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ABSTRACT

This publication discusses optical storage, a term encompassing technologies that use laser-produced light to record and store information in digital form. The booklet also discusses how optical storage systems relate to records management, in particular to the management of local government records in New York State. It describes components of such systems, discusses advantages and disadvantages of optical storage, and specifies guidelines and recommendations to ensure accessibility and intelligibility of records. Although such systems are currently being used in a small number of local governments in New York, interest in the technology is increasing. Optical disk is the most common optical storage medium. Optical disks for data storage are generally rewritable (erasable) or write-once (nonerasable; or write once, read many times), and should be distinguished from the more common Compact-Disc-Read Only Memory (CD-ROM). Typically an imaging system with optical storage consists of hardware, software, storage media, and peripheral devices, all of which are discussed. Advantages and disadvantages of components and the system as a whole are discussed. (SLD)

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Local Government Records
Technical Information Series

NEW YORK
THE STATE OF LEARNING

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The State Education Department
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Local Government Records Services
Albany, New York 12230

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Local Government Records
Technical Information Series No. 45

Introduction

This publication discusses *optical storage*, a term encompassing technologies that use laser-produced light to record and store information in digital form. The booklet also discusses how optical storage systems relate to records management. It describes components of such systems, discusses advantages and disadvantages of optical storage, and specifies guidelines and recommendations to ensure accessibility and intelligibility of records. For a discussion of optical storage systems and their relationship to electronic document imaging systems, consult *Local Government Records Technical Information Series No. 21.*

Optical storage systems are currently being used in a relatively small number of local governments in New York State, but interest in this emerging information technology is increasing among local officials. While many optical storage systems are expensive, they may be worth considering for certain applications in which large volumes of records must be quickly retrieved from multiple locations.

Electronic records — that is, records stored in a form that only a computer can process are created in a variety of ways. Most electronic records are created manually by a worker using software such as word processing, spreadsheet or database products, or automatically through software programmed to create such records. In most cases, these electronic (or machine readable) records exist in computer code which cannot be read or interpreted without computer hardware and software. These records may be stored on a variety of media including magnetic tapes or disks, magneto-optical disks or optical disks or tapes. Most public records which are stored on optical storage media entered an organization in eye-readable form, usually as paper documents. These paper documents were captured and electronic files containing images of them were created through the process of scanning. This

publication is intended to provide an introduction to and general guidance about optical storage systems.

Optical Storage Systems: Components

In the most general terms, images of documents are "recorded" through a *scanner*. Scanners look and function like photocopiers, but instead of copying onto paper, they "copy" images of documents into a digital format that is stored on a computer-readable disk or tape. Scanners are discussed below in the section on "hardware." While the images scanned into a system may be stored on either magnetic or optical computer storage media, they are most commonly stored on optical media because the files are large and optical media have extremely high storage capacity. During the process of recording images, the images are indexed to expedite future retrieval. These indexes are maintained in a database which may be stored with the images on optical media. However, indexes are most often stored separately from the images, often on magnetic media.

When optical disks are "written to" or "recorded," lasers alter their surfaces, thereby changing their light reflecting properties. These alterations are "read" by software during the retrieval process. Once retrieved, images may be read by the human eye as a display on a monitor, or printed or plotted on paper, or copied onto microfilm. These images may also be distributed via telecommunications networks so that several users may see and act on them simultaneously.

Optical disk is the most common optical storage medium. An optical disk is platter-shaped and housed in a plastic container. Optical disks used by governments for storing computer data are generally manufactured in two types: *rewritable (erasable)* and *write-once (nonerasable)*, sometimes called *WORMs (write once, read many [times])*, and should be distinguished from the more common Compact Disc-Read Only Memory, or CD-ROM, which is used primarily as a distribution medium for a variety of publications. While the nonerasable type of optical disk seems ideal for storing public records, this type is losing favor with manufacturers and is becoming less common and more expensive. Governments may store public records on rewritable media and use appropriate precautions to protect them. Records stored on any computer media may be protected to a great degree by developing, implementing, and documenting procedures for recording, storing, maintaining, accessing, and changing records. Following such procedures will reduce the negative impact of using rewritable disks.

Typically, an imaging system with optical storage consists of hardware, software, and storage media and a number of peripheral devices.

Hardware

Central Processing Unit (CPU)

As in any computer system, the size and complexity of the activity will contribute to decisions on the size, speed, and capabilities of the computer used by the system. Desktop computers, often running on local area networks, have come to be used in all but the largest electronic document imaging applications. Some systems require the capacity of a minicomputer such as an IBM AS400 or one of the Digital Equipment VAX family of computers, or those manufactured by other companies. Some very large systems run on mainframe computers, such as those manufactured by IBM and Unisys.

In addition to the central processing unit (CPU), electronic document imaging systems include numerous peripheral devices which are also selected based on a variety of factors. Since the major input device for these systems is a scanner, great care must be taken in selecting a scanner which will meet the government's requirements. Scanners should be selected for their ability to handle the volume, size, weight, and color of paper, and the colors of inks used by the government, and by those individuals and organizations whose documents the system will scan. Large systems often include scanners which can capture images of documents at very high rates of speed, much higher than those required in smaller installations.

Special monitors are recommended. These have larger screens and are capable of displaying greater detail than standard monitors. Disk drives on which the optical disks can be mounted and read are also required. Disk drives must be matched to the size and type of disks used. These disk drives may be housed in automatic changing devices, also known as "jukeboxes." Jukeboxes can hold disks and disk drives of different sizes and types. Using such devices allows searchers to locate and retrieve large numbers of images stored on different disks in a reasonably short period of time.

Software

The software in an electronic imaging/optical storage system is the key to a fully functional and smooth running application. Programs control and manage scanning, compression (since image files are very large, efficient storage and transmission require that they be compressed), storage, indexing, search, retrieval, display, and distribution among other functions. The indexing of images is one of the most critical aspects of optical disk systems. The index is the searcher's only guide to the images; retrieval of images is completely dependent on efficient and accurate indexing.

Many systems use common or "nonproprietary" software for some, most, or all of these tasks. Other systems use customized, often propri-

etary, software. Because electronic document imaging is a relatively new technology, vendors of imaging systems and optical storage devices sometimes leave this business or go out of business completely. This being the case, if proprietary software is used in a system selected by a government, it is very strongly recommended that the government obtain the source code (the programming required to make the system function) from the vendor. If the vendor will not supply the source code directly to the government, it is strongly recommended that the government have the vendor deposit the source code in escrow with a financial institution.

Storage Media

Images of documents are most often stored on optical disks. Disks are preferable to tapes because they are direct access storage devices. This means that images may be found more quickly on a disk than on a tape. Optical disks are used more often than magnetic disks because they offer a great deal of storage capacity in a relatively small space.

Examples of Use of Optical Storage Systems

Optical storage systems are used to reduce the quantity of paper, speed access to information, and meet the needs to have records made available to and accessible by several people at the same time. Some local government applications include:

1. **Deeds and other legal documents** that are filed in county clerks' offices and elsewhere and that are frequently retrieved, copied, and used. Optical systems provide for easy handling of large numbers of documents, compact storage of the information, and fast retrieval.

2. **Social Services case files** that are composed of many types of documents coming from different sources. These documents must be brought together for review by clerks and caseworkers to determine eligibility or to provide services. Storing images of documents on optical disk provides workers frequent and easy access to the content of these documents through telecommunications, allows action to be taken and noted, and allows originals to remain in file folders undisturbed.

3. **Building permits and certificates of occupancy,** two frequently referenced and very large record series. Like social services case files, these records must be kept for a long time, and should be kept in eye-readable form. However, they are frequently referenced and accessed for many purposes. Storing them on optical disk, thereby making them simultaneously available to users at multiple locations within a town building department, can significantly improve service delivery.

4. **Other records large in volume and frequently referenced**, especially by many people who use them simultaneously.

Advantages of Optical Storage Systems

1. **Density of storage.** Optical storage systems provide for exceptionally high storage densities, thereby making it possible to store large quantities of information in very compact form. Original documents with short legal retention periods (less than ten years) may be destroyed or stored off-site, thereby freeing office storage space.

2. **Multiple access.** Optical disks can be copied easily and inexpensively, but their real advantage is that the data stored on them can be accessed simultaneously by networked computer workstations. This makes it possible for information to be made available in many locations at the same time.

3. **Quick retrieval.** Depending on the number of disk drives and workstations available, it should be quicker to access information from an optical storage system than from a paper-based or microfilm-based filing system.

4. **Elimination of misfiles and missing documents.** One of the disadvantages of paper filing systems is the unavailability of records due to misfiling. This is a far smaller problem with optical storage systems because of their emphasis on indexing and searching.

5. **Readability.** Optical storage systems are capable of providing high resolution output to monitors, printers, or plotters, making for easier reading of information than is often the case on microform-based systems.

Disadvantages of Optical Storage Systems

1. **Lack of technical standards.** Few national technical standards have yet been established for optical disks or optical storage systems. The situation differs from that of older, more settled technologies, such as microfilm, where there are reliable and long-standing guidelines and standards from such recognized sources as the American National Standards Institute and the Association for Information and Image Management.

2. **Uncertainty about longevity.** It is uncertain how long the information on optical disks will last. Some manufacturers advance claims of 100 years or longer but definitive evidence is lacking to substantiate such claims.

3. **Technological obsolescence.** Regardless of how long the information lasts, it may be inaccessible due to changes in, or obsolescence of, hardware and software needed to retrieve and read the information.

4. **Expense.** Installation of an optical storage system, including purchase of all the needed equipment, hiring new people and/or training existing staff, can add up to a heavy expense. In many cases, the expense will be so great that it would be much cheaper to maintain the records in paper form or to microfilm them. Much of the expense is tied to converting the extraordinarily large amount of existing paper documents to machine-readable form.

Objectives in the Development and Maintenance of Optical Storage Systems

The National Archives and Records Administration recommends that state and local officials consider the following objectives in developing and maintaining Optical Storage Systems (from National Archives and Records Administration and National Association of Government Archives and Records Administrators, *Digital Imaging and Optical Media Storage Systems: Guidelines for State and Local Government Agencies*, Washington: NARA, 1991, pp.4-16):

- Maintain the usability of image and index data over time;
- Ensure the quality of digital images;
- Provide for system component functionality over time;
- Limit deterioration of optical storage media; and
- Anticipate new technological developments.

As in the case of managing any public records, whether they are stored on paper, microfilm or computer media, planning and careful implementation are the keys to success. The above objectives are reasonable and attainable and should be held constantly in mind by records creators, systems developers, and records managers and archivists. The section below, called "Disposition of Records Copied on Optical Media - Recommendations and Guidelines," addresses many of these issues.

How to Decide Whether an Optical Storage System Is Needed

The greatest advantages gained by installing imaging systems which include optical storage are in those applications with large volumes of records frequently referenced by users at different locations, either locally or at a distance. The economies and predictable storage capabilities associated with microforms make them an obvious choice for the long-term storage of infrequently referenced records. In many instances, imaging systems using optical storage can be justified as a workflow enhancement, independent of their storage capabilities. That is, the ability to index, store, and quickly retrieve images of documents may lead a government or agency to adopt this technology while it maintains paper or microfilmed copies of these documents as the offi-

cial record. Workflow is discussed in SARA's publication, *Electronic Document Imaging and Optical Storage Systems for Local Governments: An Introduction*, Technical Information Series No.21.

Disposition of Records That Have Been Copied on Optical Storage Systems—Recommendations and Guidelines

The Local Government Records Law (Section 57.29, Arts and Cultural Affairs Law) provides that "Any local officer may reproduce any records in his custody by microphotography or other means that accurately and completely reproduces all the information in the record. Such official may then dispose of the original record even though it has not met the prescribed minimum legal retention period, provided that the process for reproduction and the provisions made for examining the copy meet requirements established by the Commissioner of Education. Such copy shall be deemed to be an original record for all purposes, including introduction as evidence in proceedings before all courts and administrative agencies."

The Commissioner of Education, through the State Archives and Records Administration, provides that optical storage systems may be used for copying records under the following conditions:

Scanned images of public records which must be retained for 10 years or more or which have been appraised as archival, may be stored on magnetic, magneto-optical, or optical computer storage media for use by the government or by the public, but the government must ensure intelligible access for the life of the record and may do so in many ways including retaining eye-readable originals or true copies, either on paper or on microfilm which is produced according to section 185.7 of the Regulations of the Commissioner.

Scanned images of public records with a legal retention period of less than 10 years may be stored on an optical medium to replace an original record. In order to ensure accessibility and intelligibility for the life of these records, the following procedures are strongly recommended:

A. System Design

- Systems should be built from hardware and software components that are nonproprietary and conform to commonly accepted standards.
- Local governments are strongly advised to contract with vendors to supply source code and documentation to the local government or to deposit such source code and documentation in escrow with a financial institution for use in the event of the vendor's business failure or in the event of the vendor's decision to leave the imaging business.

B. Scanner Performance

- To ensure image legibility, local governments should employ appropriate scanning density (dots per inch) as recommended by the manufacturer for the type of document, weight of paper, size and form of type. These settings should be validated by empirical testing with the government's own documents. The actual scanner used in the project should be the one used in the test. Scanning density may vary by document type or quality and should be adjusted as needed. Test results should be reported and kept in a log.

- Local governments should verify and document that scanners employed during imaging are capable of capturing all colors represented in the documents being imaged.

- Local governments should provide quality control of images as described below in Section D.

C. Compression

- Local governments should use imaging systems which use prevailing compression standards.

- If local governments cannot comply with the recommendation above, it is highly recommended that they use "lossless" compression algorithms. Source code for these compression algorithms should be supplied by the vendor to the local government per Section H.

D. Input Quality Control

- Local governments should document that all system components receive periodic maintenance.

- Local governments should document that optical drives are recalibrated, at least annually, according to manufacturer's recommendations.

- Local governments should document that, before the image is written to optical disk, quality control procedures are established and performed for each scanned image and its index data.

E. Storage Media

- Local governments may store images on optical disks of any size and any type.

- It is highly recommended that local governments use optical disks with a postwrite life of at least 20 years (based on the results of documented accelerated aging tests). Local govern-

ments should note and log, for each optical disk, dates of manufacture, manufacturer's estimate of pre-write shelf life and postwrite life. Local governments should use optical disks with a prewrite shelf life of at least five years. Local governments should record data no less than one year before the expiration date provided by the optical disk manufacturer.

F. Preservation

- To ensure that images stored on optical disk are preserved, local governments should maintain proper care and handling procedures by keeping the room temperature between 65 degrees and 75 degrees Fahrenheit and the relative humidity between 30 percent and 50 percent.
- Local governments should periodically clean optical media to remove dust and other particulate matter.
- Local governments should prohibit eating, drinking, and smoking in the areas in which optical media are stored.

G. Migration Strategy

- When local governments upgrade equipment they should recopy images stored on optical or magnetic media to be compatible with new technology.
- For records which must be retained for at least 10 years and which are stored on optical media, local governments should recopy images to new media at least every 7 years, and to new technology as mentioned above.
- Local governments which cannot comply with the recommendation above should provide access to these records on eye-readable media including paper or microforms which comply with requirements stated in Section 185.7 of Part 185, 8NYCRR (Regulations of the Commissioner of Education).

H. Continuing System Functionality

- Local governments' imaging and optical storage systems should use open systems architecture (a systems design approach which permits users to interchange system hardware components with minimal impact on the primary operating software and to upgrade the system over time without risk of data loss).
- Local governments which cannot comply with the recommendation above should require vendors to provide a software bridge to systems with nonproprietary configurations.

- Local governments should document that upgrades to existing systems or new systems are compatible with existing systems.

- Local governments which cannot comply with the recommendation immediately above should require that vendors guarantee conversion of 100 percent of existing images and indexes to the new system.

- Local governments which cannot comply with either of the two recommendations immediately above should provide access to the nonportable images and their indexes through eye-readable media such as paper or microforms, following procedures described in Section 185.7 of Part 185, 8NYCRR (Regulations of the Commissioner of Education).

- Local governments which store indexes to data on optical disk should store such indexes on each optical disk at multiple locations on that disk. Local governments which store indexes to images separately from the optical disk must assure that the indexes remain accessible and intelligible for the time the images must be retained.

- Local governments should require vendors to provide or place in escrow a complete set of documentation, including source code.

- Local governments should ensure that read/write privileges are controlled and that an audit trail of rewrites is maintained when rewritable technology is used.

- Local governments should establish and follow written authentication procedures for electronic document imaging systems and optical storage systems identical to that described in Section 185.8 of Part 185, 8NYCRR (Regulations of the Commissioner of Education).

For More Information and Assistance

The State Archives and Records Administration provides records management services to local governments including technical advice and assistance, publications, training and presentations, and consultations with local government officials concerning records and information management issues. SARA has regional offices throughout the State; each office has an expert records specialist who can visit local governments and provide on-the-spot advice. These services are sup-

ported by the Local Government Records Management Improvement Fund. For further information, contact your regional office or:

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