In an effort to solve these problems, DOD turned to microform, a process of reproducing printed matter in a much



reduced size either on microfilm or microfiche. Microfilm is a roll of film bearing photographic images, while microfiche is a sheet or card containing photographic images. Both have to be magnified on a viewing device--usually called a reader or reader printer--to be read.

Microform manuals have certain advantages over paper manuals, i.e., cartridges of film or microfiche cards are easier to keep up-to-date than numerous individual paper pages, microform is more economical than paper, and less space is needed to store the manuals. For example, about 93,500 pages needed for one type of aircraft require about 10 cubic feet of storage space, while the same data can be stored on 71 microfilm cartridges requiring only 0.7 of a cubic foot.

Paper manuals are converted to microform by filming them on a 16-mm master microfilm. The master film is then duplicated and sent to users. Both the Navy and Air Force have used roll film in aircraft maintenance, while the Army has used microfiche cards. Each cartridge of film holds from 2,400 to 3,000 paper manuals pages, usually enough to accommodate several manuals. A microfiche card can contain 98 pages.

To use microform, the maintenance technicians must first identify the cartridge or microfiche card containing the manual which has the desired information. Then they insert the microfilm cartridge or microfiche card into a reader or reader printer that is usually kept in the maintenance work area. The reader printer can print a paper copy of a page if one is needed.

Prior to the mid-1950s paper was the most common form for all manuals. After that, new techniques, including microfilm, microfiche, and computerized systems, became available. Between 1965 and 1970, DOD components and commercial airlines began testing and using microfilm for aircraft manuals. Currently, most commercial airlines have some of their manuals on film. Among the three military services, the Naval Air Systems Command has an extensive ongoing microfilm program, the Army is using microfiche on a limited basis for aircraft maintenance, and the Air Force tried microfilm but terminated the program in 1976. The Naval Air Systems Command also has a computerized system in operation to produce and update manuals; the Air Force and Army are studying the concept.

Maintenance manuals are used in all three levels of DOD maintenance--organizational, intermediate, and depot. Organizational maintenance is the least complex and is usually done by the activity which uses the equipment. Organizational maintenance normally consists of inspecting, servicing, adjusting, and replacing parts, minor assemblies, and subassemblies. Intermediate level maintenance is normally more complex than organizational maintenance and less complex than depot maintenance. It usually consists of repairing, calibrating, or replacing damaged or unserviceable parts and modifying equipment. Depot maintenance is the most complex type of maintenance and usually is done in fixed shops, shipyards, and other shore-based facilities. Generally it consists of inspecting, testing, repairing, modifying, altering, modernizing, converting, overhauling, reclaiming, or rebuilding parts, assemblies, subassemblies, components, equipment, and systems.

The Office of the Secretary of Defense (OSD) has primary responsibility for establishing policies for the maintenance manual program. To implement these policies, OSD issues instructions and directives which the services use to manage their programs.

In the Air Force, the Logistics Command and the Systems Command manage the maintenance manual system. The Air Force Systems Command generally is responsible for the initial acquisition of equipment and manuals; however, the determination of requirements and specifications for manuals are developed by the systems program offices. As equipment is distributed to operational units, management of the manual system passes to the Air Force Logistics Command and to the five logistics centers under that command.

The Naval Material Command has overall responsibility for Navy manuals and it has delegated that responsibility to the various systems commands, such as the Naval Air Systems Command.

The Army's Adjutant General has overall responsibility for Army manuals and has delegated that responsibility to Material Development and Readiness Command. That command coordinates the development and procurement of manuals to assure consistency among the various Army commodity commands.

## SCOPE OF REVIEW

Although we concentrated on aircraft manuals in our review, we also gathered information on manuals used for other systems, such as missiles and ships. We believe the basic issues addressed and shortcomings noted in this report have potential application to the services' entire manual program. We reviewed documents dealing with the services' efforts to improve manual programs through the use of microfilm and computerized updating systems. We held discussions with officials of the Air Force, Army, Navy, Marine Corps, and the Office of Assistant Secretary of Defense, and visited the following user installations and offices:

- Naval Air Technical Documentation Policy and Programs Office and Naval Air Technical Services Facility, Philadelphia, Pennsylvania.
- Headquarters, Air Force Logistics Command, Wright-Patterson Air Force Base, Ohio.
- The Adjutant General Center, U.S. Army Headquarters, Washington, D.C.
- U.S. Army Materiel Development and Readiness Command, Materiel Readiness Support Activity, Lexington, Kentucky.
- The Offices of Assistant Secretaries of Defense for Manpower, Reserve Affairs and Logistics; Comptroller; and Director Defense Research and Engineering, Pentagon.
- Warner Robins Air Logistics Center, Warner Robins, Georgia.
- Naval Air Rework Facility, Jacksonville Naval Air Station and Cecil Field Naval Air Station all located in the Jacksonville, Florida, area.
- U.S.S. Saratoga, Mayport Naval Station, Florida.

Because we were told that commercial airlines were successfully using microfilm maintenance manuals, we visited the following three airlines to determine if any of their experience could be beneficial to DOD--Delta Airlines, Atlanta, Georgia; Eastern Airlines, Miami, Florida; and Trans World Airlines, Kansas City, Missouri.

## CHAPTER 2

### MAINTENANCE MANUALS ARE NOT

### FULLY MEETING SERVICE NEEDS

DOD's maintenance manuals are not fully meeting the operational requirements of the individual military services. Because manuals often are not easy to use and not current or accurate, maintenance personnel are hindered in doing their job efficiently. The consequences are potentially serious in terms of mission readiness and, possibly, operator safety. Additionally, the cost of issuing and updating manuals is constantly increasing.

### MANUALS ARE DIFFICULT TO USE

In various studies over a number of years, DOD and private contractors found manuals difficult to use (i.e., too complicated and not suitable to the work environment). As early as 1969, a DOD study reported that weapons systems technology had become more complex, while the methods used to provide detailed information to support these systems had not significantly changed. The study concluded that in many cases the value of maintenance data was questionable because

- descriptions in manuals were too complicated,
- complex procedures were not explained in sufficient detail, and
- locating necessary information was very difficult and time-consuming.

In 1974 a Naval Material Command ad hoc committee found that Navy manuals needed to be rewritten to a lower reading level to enable the recruits of the 1970s and 1980s to understand them. The committee estimated that such a revision would cost about \$65 million. The committee also reported that manuals often were not suitable for the work environment because of their physical size, the arrangement of information, and the means used to present the information.

Prompted by the problems disclosed by the ad hoc committee and recognizing longstanding deficiencies in its manuals, the Navy contracted for a comprehensive study in 1976 to improve manual effectiveness. The contractor found that naval personnel had difficulty using manuals for several reasons:

- Manuals were poorly matched with the users' skills.
- Manuals and work environment were often mismatched (i.e., large books in small places, fragile books in dirty areas, and small print in dark areas).
- The medium selected for maintenance manual presentation often hindered rather than helped. Microform was especially difficult to use in the working environment, and the viewing equipment needed to use it was not very reliable.

Air Force experience with manuals parallels that of the Navy. A 1977 Air Force study reported manuals were not well suited for the work environment because technicians were required to refer to several different sections of one or more manuals to do their work. In March 1978 another study found that manuals were not well matched to the needs of less experienced technicians and were often inaccurate, incomplete, and incomprehensible. The study stated that:

"Current paper-based technical data, are so difficult to use that technicians expend excessive amounts of time searching for the data needed. When gaps are found in needed data, no-defect parts removals often result. Both of these deficiencies [result] in substantial costs to the Air Force."

An earlier industry study in 1974 also found that the Air Force spent an excessive amount of its maintenance man-hours searching for information in manuals and removing non-defective parts from aircraft. On the basis of the study, the Air Force estimated that it could avoid costs of about \$108 million annually by improving manuals so that maintenance personnel would spend less time searching for information and removing aircraft parts that are not defective.

The following example further illustrates the problem that sometimes confronts personnel who use maintenance manuals. To find information to isolate and repair one C-141 radar malfunction, Air Force technicians have to refer to 165 pages in 8 documents and look in 41 different places--if they make no false moves.

Army manuals are also difficult to use. For example, in April 1976 the Army found that incomplete information was causing acute difficulty in repairing certain equipment for

its Improved Hawk missile system. As a result, maintenance technicians were replacing components which they could have repaired had adequate information been available. Also, some manuals for the Army's Nike Hercules missile system contained fragmented parts listings that made the manuals very difficult to use.

Our visits to Navy installations disclosed that aviation maintenance personnel also found manuals difficult to use because they had not always received adequate training on how to use either microfilm manuals or the Navy's publication system. During visits by Navy officials to obtain feedback on manuals, some aviation maintenance personnel said they had not received adequate training on the microfilm manuals. Others requested additional training on how to use paper manuals.

#### MANUALS ARE NOT ALWAYS CURRENT OR ACCURATE

For many years the services have had problems keeping manuals current and accurate. They have been unable to prepare and distribute changes in a timely manner, and users have failed to incorporate changes in paper manuals. Consequently, maintenance personnel often have inaccurate or obsolete instructions that could cause equipment failure or costly, unnecessary replacement of good parts or components.

The Air Force Logistics Command has recognized the need for more timely updating and is attempting to shorten the time involved by increasing management attention and by funding efforts to reduce the backlog. However, as of May 1978, the Air Force still had a backlog of about 10,000 routine changes to make, including 1,800 that had been pending for over 240 days.

In the late 1960s the Navy began using microfilm manuals in an attempt to eliminate delays in updating the manuals. However, even though microfilm cartridges are physically easier to maintain than paper manuals, microfilm manuals have not completely solved the problem of delays. The Navy therefore developed and implemented a computerized system to further improve the updating process. Although this system shows promise, it is used only on aviation maintenance manuals and currently affects only a small percentage of these.

An April 1976 Army report indicates that it too has had problems in keeping manuals up-to-date and accurate. The

report, an evaluation of missiles and munitions, found that field units were having significant problems keeping manuals current for the Chaparral weapon system. It stated that:

"\* \* \* The primary difficulty being experienced by units in the field is that the basic manuals are beginning to deteriorate through use, and the replenishment system is not able to produce replacements complete with all changes \* \* \*."

The report also cited deficiencies in the technical accuracy of schematics and maintenance procedures for certain components of the Chaparral and Vulcan systems.

The 1976 contractor study for the Navy (see p. 5) stated that manuals were put in use that had technical errors and inadequate or missing data. The study cites examples where maintenance personnel said that the descriptions of the theory of operation were contradictory and improperly organized, and that inaccuracies in procedural data did not enable them to find actual equipment problems. These inaccuracies had caused personnel to lose confidence in the manuals, maintenance performance to suffer, and equipment readiness rates to go down.

The need for good maintenance manuals is aptly summed up by a memorandum of a meeting of Air Force Air Logistics commanders in 1976. The memorandum states, in part:

"Conferees agreed good technical data is vital to operate in today's austere manpower environment. Additionally, the current status of TO [technical order] problems is compromising all MAJCOMs [major commands] mission capability."

#### MANUAL COSTS ARE INCREASING

Available cost data shows that manuals have become increasingly expensive to procure and update in recent years, partly because of the greater complexity of weapons systems and partly because of the accelerated rate of revisions. Increasing costs have aggravated the services' difficulties in solving maintenance manual problems.

According to the Air Force, the average cost to revise Air Force manuals increased 50 percent between 1971 and 1977, largely due to inflation. New pages that cost \$200 each in

1971 cost \$300 in 1977, while the cost of page changes increased from \$100 to \$150. In 1977 the Air Force Logistics Command estimated that an additional 5 million pages would be produced during the next 5 years. That increase in pages could cost about \$1.5 billion. The command also told Air Force headquarters that this cost increase, coupled with DOD budget reductions, created an urgent need for a new, advanced technical order system which would be cost effective.

The Naval Air Systems Command has also been concerned about increasing costs. It estimated that each year it revises about 25 percent of the 2.6 million manual pages in its inventory. In 1977 the Navy's estimated cost to update one page ranged from \$32 using computerized techniques to \$216 using conventional techniques. On the basis of these costs and estimated usage of computerized and conventional techniques, we estimate that the Navy will spend about \$129 million annually on changes to aviation maintenance manuals.

#### CONCLUSIONS

(Maintenance manuals frequently are not easy to use and are not current or accurate. These deficiencies prevent maintenance personnel from doing the most efficient job and could affect the safety of equipment, systems, and personnel. The problems have existed for many years and are increasing because the complexities of new weapons systems have caused substantial increases in the data needed for maintenance. The increase in the size of the manuals has caused a corresponding increase in the cost of issuing and revising them.) If DOD could update its manuals in a more timely manner, improve their accuracy, and make them easier to understand, it could improve maintenance and substantially reduce costs.



### CHAPTER 3

#### MICROFILMED MANUALS HAVE NOT SOLVED

##### MAINTENANCE MANUAL PROBLEMS

In an effort to correct the various problems with maintenance manuals discussed in chapter 2, the services have spent millions of dollars putting paper manuals on microfilm. In view of the large amounts being spent for this purpose, we wanted to determine what the results had been. In each of the three military services we found that microfilm manuals have failed to solve many problems and, in some cases, have aggravated the situation:

- In 1978, 10 years after its program began, the Navy was still attempting to correct longstanding problems of clarity, currency, and accuracy with its microfilmed aircraft maintenance manuals.
- The Air Force terminated its microfilm program in 1976, after 8 years of effort and millions of dollars spent, because of limited use, lack of interest, and insufficient funding.
- The Army has also been having problems with its microfiche manuals similar to problems the Navy and Air Force had with microfilm, such as clarity and lack of use.

The following sections describe the Navy, Air Force, Army, and commercial airlines' experiences in converting paper manuals to microfilm.

##### NAVY MICROFILM PROGRAM

In 1968 the Navy, after conducting several studies, decided its paper manual system had become unmanageable due to the vast increase of maintenance data and the accompanying problems of retrieval and presentation. The Navy, concerned about the effect on aircraft readiness, realized it had to reduce the time spent on aircraft maintenance. Consequently, it decided to undertake a program to eliminate the known deficiencies inherent in the paper technical manual system.

The studies disclosed a significant problem in using these manuals in unscheduled maintenance. For instance, 45 percent of all maintenance time was unscheduled and about 40 percent of that time was spent in troubleshooting. Rapid access to the required maintenance data would substantially reduce the troubleshooting time. This, of course, would reduce time spent in unscheduled maintenance and the increased efficiency could result in either reduced costs through manpower reductions or cause a reallocation of resources to improve scheduled maintenance or possibly both.

The studies prompted the Navy to develop and implement a microfilm system--the Maintenance Information Automated Retrieval System--at the Jacksonville Naval Air Rework Facility and then, after some testing, to expand the system to all naval and Marine Corps aviation activities. All levels of aircraft maintenance--organizational, intermediate, and depot--now use microfilm aboard ships or onshore. Converting to microfilm has helped, but problems, old and new, persist.

#### Problems with microfilm system

Although the Navy developed the microfilm system to replace paper manuals, numerous problems have caused the Navy to continue to extensively use paper manuals.

Our review of the microfilm system at several naval and Marine Corps activities disclosed the following deficiencies:

- Wiring diagrams and schematics on oversize pages usually were on two or more film frames so that the maintenance technician had to view all the frames, one at a time, to see the entire diagram or schematic. Technicians said it was difficult to obtain needed information under such conditions, and many technicians preferred paper over microfilm because of the problems with oversize pages.
- Many paper manuals contained photographs that identified parts and illustrated maintenance procedures, and technicians complained that the photographs on microfilm were hard to read. The microfilmed photographs that we saw were not clear and thus not useful to the technicians.

- Reader printers did not always work. Operators had difficulty focusing reader printers, and the search capability, which was supposed to automatically locate the selected page, did not always work properly. They also advised us that during their attempts to get photo copies of manual pages, photo print paper frequently jammed in the printers.
- The "portable" reader weighed about 45 pounds. Maintenance personnel complained that the reader was too heavy and consequently not mobile enough to move to every location where it was needed. They mentioned that the reader was difficult to use aboard an aircraft carrier flight deck because of its size and weight.
- Print copies were often of poor quality and hard to read because equipment was not always operated properly and the condition of the paper was poor. Photo print paper had to be stored in refrigerators or air-conditioned space--either of which was not always available--to prevent deterioration.
- Personnel lacked adequate training on how to maintain the microfilm equipment in working order. Further, they often did not even know how to locate on microfilm the maintenance information they were seeking. In one Naval Air Rework Facility, for example, personnel had received only a 1-hour training course on use of the equipment shortly after it had been installed. New personnel had to learn to operate the equipment from other employees. Some maintenance personnel who attempted to demonstrate the equipment for us did not know how to operate it properly.

The Navy has been aware of many of these problems. In fact, because of the problems, the Navy decided to distribute many of the same manuals in both paper and microfilm formats. Of 9,600 manuals that had been converted to microfilm, the Navy was distributing about 4,600 in both paper and microfilm in May 1978. This was contrary to the Navy's original intent to convert most manuals to microfilm. Of course, the preparation and distribution of the same manual in both formats is costly.

When both paper and microfilm versions of manuals were available, maintenance technicians were frequently reluctant to use microfilm versions, citing the deficiencies listed above. Given a choice between film and paper, most maintenance personnel chose paper. During a 1976 survey a Navy contractor found that about 60 percent of 427 persons questioned chose paper manuals for overall use, while only 18 percent chose microfilm (22 percent did not respond). The most prevalent complaints received about microfilm were almost identical to the system deficiencies we found during our review.

For example, of 40 maintenance personnel that we questioned at 6 maintenance activities, 36 favored paper over microfilm. Some were very outspoken in their dislike for microfilm. One maintenance technician told us that the only people who spoke for the system were the ones who did not have to use it. So intense was their dislike for microfilm that some maintenance personnel preferred to use out-of-date paper manuals instead of more current microfilm copies which had superseded the paper manuals. For example, in one shop, personnel were using three out-of-date paper manuals, one of which was nearly 10 years old instead of the current versions of the manuals which were on microfilm. Using outdated or unauthorized manuals could be very costly in terms of personnel safety, readiness of aircraft, and mission effectiveness.

#### Causes of microfilm problems

Inadequate planning was a major contributing cause of the Navy's problems with its microfilm system. Better planning could have prevented or reduced the extent of its difficulties. Specifically, the Navy did not

- establish an adequate test program to identify problems with the new equipment and find solutions before it was put into use;
- adequately screen the manuals before they were converted to microfilm to detect pages and manuals not suitable for filming;
- establish a preventive maintenance program for microfilm equipment;
- establish adequate training programs for all personnel who would use and maintain the equipment;

- remove paper manuals from work locations as soon as adequate microfilm manuals and equipment were available; or
- implement the system more cautiously, delaying full implementation until it had reasonable assurance that the system would be effective.

#### Actions to correct microfilm problems

The Navy has been aware of the inadequate planning discussed above and has taken steps to correct the problems that it has caused. For example, to eliminate the need to distribute some manuals in both paper and microfilm, the Navy has begun to screen manuals to identify which ones are suitable to remain on microfilm. Those manuals not suitable for microfilm are being distributed on paper only. Screening manuals, however, has been a slow process. For example, the Navy started screening 6,285 manuals in late 1976, and by May 1, 1978, had screened only 3,950. For the 3,950 screened, the Navy determined that

- 2,443 were suitable for microfilm;
- 1,313 could be made suitable for microfilm with corrections, such as replacing photographic illustrations with line drawings and/or reformatting schematics; and
- 194 were unsuitable for microfilm and would be distributed in paper only.

In addition to the screening program, the Navy had taken the following actions, prior to our review, to improve the microfilm system:

- Developed, evaluated, and made plans to procure a lightweight portable reader.
- Procured an improved photocopy paper for the reader printer.
- Modified the reader printer to improve its reliability.
- Rewritten manuals to clarify instructions for operating and maintaining the reader printers.

- Developed a method to solve the problems associated with filming foldout pages.
- Drafted standard procurement specifications for the manuals to help provide satisfactory microfilmed manuals.
- Studied how microfilm cartridges should be loaded to better meet users' needs.
- Began visiting user installations periodically to discuss the microfilm program.

#### AIR FORCE MICROFILM PROGRAM

Like the Navy, the Air Force developed, tested, and partly implemented a system to put its paper maintenance manuals, called technical orders, on microfilm. Although the Air Force developed its Technical Order Microfilm System independently of the Navy's system, the two systems were almost identical. However, for various reasons, the Air Force abandoned its microfilm system in April 1976.

The Air Force first tested the system in 1969 at the Warner Robins Air Logistics Center which is a depot maintenance facility. By January 1971 the Air Force had approved the system for implementation at Warner Robins and the four other Air Force Logistics Command depot maintenance facilities. The Air Force had planned to implement and use microfilm at all organizational and intermediate maintenance facilities throughout the Air Force if implementation at the depot maintenance facilities had been successful. But the Logistics Command experienced a number of problems as it further tested and began implementing the system in the depot maintenance shops. As early as 1971, the Air Force found that color illustrations on paper were not adaptable to microfilm and that photographic illustrations on paper lost much detail when converted to microfilm. In 1972 the Air Force realized that oversize pages, such as wiring diagrams larger than 8-1/2 by 11 inches, were difficult to put on microfilm. At that time the Air Force was also discovering that some maintenance personnel preferred paper over microfilm. About 2 to 3 years prior to those Air Force encounters, the Navy had found similar problems during tests of its microfilm program.

In February 1973 the Air Force began testing microfilm at organizational and intermediate maintenance levels at one

base. Although the test showed favorable results, the major commands were not receptive to using microfilm for organizational and intermediate maintenance. In July 1973, after the Air Force had begun microfilming technical orders on a full-scale basis for use in depot maintenance, it experienced more problems with microfilm. The problems were attributed to (1) efforts to reach high production rates, (2) using inexperienced personnel to do the filming, and (3) converting manuals not suitable for microfilm. To ease the problems, the Logistics Command reduced the scope of the program in January 1974, by excluding several types of technical orders--job guide manuals, flight handbooks, work cards, and checklists--from the microfilm program. But it also decided to continue testing at the depot maintenance level.

#### Microfilm program terminated

In March 1976 the Air Force Audit Agency reported that it did not believe that the microfilm system was cost effective within the Logistics Command nor would it be cost effective if implemented Air Force-wide. Therefore, the Audit Agency recommended that the Air Force terminate the microfilm program unless a new cost analysis showed a definite cost advantage for microfilm. In April 1976 the Air Force discontinued the microfilm program, citing the following reasons:

- Sufficient funding was not available to adequately support both the existing paper system and the microfilm program.
- Low user acceptance would limit the system's usefulness, the major commands had shown little interest in the microfilm program, and the Logistics Command had excluded many of its own work centers from using microfilm.
- A microfilm system would not be cost effective because many technical orders--due to command refusal of microfilm--would have to be kept on both film and paper rather than on one or the other as originally planned.

By the time the Air Force terminated the program in 1976, it had put over 63,000 technical orders on some 3,000 microfilm cartridges (about 75 percent of all its technical orders) and had also spent millions of dollars. Although total program costs were not readily available, Air Force Audit Agency figures indicated that the Air Force had spent about \$3 million

at three of the five principal test locations. Microfilm viewing equipment alone cost about \$1.1 million.

#### Causes of problems

As might be expected, since the services worked independently of one another, the Air Force experienced many of the same problems that the Navy had encountered. History offers no alternatives so it is not possible to say that the Air Force could have avoided the Navy pitfalls, but one would certainly expect that coordinated efforts in problem solution could have benefited both services. In addition to the absence of realistic planning, the primary cause of the Navy's problems (see p. 13), the Air Force encountered other difficulties, similar to those encountered by the Navy:

- Additional problems arose during the expanded implementation phase which the Air Force could have prevented or minimized by decreasing the rate of conversion, better training of personnel who filmed manuals, and more discriminating selection of manuals suitable for microfilming.
- The Air Force expanded implementation from one depot to all depots, even though it was aware of various unsolved problems. The Air Force did not test the systems at an air base organizational maintenance facility before expanding implementation from one depot to the remaining depot maintenance activities. Had it done so, it could have surfaced major command resistance to microfilm earlier and prevented unnecessary expenditures for additional equipment and testing at additional depots.

#### ARMY MICROFICHE PROGRAM

Like the Air Force and the Navy, the Army has a program to put technical manuals on microform. During the past 10 years, it has been putting depot level maintenance manuals on microfiche cards. Although we did not review the program in detail, Army officials told us that the Army had experienced problems with microfiche similar to those the Navy and Air Force had experienced with microfilm. For example, some depot manuals were not suitable for conversion to microfiche because they contained numerous foldouts. Because of such problems, the Army was maintaining manuals in both paper and microfiche formats and some commands had opted to use only paper.



## COMMERCIAL AIRLINE MICROFILM PROGRAMS

Because we were told that commercial airlines were successfully using microfilm manuals, we visited three airlines to determine if any of their experience could be beneficial to the services. The airlines' conversion to microfilm was less difficult than DOD's because they had fewer types of aircraft, less complex equipment, and fewer aircraft and maintenance locations. However, the airlines took the following basic measures--which made their conversion successful--that could have been beneficial to the services:

- Initially decided which manuals should be filmed and which should remain on paper.
- Considered user preferences in determining which film program to implement (microfiche or microfilm).
- Removed paper manuals from shops after adopting microfilm, thus preventing user preference from hampering microfilm implementation.
- Established training programs for all personnel who would use the microfilm system.
- Established preventive maintenance programs for microfilm readers and reader printers.

Two of the three airlines that we visited had used microform maintenance manuals since the late 1960s, the other since 1970. They decided to change to microfilm for the same reasons the Navy and Air Force did--to provide users with more accurate and timely maintenance information and to reduce the costs of storing, reproducing, and distributing manuals.

### Airlines did not convert all manuals to microfilm

Before implementing their microfilm programs, the airlines decided which manuals to convert to film and which to retain on paper, thus avoiding the reconversion of the manuals to paper if the microfilm was not suitable to users' needs. All three airlines, for example, left component manuals on paper because the manuals were only two or three pages long and were used in highly repetitive and specialized maintenance tasks; it would not have been cost effective to put them on

microfilm. The airlines also left wiring diagram manuals for older aircraft on paper because oversize diagrams in them would have taken up two or more film frames, requiring maintenance technicians to view all the frames, one at a time, in order to see the entire diagram.

Unlike the Navy and Air Force, the airlines removed paper manuals from maintenance areas after the microfilm versions were available. Sometimes they removed the paper manuals immediately after microfilm copies were available; sometimes they waited 1 year to give maintenance personnel a chance to adjust. Removing paper manuals eliminated the expense of maintaining the same manuals in both paper and microfilm format, thus permitting the airlines to realize the economic benefits of microfilm.

#### Airlines took steps to minimize user resistance to microfilm

By establishing training programs for personnel who would use microfilm manuals and by setting up a preventative maintenance program to improve equipment reliability, the airlines minimized user resistance. One airline conducted an intensive training program to show personnel how to locate maintenance data on microfilm and how to operate the readers and reader printers. At another airline, equipment manufacturer representatives instructed mechanics on how to use the equipment and, in addition, airline personnel trained all mechanics on microfilm. After the training session, the mechanics had to demonstrate that they knew how to locate maintenance data on microfilm. The airlines also established preventive maintenance programs for microfilm equipment. One airline set up a routine quarterly maintenance program, which, according to officials, had virtually eliminated equipment malfunctions. The other two airlines had maintenance contracts with the equipment manufacturers.

#### Conversion to microfilm not as difficult for airlines

Although similarities exist between the maintenance activities of commercial airlines and military services, some basic differences admittedly made it easier for the airlines to convert to microfilm. The Navy and Air Force, for example, have significantly more aircraft and different types of aircraft than the commercial airlines. One airline had only four types of aircraft while the Navy and Air Force

have numerous types. Also, the Navy has over 6,000 aircraft and the Air Force over 9,000, while the largest commercial airline that we visited had only about 260 aircraft. Thus, the airlines had substantially fewer manuals to maintain than the military services--5,000 at the largest airline, compared to 102,000 for the Air Force and 27,000 for the Navy. Moreover, the services distribute manuals to many more locations than the airlines. For example, the Navy distributes aircraft manuals to about 10,000 addressees while one airline distributed manuals to only 75 locations and another to only 62. The specifications used by airlines to procure maintenance manuals further eased the conversion process for them. These specifications prohibited aircraft manufacturers from using oversize schematics and wiring diagrams, photographs, and color in maintenance manuals, thus making them suitable for microfilming. We understand that the Navy is now developing specifications which will place similar requirements on contractors. Overall, airline officials indicated satisfaction with microfilm because it had improved the integrity of maintenance information and cost less than paper, enabling the airlines to realize savings in postage, storage space, and time required to make changes and revisions.

#### CONCLUSIONS

(Unlike the commercial airlines, the Army, Navy, and Air Force have been unable to fully correct maintenance manual deficiencies through use of microfilm.) As a result, old problems remain and new ones have been created. Specifically, the Navy is still attempting, after 10 years of effort, to correct longstanding problems with its microfilmed manuals for aircraft maintenance; the Air Force terminated its microfilm program in 1976, after 8 years of effort and millions of dollars spent; and the Army is having problems with its microfiche system similar to those the Navy and Air Force had with microfilm.

Commercial airlines have fewer manuals and thus have an easier task than the services in effectively maintaining them. Their experiences, however, with microfilmed manuals strongly indicate that careful management has been the major factor in avoiding many of the problems the services have encountered.

Additionally, the airlines' successful experiences with relatively small numbers of aircraft and maintenance manuals offer significant potential, in our view, for similar accomplishments on a greater scale by the services. Many known

and unknown problems await the services' efforts in developing a reasonable and acceptable substitute to paper manuals and indicate a need for the efforts to be orchestrated by a management or policy level which can oversee or direct efforts by service departments. For example, Navy efforts to develop specifications for procuring manuals should be closely monitored for their applicability to other services' requirements, and successes in one service on breakthroughs in solving manual problems can be rapidly disseminated to other services to prevent "reinventing the wheel" processes.

## CHAPTER 4

### NEED FOR BETTER MANAGEMENT

#### OF MAINTENANCE MANUALS

The current problems with maintenance manuals discussed in previous chapters provide ample evidence that a suitable substitute for costly and ineffective paper manuals is not at hand. DOD's decentralized management concept, which allows the services to independently pursue solutions, has failed to effectively deal with this burgeoning problem. Decentralization in fact has fostered diverse programs and duplication of effort between and, at times, within the various services.

Various study groups have recommended establishing DOD-wide policy and direction for maintenance manuals. Our review supports the need for better management. Further, we believe that assigning management responsibility for all DOD maintenance manuals to one office in DOD could result in improved use of resources which could provide benefits not realizable under current management arrangements.

#### DECENTRALIZED MANAGEMENT HAS BEEN INEFFECTIVE

As a result of decentralized management, the services have duplicated efforts to improve their maintenance manual systems. The Navy, Air Force, and Army have each independently developed microform systems to solve similar problems. Their efforts have not been successful and now the services are again independently either developing or studying computer systems for producing and updating manuals.

In 1973, when the Air Force began testing the possibility of using computer systems to produce and update maintenance manuals, the Navy had already determined that such a system was feasible. Had the Air Force or a single office been directly involved in the earlier Navy development efforts, much of the expenditure of Air Force funds and effort could have been avoided. The Army is also considering using computers to produce and update its maintenance manuals. Having done one study in 1975 to look into this possibility, it is now doing a followup study to investigate the feasibility of implementing such a system. In another instance, as noted in chapter 3, the Navy in 1967 and the Air Force in 1969 each began developing similar microfilm systems. Although the Air Force knew of the Navy's microfilm program, it independently tested and implemented its own program. The Air Force

thus incurred costs associated with testing, such as equipment purchases and salaries, that could have been avoided had the two services pooled resources and efforts. After implementing the microfilm programs, both services experienced similar problems but again did not jointly pursue solutions. For example, each identified difficulties associated with filming foldout pages, the Navy in 1969 and the Air Force in 1972. However, independently of one another, the Navy found a way to solve the problem in 1970, and the Air Force in 1975.

In addition to the duplication in earlier programs discussed above, the services are currently doing extensive independent studies or tests which have the potential for duplication. A single office, having appropriate authority, could eliminate much duplication. For example, the Army is testing and studying ways to combine training and maintenance functions to simplify manual content and format. The Navy is also studying similar applications, according to OSD officials. An Air Force official indicated that the concept of combining maintenance and training manuals might also apply in its manual systems. A uniform, DOD-wide approach to studying and implementing this new technique could bring together the best ideas of each of the services and would have significant potential for finding quicker, better, and more cost-effective solutions.

#### IMPROVEMENTS POSSIBLE WITH BETTER MANAGEMENT

Various studies by DOD groups and industry associations have disclosed significant problems with the structure and use of maintenance manuals and recognized that centralized management offered realistic opportunities for more effective management of manuals. Some of the findings and recommendations of several of these studies are discussed below.

#### Naval Material Command

In 1974 the Naval Material Command convened an ad hoc committee to review all Navy maintenance manuals. The document establishing the committee stated that the diverse methods and documents used in the Navy for stating requirements, procuring, preparing, identifying, indexing, distributing, and updating maintenance manuals resulted in dissimilar documentation and management networks. The document further stated that the diversity confused Navy technicians who operate and maintain equipment and systems and it also confused contractors who supply hardware and documentation

to the various systems commands, thereby precluding a rapid response to the need for high quality, current, and understandable maintenance manuals.

The ad hoc committee identified a number of deficiencies in maintenance manuals. For example, the committee reported that there was no single place or single document aboard ship where a sailor could learn what manuals existed for his equipment, if they were up-to-date, or if they reflected the configuration of installed equipment. It also reported that the problem was further complicated because the maintenance manuals were being issued on microfilm, microfiche, and paper.

The committee concluded that decentralized management had resulted in variations in management attention by the various Navy system commands. It also noted that varying degrees of resources were committed to the problem, and little or no coordination was exercised either among the commands or by organizations within the commands. It found that the Navy Material Command did not have adequate staff or a management organization strong enough to insure that command policies were carried out. The committee recommended that the command adopt an organization headed by a strong central manager, but the recommendation was not adopted. A Naval Material Command memorandum dated December 7, 1976, stated that implementing such a recommendation "would require a major reorganization, the transfer of hundreds of personnel, and several years to accomplish." It went on to say that the latter "is probably the only thorough remedy for the technical documentation problems that exist today, but would require the [system commands] \* \* \* to relinquish some authority and resources."

Subsequent to the ad hoc study, in 1976 the Navy contracted for a study to seek improvement in its manuals. The study had not been completed at the time of our review.

#### Defense Logistics Agency

On September 10, 1976, the Assistant Secretary of Defense (Installations and Logistics) requested that the Defense Logistics Agency make a definitive review and analysis of the methods and equipment for producing, updating, distributing, and using maintenance manuals in the services. Noting that many DOD personnel were seeking to take advantage of technological advances to improve their manuals, thereby improving user effectiveness and reducing costs, the Assistant Secretary said:

"\* \* \* It appears these worthy objectives could be significantly enhanced through better coordination with attention directed toward eventual standardization of a best system(s) where practical \* \* \*."

He also said that the review would establish a base for improved coordination and for follow-on efforts. The Agency was to identify and assess the services' current practices and future plans and recommend alternative methods and systems with the most promise from an overall DOD viewpoint.

The Defense Logistics Agency started the review and completed the first phase, but plans for subsequent phases were canceled after the Agency learned of the Navy contractor's similar, more comprehensive, and better funded review of Navy manuals which the Agency believed should be expanded DOD-wide. Nevertheless, the Agency's April 1977 report on the first phase of its view contained the following findings and recommendations:

- A number of organizations within OSD and the services had overlapping and/or redundant functions, responsibilities, and authorities either through actual mission assignment or through assumption in practice. This situation had either caused or permitted the planning, development, and implementation of conflicting or redundant policies, programs, and systems.
- The services, in applying automation and micrographics to maintenance manuals, did not coordinate their testing and implementation efforts, nor were their efforts monitored by OSD.
- The diversity of manuals used in DOD at all levels of maintenance, among and within the services, was causing problems in the effectiveness and interchangeability of manuals. This diversity in the type, content, and media of presentation was attributed to the different approaches used by the groups issuing the manuals.
- The Assistant Secretary of Defense (Manpower, Reserve Affairs and Logistics) should designate a single office that would be responsible for managing maintenance manuals throughout DOD and for expanding the ongoing Navy review of maintenance manuals to all DOD components.



When we asked what action had been taken on the Defense Logistics Agency's recommendations, OSD officials told us that the study had never been "officially issued" and that its recommendations had failed to win sufficient agreement to warrant implementation. They also said that the recommendations to establish a central manager did not agree with DOD's decentralized management concept. Despite this decentralized management policy, DOD has applied the central manager concept to other areas, such as transportation, communications, and supply, to eliminate duplication and overlapping effort and to improve the effectiveness and economy of operations. OSD officials, however, also acknowledged problems with the decentralized approach. They said that, under that approach, DOD lacked the degree of control it should have over the way services implement programs.

#### Industry comments

In July 1977 the Aerospace Industries Association of America, Inc., representing manufacturers/suppliers of aerospace/electronics equipment, at the Air Force's request, reviewed and commented on Air Force plans for an automated system to produce and update maintenance manuals. The association stressed the importance of developing one DOD system instead of duplicative and possibly conflicting systems for each service. The association also stated that a uniform approach should be established to meet the needs of the services, in consonance with industry capabilities, in order to achieve maximum efficiency and economy. Lacking this approach, the association believed that development of competitive systems by the services would be ultimately destructive to the best interests of the individual services.

Previously, in 1975, the National Security Industrial Association's Technical Data Subcommittee, Logistics Management Advisory Committee, also commented on the Air Force proposal to automate production of manuals. It recommended that DOD use a standard approach to automated systems. The association had warned that redeveloping features that already existed in industry or elsewhere in DOD had an adverse impact on cost. It also pointed out that contractors needed uniform standards in preparing maintenance manuals in order to insure, to the maximum extent, the compatibility and interchangeability of the various maintenance manual systems.

### Centralized management of maintenance manuals by the Army

Unlike the Navy and Air Force, the Army has assigned management responsibility for maintenance manuals to its Materiel Development and Readiness Command which designated the Materiel Readiness Support Activity at Lexington, Kentucky, as the central management group. The Support Activity has oversight responsibility for all aspects of maintenance manuals, from research and development to operational readiness. It has also coordinated maintenance manual development with training and operating requirements and manuals. Another related accomplishment has been its program to assure uniformity in contract specifications for operating and maintenance manuals procured with equipment.

These actions should improve the program. We believe the Army management program could be used as a guide to establish a focal point for management in the Navy, the Air Force, and a DOD-wide central management program.

### CONCLUSIONS

DOD is experiencing significant difficulty in attempting to manage a burgeoning maintenance manual program. (The concept of allowing each service to independently pursue solutions to the problem of finding an effective maintenance manual program has not worked. This decentralized concept has resulted in a proliferation of complex and costly maintenance manual systems and duplication of effort, which has wasted funds.) Also, the Army, Navy, and Air Force all have significant improvement efforts underway with similar features or objectives, thus setting the scene for continued duplication. Moreover, the services recognize that the maintenance manual programs are at a critical point--effective results are crucial.

Assigning management responsibility for all DOD maintenance manuals to one office could result in improved utilization of resources with the following benefits that are not realizable under the current management system:

- Provide overall program policy and guidance.
- Direct and consolidate, to the extent practicable, studies, research, development, testing, and evaluation on proposed new systems and new techniques and

other efforts affecting more than one service. Fewer tests, for example, should be less costly than the many studies and tests each service now carries out on its own. Attention could be concentrated on fewer, more comprehensive efforts to improve the manual system.

- Increase standardization of specifications for preparing manuals. Although the services have worked to improve this area, more needs to be done. Standardization will ease the burden of the contractors who furnish much of the information to the services and will ease the services' system support problems, all of which creates significant potential for reducing costs.
- Standardize maintenance manual systems, to the extent possible, and work toward adopting uniform systems to prepare, update, and distribute manuals; such systems, whether for one or more services, should be both less costly and easier to support.
- Control personnel and limited funds and allocate them to areas most in need of improvement. The services feel that they do not have sufficient funding--and there are indications that they do not have enough specialists--to adequately support their present and anticipated future systems. If one office had appropriate authority to manage all DOD and service skills based on total system requirements, it could allocate critical, short-supply skills according to overall requirements and priorities and call on contractors to fill shortages of needed skills.

At the conclusion of our review, the Secretary of Defense, at the request of the President, had a defense reorganization study underway to improve the efficiency and responsiveness of DOD organization and management by identifying and eliminating unnecessary overlap, fragmentation, and operating redundancies. In DOD's annual report for fiscal year 1979, the Secretary stated that he had made organizational and management reform a matter of priority, based on his desire to increase efficiency and get the most out of every defense dollar. We support the Secretary's goals and believe that maintenance manual programs are logical candidates for inclusion in the Secretary's reorganization efforts. We further believe that assigning management responsibility for all DOD maintenance manual

programs to one office offers significant potential for increasing the efficiency and effectiveness of these systems at the least possible cost.

#### RECOMMENDATION

We recommend that the Secretary of Defense assign responsibility for the management of all maintenance manual programs to one office at the DOD level. The office should have authority to provide overall program policy and guidance to minimize duplication of efforts and direct research, development, testing, and evaluation efforts to change or improve technical manual programs. As a prerequisite to placing overall responsibility in one office, however, a central manager should be established in each of the military services, similar to the Army's central manager, with management responsibility over all manuals within each service.

#### AGENCY COMMENTS

DOD did not provide formal comments to our report. However, we met with DOD officials who told us that they generally agreed with our findings, conclusions, and recommendation. They promised corrective action, although they were undecided at that time concerning the specific corrective measures that they would take. They advised us of several efforts either planned or underway which they hoped would improve maintenance manuals. The officials told us that the Defense Materiel Specifications and Standards Office had identified 28 specific areas in the overall maintenance area, including manuals, that required attention, and that a program plan was being prepared for each area. For example, a program plan for standardizing contract specifications for the preparation of manuals was in draft form and was expected to be issued in about 4 months.

While these plans appear to be a step in the right direction, we believe that corrective action must include, as a prerequisite, single service managers similar to the Army's single command responsibility, and one office at DOD level with responsibility for overall program policy setting, guidance, and monitoring.

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