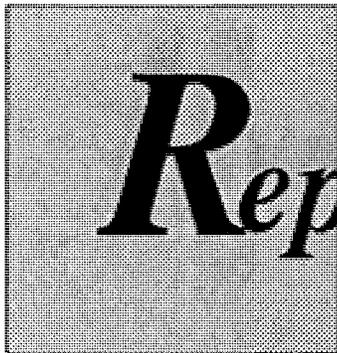


Evaluation



Report

OFFICE OF THE INSPECTOR GENERAL

EVALUATION OF CONTROLS OVER
WORKFLOW APPLICATIONS SELECTED FOR
ELECTRONIC DOCUMENT MANAGEMENT

Report No. 97-050

December 17, 1996

DEPARTMENT OF DEFENSE

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Acronyms

DCC	Document Capture Center
DFAS	Defense Finance and Accounting Service
EDM	Electronic Document Management
IAPS	Integrated Accounts Payable System
OPLOC	Operating Location
PC	Personal Computer



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Report No. 97-050

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**MEMORANDUM FOR DIRECTOR, DEFENSE FINANCE AND ACCOUNTING
SERVICE**

**SUBJECT: Evaluation of Controls Over Workflow Applications Selected for
Electronic Document Management (Project No. 6FG-5019.00)**

Introduction

We are providing this evaluation report for your information and use. This report is one in a series of reports on the Electronic Document Management (EDM) system. The Director, Defense Finance and Accounting Service (DFAS), requested assistance from the Inspector General, DoD, in reviewing the design and development of the EDM system to ensure that management and system control requirements are met before DFAS accepts the EDM system. We reviewed the EDM system in a series of design reviews and tested the EDM system at the DFAS Omaha Operating Location (OPLOC) during system acceptance training and testing. We briefed the Deputy Director, Plans and Management, DFAS, on July 11, 1996.

Evaluation Results

We commend DFAS for its critical examination of the EDM system during the testing period, and for a detailed accounting of performance and control deficiencies identified by the EDM system acceptance team. The EDM system acceptance test showed that controls over the EDM vendor payment process and workflows can achieve management control objectives related to the completeness, accuracy, and authorization of data. However, improvements are needed in the security controls over EDM system data. Specifically, controls were needed to limit log-on attempts, meet auditability requirements, and protect secure files. DFAS initiated corrective action; therefore, we are not making any recommendations at this time.

Objectives

The overall objective of the evaluation was to determine whether the EDM system can achieve management control objectives related to the completeness, accuracy, and authorization of data, and whether the system can meet requirements for document retention. Specifically, we determined whether controls over workflow applications selected for EDM were adequate. During this phase of the evaluation, we did not review procedures for rapid application development and phased implementation to assess the future auditability of imaging systems.

Scope and Methodology

Scope and Methodology. The scope of our evaluation was the EDM system prototype scheduled for use in making vendor payments at the Omaha OPLOC. To achieve our objectives, we participated in reviews of the EDM system's design, training, and acceptance testing. Enclosure 1 lists the DoD organizations that participated in the EDM system acceptance testing and the organizations we visited or contacted. Before testing, we received formal training on the EDM system and assisted the functional and technical team leaders in developing a test plan. During testing, we assisted management in evaluating system controls and security by testing the system and assessing problem reports. We maintained our independence by acting in an advisory capacity only. We did not work with the system design and development teams or participate in the DFAS decisionmaking process.

Technical Support. The Quantitative Methods Division of the Analysis, Planning, and Technical Support Directorate, Office of the Inspector General for Auditing, DoD, provided technical support in testing the EDM UNIX operating system security, reviewing evaluation steps for technical accuracy and effectiveness, and reviewing the Omaha OPLOC statistical plan for selecting the voucher packets used in EDM system acceptance testing.

Evaluation Period and Standards. This financial-related evaluation was performed from November 1995 through August 1996 in accordance with standards implemented by the Inspector General, DoD. We announced this evaluation on October 31, 1995, and performed fieldwork at the Integrated Test Facility, Camp Hill, Pennsylvania, and the Omaha OPLOC. We also performed fieldwork at the Omaha OPLOC during EDM system acceptance training and testing from April 1, 1996, to May 28, 1996. We completed our fieldwork on August 9, 1996. In performing this evaluation, we did not rely on computer-processed data.

Scope Limitations. We identified the requirements for retention of electronically stored documents, but we were unable to conduct tests to determine whether the EDM system could meet those requirements. This was because the DFAS EDM Project Manager and the system developer did not plan to convert document images to optical disks as part of EDM system acceptance testing. The DFAS Financial Systems Organization plans to test document storage and retrieval from optical disks before installing the optical long-term storage subsystem. We did not review rapid application development procedures because, according to the system developer, those procedures were not followed. Also, we did not review the phased implementation strategies because evaluating the EDM system had higher priority. We will review the procedures for rapid application development and phased implementation during the next phase of our evaluation of the EDM system.

Prior Audits and Other Reviews

No audit reports have been issued in the last 5 years concerning system controls over EDM systems in DoD, and no reviews have been performed.

Background

In 1995, DFAS selected the Omaha OPLOC for the design, development, and implementation of the EDM system prototype for vendor payments. Also in 1995, the system developer conducted a business process analysis of the Omaha OPLOC, which showed that four functional areas and associated DFAS business processes would benefit from implementing an EDM system. The four areas selected were vendor payments, disbursing, accounting operations, and travel accounting. Within those 4 areas, 27 workflow processes were identified and selected for implementation. Workflow is the automation of existing business procedures that control how work travels through an organization. Initially, 7 workflows associated with invoice payments (representing 80 percent of the total work load) would be implemented; the other 20 workflows would be implemented later.

OPLOC Consolidation and Work Load. As of July 31, 1996, the Omaha OPLOC had consolidated 22 Defense Accounting Offices for 7 Air Force and 15 Air National Guard bases. The vendor payment process at the Omaha OPLOC is document-intensive, and volume has significantly increased as the result of DFAS consolidation. DFAS projected that during 1996, the work load would increase from 12,000 to 25,500 vendor payments monthly, creating approximately 765,000 pages of documentation each month by December 1996. DFAS expects a significant increase in productivity resulting from EDM implementation. For example, economic analysis by DFAS shows that for processing payments on invoices, cycle time will improve by 41 percent and direct labor costs will improve by 43 percent.

EDM System Design. The EDM system is designed to replace paper documents with electronically imaged documents, control the workflow through the OPLOC vendor payments section, and match obligation documents, invoices, and receiving reports to payment vouchers created by the Integrated Accounts Payable System (IAPS). The EDM system is an automated information system that consists of three subsystems: document capture, indexing, and workflow. Document capture is the scanning of paper documents to create computer images of those documents. The scanner automatically tags the paper document and image with a document identifier, allowing retrieval of the paper document when necessary. Next, the indexer uniquely marks the image by document type and categorizes the image according to a predetermined workflow, which allows subsequent retrieval, viewing, and processing. Workflows consist of a series of tasks to be accomplished in processing obligations, invoices, receiving reports, vouchers, and various combinations of those documents.

The EDM system consists of hardware and software, and uses the local area network at the OPLOC. The hardware consists of scanners that convert paper documents to electronic images; servers that run the document scanning programs, maintain the operating systems, and execute the main indexing program and workflow programs; direct access storage devices that provide data access and storage; an optical disk storage subsystem that provides long-term document storage; fax gateways that electronically receive and deliver vendor payment documents and correspondence; and 200 to 380 workstations,

consisting of personal computers (PCs) connected to the local area network that allow technicians to view and process imaged documents. The software consists of Wang off-the-shelf software, UNIX operating system software, and software applications customized by the developer that control and direct all EDM system actions. The local area network uses Novell 4.1 software.

Administration of Acceptance Testing. The EDM test plan for system acceptance was issued on April 22, 1996, and described test methodology and procedures for conducting the acceptance test and reporting test results. The test plan evaluated functional and technical requirements for the document capture, indexing, and workflow subsystems. For each evaluation area within a subsystem, a test objective, criteria, and scenarios were developed. The test objective stated the purpose of the test. The EDM Project Manager at the Omaha OPLOC used functional descriptions and technical documentation to develop the criteria as standards for acceptance. The scenarios described the specific methodology to be used to conduct the test and provided the basis for analyzing and recording the test results.

The test teams used standard formats for problem reports to document issues noted during the test. The plan required all reported problems and deficiencies to be categorized in one of three ways.

- o A broken designation meant the problem required immediate attention by the system developer and a retest by the user.

- o A critical designation meant the problem was critical to system acceptance and required the concurrence of the review board to direct the system developer to implement a solution before system acceptance.

- o A desirable designation meant the problem was not essential to system acceptance, but the review board would consider the solution for future implementation.

The results of the test scenarios and the problem reports were used to assess the EDM system's performance. The EDM Project Manager at the Omaha OPLOC, serving as the acceptance test chairperson, held daily meetings with the test team and on-site system development personnel to obtain a consensus on test results, assign action items, catalog and track problem reports, and coordinate test activities.

The EDM Project Manager at the Omaha OPLOC established a review board for EDM system acceptance to provide corporate-level direction to the EDM system acceptance team in discussing test results and resolving problem reports. The review board consisted of senior managers from the Omaha OPLOC; Headquarters, DFAS; the DFAS Denver Center; and the DFAS Financial Systems Organization. Representatives from the Inspector General, DoD, and the Contracting Office Representative from the DFAS Financial Systems Organization were advisors to the board. The purpose of EDM system acceptance testing was to assure management that the EDM system performed

as intended. The test results were to support the certification and accreditation process by ensuring that security safeguards were in place for the level of risk accepted by management.

Status of Testing. Testing was suspended on May 28, 1996, because of a high volume of documented system problems. From April 15 to May 28, 1996, DFAS conducted system acceptance testing for the EDM system prototype at the Omaha OPLOC. The EDM Project Manager at the Omaha OPLOC briefed the EDM system acceptance review board on May 23, 1996, and recommended that testing be suspended while solutions to the system problems were being implemented. The review board agreed. DFAS and the system developer formally detailed the system problems and requirements on June 7, 1996. On June 20, 1996, the system developer submitted proposed solutions and a schedule for testing and implementation. Based on DFAS approval of the solutions, November 19, 1996, was established as the new acceptance test date.

Discussion

We commend DFAS for its critical examination of the EDM system during the testing period, and for a detailed accounting of performance and control deficiencies identified by the EDM system acceptance team. Test results produced 134 open problem reports that identified performance and control weaknesses in the EDM system. Further, the 134 problem reports identified 30 functional and technical requirements that needed a system-wide solution before acceptance testing could resume. The EDM system acceptance test showed that controls over the EDM vendor payment process and workflows can achieve management control objectives related to the completeness, accuracy, and authorization of data. However, improvements are needed in the security controls over EDM system data. Specifically, controls are needed to limit log-on attempts, meet auditability requirements, and protect secure files.

Results of EDM System Acceptance Test. The results of the EDM system acceptance test showed that the system needed improvements. As of May 24, 1996, the EDM system acceptance team prepared 307 problem reports. Of the 307 problem reports, the team determined that 120 were reports of recurring problems. Of the remaining 187 problem reports, 53 were satisfactorily closed and 134 were left open. After team analysis, functional and technical team leaders designated 44 reports as broken, 33 reports as critical, and 57 reports as desirable. A majority of the functional problems were directly or indirectly related to technical problems. The lack of PC memory and the system's inability to efficiently manage PC memory were responsible for at least 49 error messages that were recorded during workflow testing. Also, system response times during the workflow process exceeded acceptable limits. For example, image retrieval times averaged 26 to 33 seconds compared to a desired time of 5 seconds. Midway through the testing period, a team led by the Director, DFAS Financial Systems Organization, identified potential solutions to the problems with PC memory and system response time. To ensure that the EDM system meets acceptable response times, a stress test will be conducted when acceptance testing resumes.

The EDM system acceptance team and the system developer analyzed the 134 open reports and identified 30 functional and technical requirements (21 functional and 9 technical requirements) that needed a system-wide solution before EDM system acceptance testing could resume. Also, according to the test plan, those problem reports would not be closed until the solutions were tested. The 30 problem areas and proposed solutions are described in the system developer's draft report, "Solutions A - T for the DFAS Electronic Document Management Partnership," June 20, 1996.

Analysis of the EDM Vendor Payment Process and Workflows. Tests showed that the EDM vendor payment process and the workflow process can perform as described in the documentation and can achieve management control objectives related to the completeness, accuracy, and authorization of data. During testing, several functional and technical problems were encountered that required solutions; however, the system's controls over the EDM vendor payment process and the seven workflows tested will perform as intended when the problems are corrected. The seven workflows are obligation posting and invoice posting for vendor payments, posting of receiving reports, voucher certification, vouchered for-others processing, disbursing automated payments, and customer inquiry. Some of the corrections and anticipated benefits from the EDM prototype system are as follows:

Document Capture and Indexing. As a result of testing, changes to the document capture and indexing subsystem are being made. Procedures will be modified to ensure that incoming electronic fax documents are not misrouted after rebooting the scanning servers. Also, multiple documents scanned together require that the software allow documents to be split and the document type changed while the same document is indexed several times. The EDM vendor payment process begins with the Document Capture Center (DCC), where OPLOC personnel open, sort, and batch vendor payment documents. The vendor payment documents are scanned and the paper documents are imprinted with a document identifier for potential retrieval. The document image is placed in the electronic indexing queue, along with electronic fax images processed through the fax monitor. The images are indexed by document type and categorized according to a predetermined workflow. The EDM subsystem for electronic document capture provides more control over vendor payment documents than a manual system because the documents are immediately indexed and boxed, and are retained as prescribed by local operating procedures. Also, EDM electronically records the receipt date and location of the document image. Electronic and manual quality controls are used to ensure that images are readable, complete, and accurate, and that control logs are kept for exception handling. Assembling and batching documents in the DCC and uniquely marking the images in the database during the indexing process gives accounts payable technicians and obligation entry technicians immediate access to organized sets of the vendor payment documentation they need to accomplish their work.

Accounts Payable Workflows. Acceptance tests identified changes needed to make accounts payable workflows more efficient. For example, workflow software will be modified to allow the accounts payable team leader to change a document type, cancel the old workflow case, and create a new case

when documents are indexed incorrectly. After indexing, a workflow case is created for each document and is entered into one of four accounts payable workflows. Those workflows are obligation posting and invoice posting for vendor payments, posting of receiving reports, and customer inquiry. Each technician performs his or her assigned duty, such as viewing documents, updating indexing data, researching documents, verifying data, or entering data from document images into IAPS. Before entering data into IAPS, technicians examine the images for clarity, completeness, and accuracy. The risk of entering incorrect data into IAPS has been reduced. By using the Windows cut-and-paste feature, data can be transferred from the document index screen to the IAPS screen without error. Other options available to the technicians are returning documents to the DCC for rescanning or exception handling, and forwarding documents to team leaders when their help is needed. Management controls are enhanced because all screen actions taken by technicians are recorded and visible through system productivity reports, allowing management to identify production problems and evaluate employee performance.

Voucher Certification Workflow. As a result of testing, several changes to the software for voucher certification workflow will be implemented to make it more efficient. For example, the software will be modified to allow voiding a certified voucher until the print file is sent to processing. The EDM system intercepts the IAPS voucher print files, converts them to voucher images, and creates a workflow case for each voucher. The voucher is inserted into the workflow for certification. During this process, supporting document images are added to each workflow case by linking contract numbers, invoice numbers, and dates when goods and services are received. Certifying officers view the workflow cases containing the voucher and supporting document images, and certify, void, or return the voucher folder to an accounts payable technician for additional review. This workflow has the greatest potential for saving time, and the automatic assembly of supporting documents for each voucher has the greatest potential for increasing productivity.

Disbursing and For-Others Workflows. The workflow for disbursing automated payments needed correction to show separate totals for cash, check, and electronic funds transfer payments in the reconciliation report, while no corrections were needed to the for-others workflow. The for-others and disbursing automated payment workflows are initiated upon voucher certification. The workflow for vouchered for-others processing recognizes certified vouchers marked "for-others processing" and routes the voucher package to the assembly technician, who prints the documents and forwards them to the appropriate accountable station. The workflow for disbursing automated payments makes voucher status data available to the disbursing section, where personnel reconcile voided and certified vouchers between IAPS and EDM. The disbursing section electronically forwards the reconciled and certified check print files to the DFAS Denver Center for payment.

Analysis of Security Requirements for EDM Systems. Security controls over EDM system data needs improvement. The results of EDM system acceptance testing showed that the system could not demonstrate the necessary log-on security, audit trails, and safeguards for protecting secure files. According to DoD Directive 5200.28, "Security Requirements for Automated Information

Systems (AIS)," March 21, 1988, DoD automated information systems require a Class C2 level of security (Controlled Access Protection). The C2 standard is defined in DoD 5200.28 Standard, "Trusted Computer System Evaluation Criteria," December 1985. Systems in this class use access control to protect files and programs from unauthorized access. Users are made individually accountable for their actions through log-on procedures and auditing of security-related events such as users exceeding limits for log-on attempts. Logging functions that collect data on security-related events should also be isolated from the data they protect, and should be subject to the same access control and auditing requirements.

Access Control. The system administrator exercises access control by providing individuals with access to the EDM system in accordance with access lists approved by management. The lists identify the role assignments for which each individual is authorized. The role assignments are defined by system parameters and linked to user identification numbers set by the system administrator. The EDM system authenticates the user identification number by matching it to a password recognized by the system and known only by the user. In this manner, manual and automated access controls ensure that vital workflows necessary to process vendor payment documentation are limited to technicians who are authorized to do the work. The system developer is responsible for system administrator functions until the function is turned over to OPLOC personnel.

Log-on Procedures. EDM applications and the UNIX operating system allowed unlimited attempts to log on to the system. The system administrator determines the number of attempts allowed. The generally accepted standard for automated information systems is to allow three attempts, after which the system administrator must intervene. The risk in allowing unlimited attempts is that an individual could eventually guess the user's password and gain access to the system without the system administrator's knowledge. The system developer has developed a solution for the EDM applications, but not for the UNIX operating system.

Audit Trails. Features of off-the-shelf software designed to ensure adequate audit trails were not turned on during acceptance testing. Therefore, the test team could not determine to what extent operating system events and application system events could be reconstructed, or how system performance would have been affected if the features had been turned on. In response to problem reports on the adequacy of EDM audit trails, the system developer made the following statement in the "Omaha Detailed Requirements for the DFAS Electronic Document Management Partnership," June 7, 1996.

A substantial amount of raw information is currently being gathered by some of the application software products being used in the EDM system. These applications include the Oracle database and the Wang OPEN/workflow database. In some cases software tools exist to extract and format this data for auditing purposes. In many cases new software tools will have to be developed. New development will be required to gather and report the other data events which occur in the EDM system. In the operating system area [UNIX], very little

information is currently being gathered and the operating system software provides little capability to capture the information without extensive operating system modification.

At a minimum, system transaction and access logs should be date- and time-stamped for each individual user session. Audit data must also be available for reconstruction of any user session to aid security review or auditing. The system developer stated that transaction logging data could be collected if the portion of the EDM system that runs on Hewlett-Packard computers could run under the Hewlett-Packard "Trusted System".* However, according to the system developer, that trusted system is not compatible with the Network Information Service configuration used by EDM to provide basic user authentication for the Wang products. We are working with the DFAS Financial Systems Organization, the EDM Project Manager at the Omaha OPLOC, and the system developer to define a format for creating an adequate audit trail.

Secure File Protection. The password file in UNIX is not hidden from potential unauthorized system users to ensure file protection. Once access to UNIX is obtained, individuals can read the list of user identifications in the secure password file and attempt to decode the encrypted passwords. System integrity would be compromised if an unauthorized user gained access to the system's production, logging, or program data, because no record would be made of the files accessed or actions taken against those files. In addition, an unauthorized user could alter the audit files, thus eliminating any evidence of intrusion. The system developer and personnel from the DFAS Mid-Tier Maintenance Organization have discussed the problem and proposed several approaches to making the password file less visible and reducing the risk that unauthorized users can access EDM system files.

Other preventive controls are in place to protect system data from unauthorized users. For example, the first log-on required to access the EDM system applications is through the Novell 4.1 network software, which limits log-on attempts. Also, a barrier to unauthorized entry over the internet is provided by the Transmission Control Protocol Wrapper Program, which requires positive identification by internet protocol address of all attempts to access the EDM system.

Summary

EDM system acceptance testing produced 134 open problem reports that identified system performance and control weaknesses. Those 134 problem reports identified 30 functional and technical requirements that needed a system-wide solution before acceptance testing could resume. The EDM system acceptance test showed that the controls over the EDM system's vendor payment process and workflows can achieve management control objectives related to the completeness, accuracy, and authorization of data, and can perform as intended when the 30 identified requirements are satisfied. Included

*Establishes a system as Class C2.

in those requirements is a need for DFAS to improve the EDM system's security controls in order to limit log-on attempts, meet system auditability requirements, and protect secure files. DFAS initiated corrective action, therefore, we are not making any recommendations at this time. We will continue to review the EDM system in the next phase of our evaluation.

Management Comments

We provided DFAS a draft of this report on September 9, 1996, for review and comments. We did not request written management comments, and none were provided. We discussed the draft report and the results of our evaluation with the EDM Project Management Office. The EDM Project Office agreed with the results of our evaluation and suggested minor changes to the final report. We agreed that those changes were appropriate and included them in the final report.

We appreciate the courtesies extended to the evaluation staff. If you have any questions or wish to discuss this report, please contact Mr. Christian Hendricks, Evaluation Program Director, at (703) 604-9139, or Mr. Carl Zielke, Evaluation Project Manager, at (703) 604-9147. The distribution of this report is listed in Enclosure 2. Evaluation team members are listed inside the back cover.



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