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

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Information Management and
Technology Division

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The Honorable Earl Hutto
Chairman, Subcommittee on Readiness
Committee on Armed Services
House of Representatives

Dear Mr. Chairman:

In September 1989, your office requested that we review the cost effectiveness of the Air Force Logistics Command's Automated Technical Order System (ATOS). Technical orders are the information and instructions needed to operate and maintain weapons and other equipment. As originally planned in 1982, ATOS would have automated the receipt, storage, distribution, and revision of Air Force technical orders. However, because of early development problems and funding constraints, the Air Force completed only the first phase of ATOS and uses the system to revise technical orders.

Our objectives were to determine (1) if continued operation of ATOS is cost effective, and (2) whether further expenditures to enhance the system are warranted. Appendix I provides detailed information on our objectives, scope, and methodology.

Results in Brief

The Air Force's goal of automating the technical order management process is laudable. However, ATOS, which automates the technical order revision process, is not cost effective as a stand-alone system and further expenditures to operate and enhance it are not warranted for three reasons. First, ATOS is being used to make less than 3 percent of technical order revisions (most are done by contractors). Second, using ATOS to revise technical orders costs the Air Force over six times more than using contractors—$74.46 per page compared to $11.42 per page. Third, even if the Command invests another $100 million to enable it to do a larger share of the work load, using ATOS would still cost three times

Order Management System (AFTOMS).[1] However, because AFTOMS is in the early planning stage and data needs have not yet been defined, any effort expended now to build a data base could be wasted. Therefore, this report recommends that the Command discontinue building the ATOS data base and use contractors to make all technical order changes.

Background

The Air Force uses over 23 million pages of repair manuals, flight manuals, and other publications called technical orders. These technical orders, consisting of illustrations and text, contain the information, instructions, and safety procedures needed for the operation, maintenance, inspection, modification, and supply support of Air Force weapons systems and other equipment. (Two examples of technical order pages can be found in app. II.) ATOS units are located at each of the Air Force Logistics Command's five Air Logistics Centers and the Aerospace Guidance and Metrology Center.

In 1982, the Command initiated ATOS to provide an automated capability to manage technical orders and estimated its cost at $500 to $700 million. ATOS was originally intended not only to help the Command move from its paper-oriented method of revising technical orders to a computerized method, but also to automate the management—receipt, storage, and distribution—of technical orders. However, because of development problems and funding constraints, the Command stopped ATOS development after the first phase was completed at a cost of $29 million. Most of the remaining technical order management objectives from the original ATOS project were moved in 1988 to a new Air Force project called AFTOMS. Since 1987, the Command has been using ATOS as a stand-alone system to revise technical orders and plans to do so until AFTOMS is complete. The Command then hopes to incorporate some of the ATOS system (hardware and software) into AFTOMS.

In December 1989, we reported to you that the Command had not considered all costs for ATOS when it performed the cost/benefit analysis.[2] Since a cost/benefit analysis is critical in deciding whether to develop...

into consideration the up to $100 million that would be needed to build the required data base.

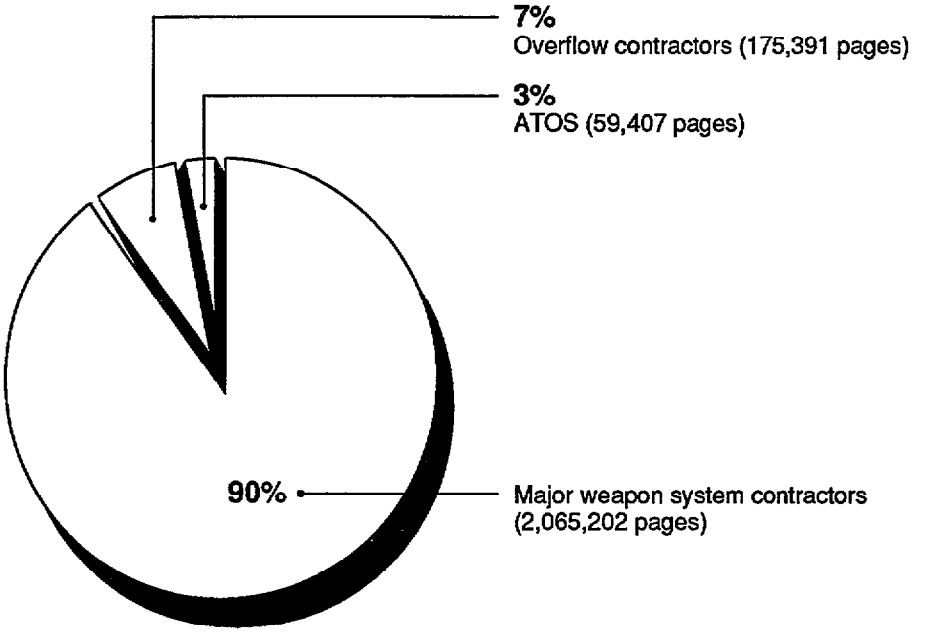
ATOS Is Not Cost Effective

Using ATOS to revise technical orders is not cost effective because (1) the Command uses it for only a small percentage of the total technical order revisions and (2) it costs less for contractors to revise technical orders than for the Command to revise them. ATOS operating costs are high because the hardware is expensive to maintain and ATOS operations incur high personnel costs. In addition, the data base needed to make the revisions has only been partially built and the Command overestimated the number of technical order pages that would need revision. As a result, ATOS' cost per page—total operating costs divided by number of pages revised—is extremely high compared to the contractors' costs.

ATOS Is Used for Only 3 Percent of the Technical Order Revisions

The Command's share of technical order revisions is very small. The Command manages over 23 million pages of technical orders and about 2.3 million pages are revised annually. However, about 97 percent of all technical order revisions are made by contractors; the Command makes only about 3 percent of the revisions. Figure 1 shows the division of responsibility for making technical order revisions.

Figure 1: Who Revises Technical Orders?



Two different groups of contractors revise technical orders —weapons systems contractors and overflow[3] contractors. Weapons systems contractors, who make 90 percent of all technical order revisions, design and build weapons systems. These contractors by necessity make all technical order revisions pertaining to their systems as long as they have engineering design responsibility for those systems. The Command is responsible for the other 10 percent of technical order revisions for older weapons systems and equipment where the weapons system contractors no longer have engineering design responsibility. ATOS was intended to be used to make the Command's portion of these revisions. However, because the data base needed by ATOS to make these changes is incomplete and the ATOS units are not adequately staffed, ATOS is used for only 3 percent of the revisions; overflow contractors make the remaining 7 percent of the revisions.

Another reason for the small amount of revisions made using ATOS is that the Command overestimated the number of technical order page revisions it and the overflow contractors would make. One reason for

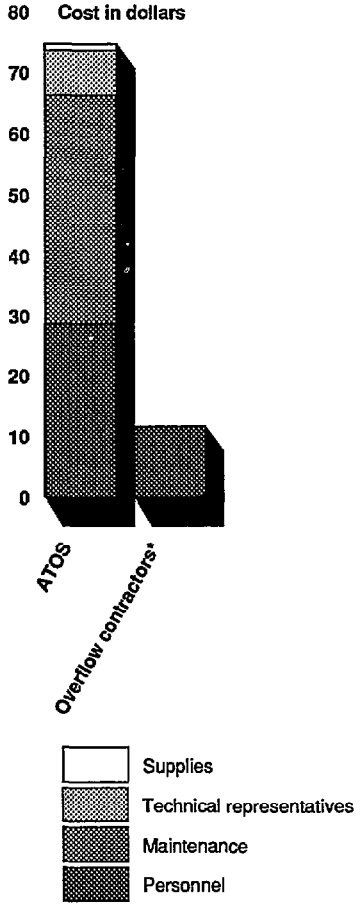
[3]The Command calls these contractors overflow contractors because they make the technical order revisions that overflow the Command's capacity to make revisions. The overflow contractors are usually small, private companies.

this overestimation is that the Command based it on the number of revisions made by weapons systems contractors. However, weapons systems contractors work with developing systems that require far more changes than older systems. The Command estimated that it would need to revise between 346,000 and 460,000 pages per year. During the past year, however, only 234,798 pages were revised, of which the Command used ATOS to revise only 59,407 pages.

Contractors Can Revise Technical Orders for Less Cost Than ATOS Can

It costs the Command about $5 million annually to operate ATOS. When all costs are considered, using ATOS to revise technical orders costs over six times more than using overflow contractors--$74.46 per page versus $11.42 per page. (App. III contains an explanation of our methodology for determining costs per page.) Figure 2 shows a comparison of technical order revision costs.

Figure 2: Technical Order Revision Costs Per Page



*Represents total overflow contractors' costs; costs are not broken down into categories.

ATOS' cost per page includes the cost to enter the page into a data base, a prerequisite for using ATOS to make the change. Command officials, therefore, contend that future revisions to the page will be less expensive than the initial revision. However, the portion of the cost per page attributable to data entry is $15.99, which still makes it considerably less costly to use overflow contractors. Overflow contractors do not enter the pages into a data base and are less expensive than using ATOS. Overflow contractors use a variety of methods for revising technical orders, some involving little more than a cut and paste procedure. In addition, technological advances in word processing and photocopying used by the overflow contractors have also helped them keep costs down.

The Command is paying $5 million annually—$2.2 million for equipment maintenance, $2.3 million for personnel, $0.44 million for contractor technical representatives, and $0.06 million for supplies—to revise fewer than 60,000 technical order pages. If the Command stops using ATOS to make technical order revisions and instead uses overflow contractors, it could save $4.3 million, the difference between ATOS operating costs and the cost to contract out the remaining technical orders.

Command officials stated that, although cost is a major consideration, ATOS is needed to meet requirements for technical order timeliness, accuracy, and quality. However, overflow contractors are meeting these requirements.

Further Expenditures to Enhance ATOS Are Not Warranted

The Command contends that ATOS will be more cost effective as the number of technical orders revised increases. However, to increase productivity the Command will have to continue to build the data base and significantly increase staffing of ATOS units. While we agree that ATOS can be made more cost effective, it will still not be as cost effective as using overflow contractors. In fact, even if the ATOS units made all the technical order page changes required, ATOS costs would still be about three times higher than the cost of using overflow contractors.

Command officials estimate that completing the ATOS data base will cost $100 million and they have requested $25 million per year for 4 years to enter approximately 4 million technical order pages into the data base. Pending funding approval, the ATOS units have started entering technical data piecemeal with miscellaneous funds. As of March 1, 1990, only 228,439 pages had been entered. (Over 4 million additional pages need to be entered.) Further, the latest ATOS staffing study indicated that the Command needed an additional 67 persons to fully staff a single shift at all ATOS units. Sixty-seven staff would cost an additional $1.8 million per year. The Command has requested additional staff for the ATOS units but, because of budget cuts, does not believe it will get all the staff required.

The Command further contends that the ATOS data base can eventually be used for the Command's AFTOMS system. However, because the AFTOMS system is in the early concept development phase, any effort expended now to build the ATOS data base could be wasted. Moreover, the Air Force has just recently proposed that AFTOMS be adopted as a standard Defense-wide automated technical order system. This will further delay system development because requirements will have to be redefined and

a new system development schedule has yet to be defined. Since ATOS is being used for technical orders for older systems, some of these orders could be obsolete by the time AFTOMS is operational. Moreover, it may be more prudent to build a data base of technical orders for new systems rather than older systems.

In addition, Command officials expect that future data-entry technology advances—such as improved optical scanning devices and software—could significantly reduce data-entry costs. Waiting until new technology becomes available could save the Air Force millions of dollars.

Conclusions

As we reported previously, the Command did not accurately account for the up to $100 million required to build the data base when it did the ATOS cost/benefit analysis. Additionally, it overestimated the number of pages ATOS would handle. Had it accurately accounted for these costs before developing the system and acquiring the hardware, it may have decided that ATOS was not economically justified.

The Command is now operating ATOS when less costly alternatives are available. Using ATOS currently costs the Air Force over six times more than using contractors to perform the same work. Furthermore, the Command plans to invest up to $100 million to complete the ATOS data base and hopes to significantly increase ATOS staffing. Even if the ATOS production rate quadruples to handle all of the Command's 10-percent share of the technical order revisions, it will still cost three times more than using contractors.

Recommendations

We recommend that the Secretary of the Air Force direct the Air Force Logistics Command to

- discontinue using ATOS to revise technical orders and use contractors instead, and
- discontinue all efforts to build the ATOS data base unless the Command can justify ATOS as a part of the AFTOMS program by clearly demonstrating that it is the most feasible and cost effective approach to building the AFTOMS data base.

In accordance with your wishes, we did not obtain official agency comments on a draft of this report. However, we discussed our findings with Defense and Air Force officials and have included their comments where

appropriate. We performed our work in accordance with generally accepted government auditing standards.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution of the report until 30 days from the date of this letter. At that time, we will provide copies to the Secretary of the Air Force. We will also make copies available to other interested parties upon request. This work was performed under the direction of Samuel W. Bowlin, Director, Defense and Security Information Systems, who can be reached at (202) 275-4649. Other major contributors are listed in appendix IV.

Sincerely yours,

Ralph V. Carlone
Assistant Comptroller General

Contents

Abbreviations

ADP	automated data processing
AFTOMS	Air Force Technical Order Management System
ATOS	Automated Technical Order System
GAO	General Accounting Office
IMTEC	Information Management and Technology Division
JUSTIS	Joint Uniform Services Technical Information System

Objectives, Scope and Methodology

At the request of the Chairman, Subcommittee on Readiness, House Committee on Armed Services, we reviewed the Air Force's Automated Technical Order System (ATOS). Our objectives were to determine (1) if continued operation of ATOS is cost effective and (2) whether further expenditures to enhance the system are warranted.

To determine if ATOS is cost effective, we reviewed the Air Force's efforts to monitor the project's ability to effectively serve its users. We used as criteria Department of Defense Instruction 7920.2, which provides policy for reviewing major automated information systems. This instruction states that periodic system effectiveness reviews should be conducted after the first year of full system operation to validate the continued need for the system. In addition, we performed a cost comparison similar to that made in the original ATOS economic analysis. In our cost comparison, we reviewed ATOS operating costs and contractor costs for making technical order changes. For comparison purposes, we used as criteria the major cost elements contained in the Office of Management and Budget Circular A-76. Circular A-76 establishes federal policy that prohibits the government from starting or carrying on any activity to provide a commercial product or service if the product or service can be procured more economically from a commercial source. We also evaluated the potential for contractors to perform all ATOS change functions.

To determine whether further expenditures to enhance ATOS are warranted, we reviewed the ATOS feasibility study, the ATOS economic analysis, and the Air Force Technical Order Management System feasibility study. We also reviewed current project status reports and discussed these with Command officials and ATOS users. In addition, we reviewed the Air Force Audit Agency's assessment of ATOS and interviewed ATOS project office and Air Force Logistics Command headquarters officials.

Our review was conducted from October 1989 to March 1990, primarily at the Office of the Director of Technical Data, Air Force Logistics Command; the Office of the Deputy Director for Technical Data Integration; the Office of the Deputy Chief of Staff for Material Management; the Logistics Management Systems Center; and the Office of the Deputy Chief of Staff for Contracting/Manufacturing, all located at Wright-Patterson Air Force Base, Dayton, Ohio. We also visited the Air Logistics Centers in Oklahoma City, Oklahoma; Ogden, Utah; Sacramento, California; and the Office of the Assistant Secretary for Acquisition, United States Air Force, in Washington, D.C. Our work also included discussions with Air Force officials at the Aerospace Guidance and Metrology

Center in Newark, Ohio, and the Air Logistics Centers in Warner Robins, Georgia, and San Antonio, Texas.

Samples of Technical Order Pages

The following are technical order pages taken from an Air Force technical manual. These examples were chosen to show the use of text and graphics in Air Force publications to guide repair and maintenance.

1-31. ADJUSTING AND TESTING MM-3 ATTITUDE INDICATING SYSTEM. ▲

a. Remove door 7 (refer to T. O. 1T-37B-2-1), unclamp MD-1 gyro from shock mount.

b. With power on, check that indicator flag disappears within 1.5 minutes and that MM-3 Attitude Indicator has erected to approximate aircraft attitude.

c. Adjust roll trim adjustment on rear of indicator as required.

d. Rotate pitch trim knob fully clockwise, then fully counterclockwise. In clockwise position, horizon bar on spheroid should show 10 to 20 degrees dive.

e. Place the MD-1 gyro on its side (90° from normal upright position), turn power off, allow gyro to come to a full stop.

f. Set MD-1 gyro back on shock mount.

g. Turn power ON and watch indicator gyro erection. Within 1.5 minutes the indicator should show zero indication in both axis within ±2°.

h. If system does not operate properly, remove components for bench check.

i. Turn off power, clamp MD-1 gyro to mount, install door 7, and remove jacks.

1-31A. OPERATIONAL CHECKOUT, MM-3 ATTITUDE INDICATING SYSTEM. ▲

a. With power on, check that indicator flag disappears within 1.5 minutes.

b. Allow system to operate for four minutes.

c. Align horizon bar to miniature aircraft display with pitch trim knob.

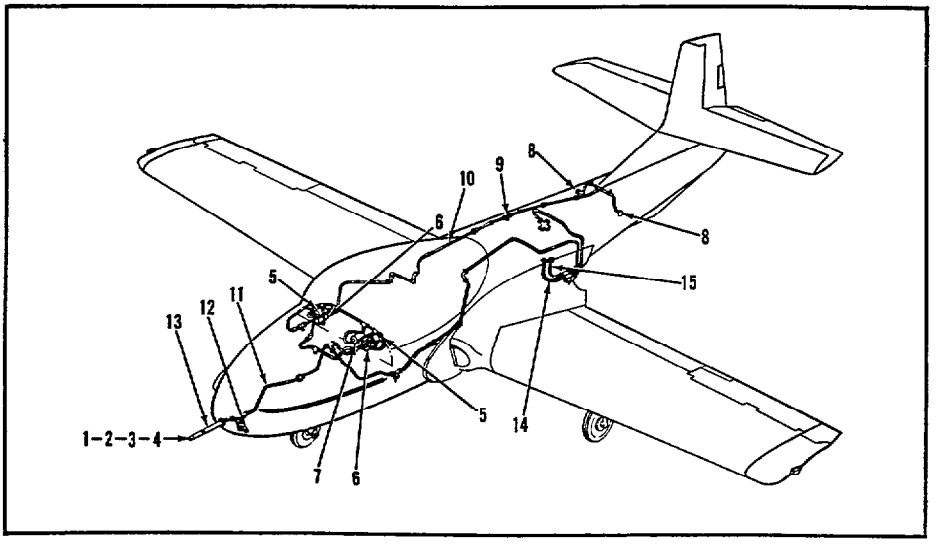
Note

The attitude indicator may not read exactly zero degrees in roll and pitch because normal aircraft parking attitude can be slightly off level.

d. Simulate flight attitudes by deflecting MD-1 displacement gyro to four positions, shown in figure 1-8A. The spheroid of attitude indicator should display the simulated flight attitude position and return to initial position when replacement gyro is released.

e. Rotate pitch trim knob fully clockwise, then fully counterclockwise. In clockwise position, horizon bar on spheroid should show 10 to 20 degrees dive. In counterclockwise position, horizon bar should show 5 to 10 degrees climb. (See figure 1-8A.)

▲ PRIOR TO T.O. 1T-37B-561



1. Pitot head
2. Screw
3. Nut
4. Heater plug
5. Airspeed indicator
6. Altimeter
7. Rate-of-climb indicator
8. Static inlet port
9. Static drain port
10. Static line
11. Pitot line
12. Pitot drain line
13. Pitot tube
14. To static line
15. To pitot line

Figure 1-9. Pitot Static System

SECTION V

ALIGHTING GEAR

5-1. DESCRIPTION. The main gears are carried by the wings and are housed within the wing gear wells when retracted. The nose gear retracts into the fuselage nose wheel well. Doors covering the wells are regarded as parts of the landing gear assemblies but the wells are structural features of the wings and fuselage.

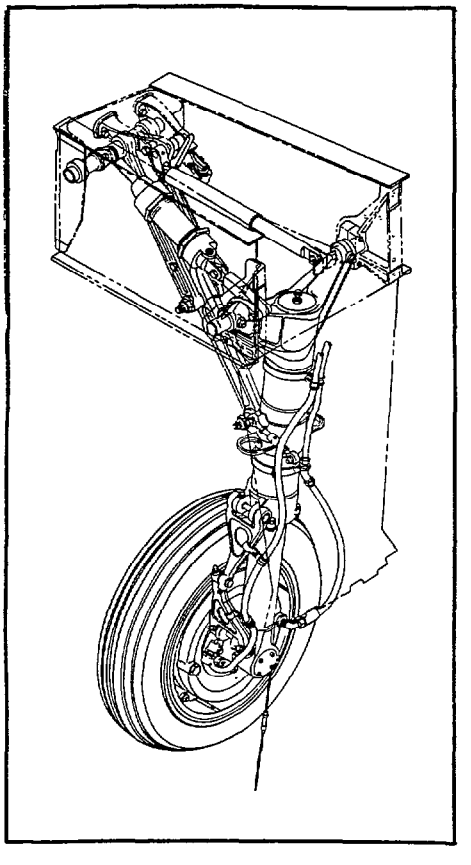


Figure 5-1. Main Landing Gear Structure

5-2. REPAIRS OF ALIGHTING GEAR GROUP. Figures 5-1 and 5-2 show the main and nose gear assemblies. These assemblies are composed of parts that are not regarded as repairable. Minor repairs are permissible on the doors but when they are reinstalled there must be no distortion that will prevent perfect operation.

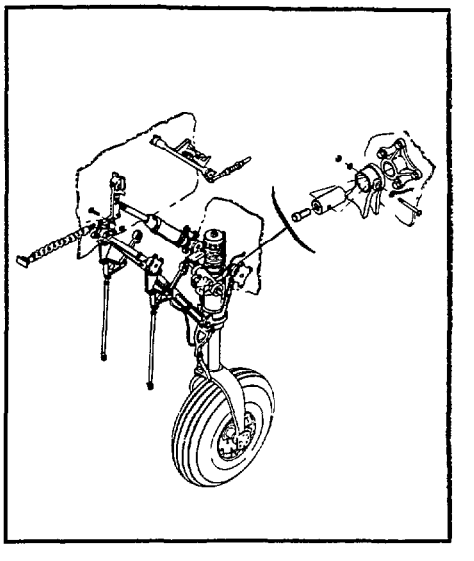


Figure 5-2. Nose Gear Structure

5-3. REPAIR OF MISALIGNED HOLES IN MAIN LANDING GEAR CYLINDER SUPPORTING STRUCTURE.

a. Disassembly and Inspection.

1. Ground aircraft to a suitable grounding fixture.
2. Defuel aircraft in accordance with instructions contained in T.O. 1T-37B-2-2.
3. Disconnect batteries located in the left forward nose compartment.
4. Relieve all hydraulic pressure in accordance with T.O. 1T-37B-2-3.
5. Remove panels Nos. 54L or 54R, as appropriate. (Ref. T.O. 1T-37B-2-1.)

Methodology for Determining Costs Per Page

Both our review and an Air Force feasibility study for the Air Force Technical Order Management System (AFTOMS) show that the Automated Technical Order System (ATOS) is not cost effective. The feasibility study for AFTOMS reported that ATOS' cost of making technical order page changes was $28.79 per page. However, we found that the study did not recognize some direct costs that significantly add to the ATOS page-change cost. When these costs were added, the study's estimated ATOS page-change costs increased to $74.46. A breakdown of these costs is supplies, $1.00; contractor technical representative, $7.30; maintenance, $37.37; and personnel, $28.79.

We found that the ATOS cost to make a page change from June 1988 through May 1989 actually ranged from a low of $74.46 to a high of $87.03 per page when the estimates supplied by the Command were similarly adjusted. The cost differs because the personnel costs varied between the Command's estimates and the study's estimates.

We computed maintenance and contractor technical representative costs by dividing them by the total ATOS production of 59,407 page changes. Personnel costs were taken from the AFTOMS feasibility study, and maintenance costs were actual Air Force contracted costs. Maintenance of the ATOS system equipment costs the Command over $2.2 million a year. In addition to the maintenance cost, we found that the Command also paid $0.44 million for the prime contractor to keep a contractor technical representative at each ATOS unit for 1 year. Supply costs were estimated at $1 per page on the basis of ATOS' original economic analysis.

In contrast to the $74.46 per page cost of using ATOS, contractors charged $11.42 per page to make page changes. On the basis of information provided by the Command, contractors were actually charging between $7.73 and $37.98 per page for changes, with an overall average of $24.13 per page. However, one ATOS unit, because of unusual circumstances, was paying private contractors an average of $37.98 per page change. When this ATOS unit's charges are removed from the average, the average price for changes made at ATOS units becomes only $11.42 per page. It is reasonable to exclude the high unit's costs from the average because in 1990 this same unit authorized a contract for technical order page revisions for about $12 per page.

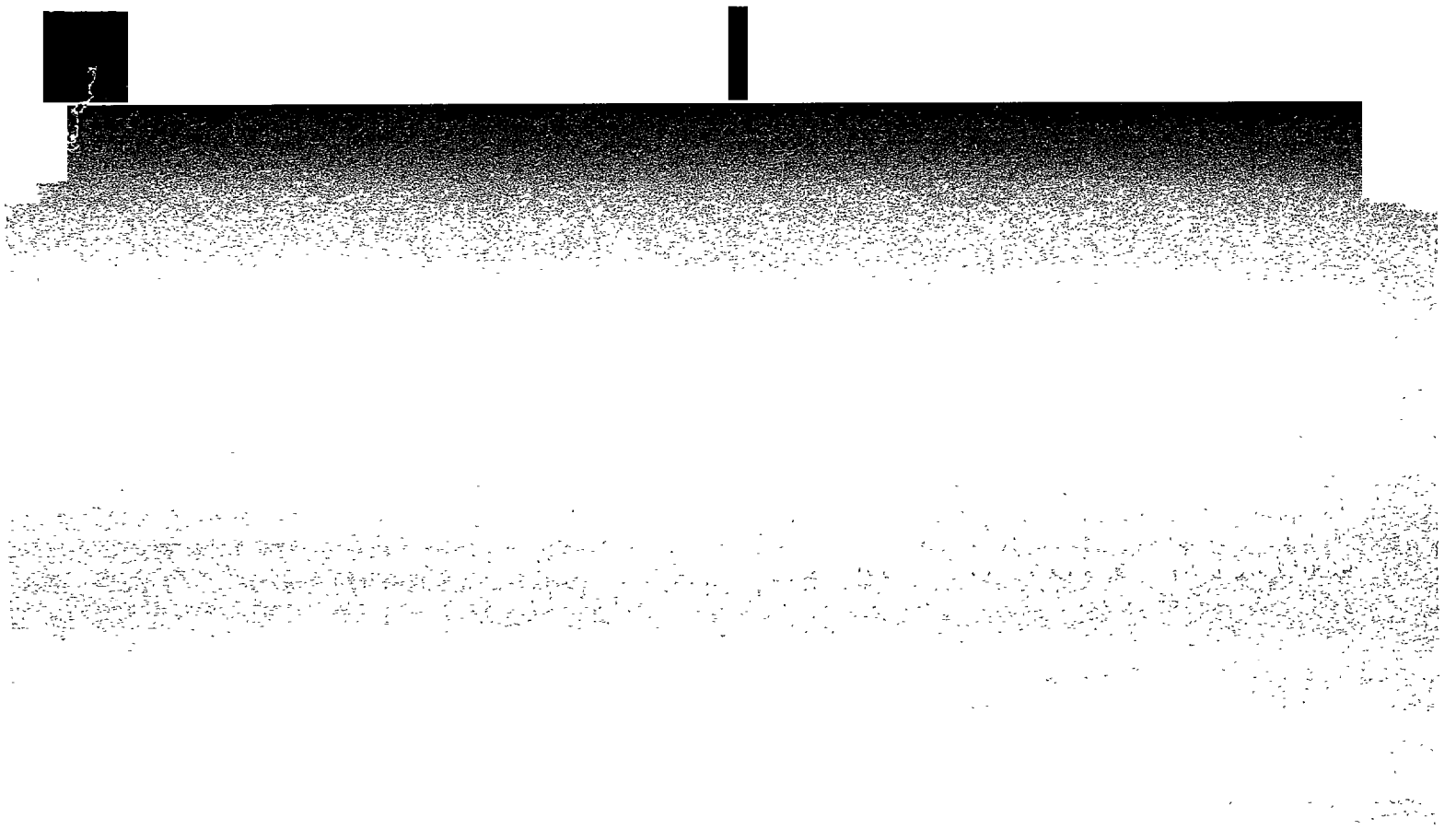
Major Contributors to This Report

Information Management and Technology Division, Washington, D.C.

John B. Stephenson, Assistant Director
Suzanne M. Burns, Adviser

Cincinnati Regional Office

Daniel V. Loesch, Regional Management Representative
Roger S. Corrado, Evaluator-in-Charge
Frederick J. Nass, Evaluator
Valerie P. Garth, Evaluator



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