Innovations in Election Administration

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Election Signature Retrieval Systems

Federal Election Commission · United States of America

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Introduction by the Clearinghouse

This report is the third in our series on Innovations in Election Administration being published by the FEC's National Clearinghouse on Election Administration.

The purpose of this series is to acquaint State and local election officials with innovative election procedures and technologies that have been successfully implemented by their colleagues around the country.

Our reports on these innovations do not necessarily constitute an endorsement by the Federal Election Commission either of the procedures described or of the vendors or suppliers that might be listed within the report. Moreover, the views and opinions expressed in these reports are those of the author and are not necessarily shared by the Federal Election Commission or any division thereof.

We welcome you comments on these reports as well as any suggestions you may have for additional topics. You may mail these to us at:

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Election Signature Retrieval Systems

Productivity, the word so often heard in management in the '80s continues with us into the '90s. With shrinking budgets managers are constantly asked to do more with less. Many computer systems have delivered less than promised in the areas of reducing labor costs and processing times. With Signature Retrieval Systems promises seem to be fulfilled in the experiences of the majority of election jurisdictions nationwide that have chosen to install these systems.

The labor intensive, time consuming task of checking the validity of voter's signatures on petitions, candidate nominations, absent voters and mail ballot elections has become a very significant problem for elections administrators. As the popularity of voting by mail and the initiative process continues to grow the workload also has risen.

The increased workload has caused many jurisdictions to choose computers to aid in the verification of signatures. Leading the way were Pinellas, Orange and Dade Counties in Florida. These systems provide an image of the voter's signature on a computer monitor screen that is manually compared to a voter's signature on another document, eliminating the need to search through paper files or microfilm. Many agencies have found that without these systems they would not be able to meet the legal deadlines for verifying signatures because of the volume of work.

Some jurisdictions have reported a 300% improvement in productivity. Palm Beach County,

Florida states that one person can check 1,200 signatures per day with their automated signature retrieval system (SRS). Under their manual process one person could check only 400 signatures per day. Manpower hours in this jurisdiction have been reduced overall by one third. Most agencies surveyed, like Monterey County in California, report significant savings in their absent voter and petition checking process with these systems.

Generally, the signature retrieval systems operate as follows. After a voter registration document is checked to make sure it is completed properly, the document is scanned, with a document scanner or video camera. Scanning, also called digitizing, is taking an electronic copy of a document or signature by converting it to a series of dots.

To associate the signature with the voter record, usually, it is necessary for the operator to enter data from the document before scanning. In other systems the operator enters data, on the same screen on which the image is displayed, as is true with the Los Angeles County, California system.

At time of scanning, the system allows the operator to examine and adjust the image before causing it to be stored on magnetic or optical disk. Several systems store the document on optical disk and the signature on magnetic disk. Doing this improves responses times for retrieving signatures that are required much more frequently,

than is the whole image of the document. Response time is the amount of time the computer requires to retrieve the requested information and display it on the screen.

Those jurisdictions that store the image on optical disk, do so to have a duplicate of their paper document and, in some cases, to eliminate microfilm. Some jurisdictions make a backup of the optical disk platter. The backup platter is stored in an off-site location, much as they do with backups of the magnetic data files. This can provide them with a means to recover should their facility be destroyed by fire or other disaster.

Once stored, the document or image can be retrieved and displayed on a computer screen. A person can use the displayed signature image to validate a signature on another document.

While most of the systems are used for petitions and absent voter processing, Sarasota County, Florida has extended the use of their hardware and software investment. They have implemented a separate system for tracking Loyalty Oaths, Appointments of Treasurer information and Treasurers reports for Candidates and PAC's using their signature retrieval equipment.

The more sophisticated systems allow signature retrieval with the data entry functions for tasks such as checking petitions and returned absent voter ballots. In these cases, the operator can immediately update the petition or absent voter data base with the results of the signature check. With some systems, one checks the signature, makes a notation and then later enters the results of the check to the appropriate data base.

Signature retrieval system hardware can include the following: personal computer with monitor(screen), keyboard, mouse(pointer device), floppy disk and hard disk; backup tape unit; optical disk unit; document scanner or video camera; and a laser printer.

Purpose and Approach of Report

The purpose of this report is to help state and local election administrators, especially those jurisdictions without data processing staff, by providing a review and benefits assessment of the current state of signature digitization technology.

Agencies already using signature retrieval technology were surveyed and have willingly provided input to this article. We have consolidated and reported their experiences with these systems. This article shares their best ideas and cautions to those who come behind them.

It is important to clarify that this report is not evaluating or comparing systems currently offered in the marketplace. No endorsements of vendors or their systems are made or intended. Vendors providing these systems were usually a good source of information and referral.

Besides identifying agencies where the technology is currently being used, the report explains background, history, technology, benefits, costs and problems associated with signature retrieval systems in elections.

We contacted all the states and the territories to ask for referrals to jurisdictions where these systems were currently in use. Two questionnaires were prepared. One was sent to the fifty Secretaries of State to ask them to identify jurisdictions where the systems are in use in their state. We received replies from thirty five states.

When specific referrals were received from the state office, we sent a detailed thirteen page questionnaire to the local agency asking about their system and experiences associated with installation. Fifty agencies in ten states were sent the longer questionnaire. Twenty-two were returned by local jurisdictions from the states of Arizona, California, Florida, Georgia, New York, Oregon and Washington. Several sites, in Florida and California, were visited where these systems are working in production.

The information received was summarized to provide the information needed for this article. It

makes recommendations about what to look for should you be considering installation of a signature retrieval system, in your jurisdiction.

Definitions

The following definitions intend to clarify usage of terms used in this report.

Signature Digitization - is the function of scanning a signature or document to encode the image of a signature in a computer. The captured image is much like the image on a television screen. The image is stored on magnetic media, such as disks or tape, or on an optical storage device.

Signature Retrieval - this term, as used, includes digitizing, retrieving and displaying a document or signature on a screen or report.

Signature Verification - the process where a person compares a signature on a screen to a signature on another document.

Automated Signature Verification - the process where a computer compares a signature on one document to another signature on a data base. Currently installed signature retrieval systems cited in this article do not have this capability. In the opinion of the authors, we believe that it will be at least a decade before these systems are economically feasible.

The reason for the delay is two-fold: one, we don't write our signature the same way each time we sign our name. This requires the computer to match things that are not the same. Second, making the comparison at speeds comparable to those being achieved with existing systems. This type of matching will require much faster computers with artificial intelligence.

Image Compression and Expansion - Images are a form of computer graphics representing the data in dots or pixels (picture elements). With the data scanned and displayed, measured in dots-per-inch, much of the image consists of "white space." Most image scanning and retriev-ing systems use image compression to reduce the amount of magnetic or optical disk space required to store the image. Image compression also reduces the amount of data that must be transmitted from storage to be displayed thus improving response time for displaying an image.

A simple explanation of compression and expansion is as follows. With compression, a blank line on a screen requiring eighty characters can be reduced to a few characters of a formula. Compression of an image occurs before storing it on a storage device.

Expansion happens after an image is read from storage and before the image is displayed on a screen or printed. It uses the mathematical formula to put the "white space" back in the blank line.

In most systems, compression is done with software, although some use special computer hardware boards that are usually faster and can provide greater compression of the image.

Background and Beginnings

The Technology

Signature retrieval systems go back to the earliest days of microfilm, which is an application of Document Image Management (DIM). Microfilm, beginning in the early 1970s', as a computer driven technology, was first used to address the needs of paper look-up tasks.

Signature retrieval systems use what is known in the computer industry as Document Image Processing (DIP). The DIP technology became possible in the 1920s' with the transmission of pictures over trans-atlantic cable. Practical applications came during the 1960s' space program.

Phillips, a Dutch company, invented the optical disk in 1969. The optical disk is used for storing the image of a document. The first Signature Retrieval System in a business application occurred in the early 1970s', in Sweden. When IBM's World Trade Corporation installed a sys-

tem used to verify checking account signatures for a banking system.

Signature retrieval technology became economically feasible with the arrival of personal computers, in the early 1980s'. These systems combined personal computers with optical disks, document scanners and laser printers. This is the base technology for signature retrieval systems.

Online access was allowed to documents stored on an optical or magnetic disk to be retrieved via a computer terminal through its data base index. The laser printers provided excellent hard copy reproduction of the digitized data.

Automated signature verification will use Document Image Analysis (DIA). DIA includes extraction of lines and curves in images, classification of objects using boundary information, texture analysis and analysis of images for estimating the motion of objects. These are the processes a computer will need to use to compare one signature to another. For more information on these technologies, periodicals such as *"OPTICAL INFORMATION SYSTEMS,"* can be very informative.

Development begins in Florida

Development and implementation of Signature Retrieval Systems for use in elections began, in Pinellas County, Florida, in 1986. Our survey shows that many counties in Florida have since installed these systems. Pinellas, Dade and Orange Counties have been the innovators and trailblazers in using these systems.

Petition signature checking requirements have been the impetus in many election agencies to install signature verification systems. Recent experiences with right-to-die petitions in the State of Washington suggest that legal deadlines could not have been met without such a system in place.

Majority of Systems are PC Based

Most of the systems seen by the authors have been Personal Computer (PC) based, although main frame and mini-computers may be used.

The scanning or digitizing of documents and/or the signatures, is done on a PC. Most systems display signatures or documents on a PC. Although, some systems use main frame and mini-computer terminals for displaying the information. Main frames and mini's are used primarily for storing the data, while compression and expansion of data usually occur on the PC.

Acceptance of Electronically Reproduced Images by the Courts

Generally, information from agencies returning the questionnaire has shown acceptability of electronically reproduced images have, yet, to be tested in the courts, in some states.

The State of Florida has passed enabling legislation that generally reads, "an electronically generated reproduction of an original voter registration . . . which reduction is certified by the supervisor of elections who is custodian of the record, is admissible as evidence in any judicial or administrative proceeding . . . with the same effect as the original voter registration record" (Witnesses, Records and Documents section 92.295).

Florida also allows destruction of the original master record cards, after microfilming, if they have been maintained digitally on electronic, magnetic or optic media. (Registration Office, Officers and Procedures section 98.412)

Other agencies, like San Diego County, California, Registrar of Voters have found that the California Government Code allows destruction of the uncancelled affidavits, after microfilming, while the Elections Code does not permit this. Their solution is that they have proposed legislation that will eliminate the difference between the two governing codes.

In informal discussions with Federal Election Commission National Clearinghouse and United States Department of Justice staff it was stated by the Justice Department staff that the original voter documents should be kept for at least twenty-

two months after a person last voted, as required with ballots and other election materials.

Some jurisdictions, with whom we have communicated, have a problem with the retention of canceled affidavits. They have indicated they do not plan to remove them from their paper files because it is too costly. If the documents are not removed, they will eventually become a problem to someone.

Many jurisdictions have shown they have savings, in filing of the original documents, by filing them in the order received. This eliminates the need for sorting and filing of documents. Agencies place them at the end of the file.

Description of Signature Retrieval Systems

The systems that are available range from signature retrieval system software only, for scanning and retrieving a document (you buy your own hardware), to complete election systems with hardware. Costs vary from a few thousand to a few million dollars. Specific costs reported by the agencies in the survey can be found in the appendix. The following is a brief description of some variations that are available.

Signature retrieval systems, that use optical disk and digitize the whole document, can be used to replace microfilm. Some advantages of optical disk are that it does not require developing and the images are available immediately. Optical disk also may be more environmentally friendly because of the elimination of the developing chemicals and process.

Turn Key System

Turn key systems are those that can provide both voter registration and signature retrieval module, in one package. Frequently, these systems also provide modules for absent voters, petitions, polling places, polling place workers, precincts or election districts, and candidate filing. These modules may all be included in one package or each can be purchased as a separate option to "customize" the system as needed by the jurisdiction.

Interfacing System

These systems usually provide signature retrieval only and are intended to interface with an existing voter registration system. These may require separate screens for displaying the voter data and signature. Again, depending on how the interface is accomplished it may appear to be a "seamless" system.

Software only

Some vendors are supplying software only, which has to be installed on the acquiring jurisdiction's computer hardware. This can be an option if the jurisdiction has computer hardware or if the jurisdiction can buy the hardware at a lower price by receiving government discounts. If you decide to have new software written to fit your specific needs or if you are the first customer for new vendor software be aware as Collier County, Florida experienced that "little" things will come up and must be corrected by the vendor or programmer before the system is considered fully operational.

Equipment Required

The equipment or hardware varies widely from one signature retrieval system to another. Numerous computer and computer peripheral manufacturers are represented by the systems.

Computers - There are many different manufacturer's computers used. It is important that you buy a computer with enough memory to service the needs of your agency. Not enough memory or fast enough processing capabilities will result in slow retrieval times for signatures to be displayed on the computer screen. This results in staff waiting for the computer to provide the requested signature. Time is wasted resulting in lowered productivity and poor focus on the task. Ask the vendor to recommend hardware if you are buying software only. Consider requesting that equipment compatible to other

office computers you already have installed be provided. Be sure that your workload is clearly stated so the vendor can recommend the right equipment for your site.

Scanners or Video Cameras - This equipment is used to "scan" or digitize the document orsignature. The scanner or camera converts the document to an electronic image that can be stored on magnetic or optical media. More scanners may be required, on a rent or lease basis, for conversion as was the case in Fulton County, Georgia and Amador County, California.

Again, there are a large variety of manufacturer's and equipment. The scanners can vary from automatically fed flat-bed scanners, that can scan large documents at rates of one a second, to a hand held scanner that is used to scan a signature only. Its speed is dependent upon the manual dexterity of the operator.

Video camera scanning, while used, is the exception rather than the rule. The quality of the video image is comparable to that of scanners, but none have been seen that provide for automatic feeding of documents.

Mouse - Most of the systems have a mouse device that is used to identify the area to be scanned, if not an automated function. The mouse is also used to crop the signature image. The mouse can be used like an eraser to eliminate extraneous printing, near the signature, that may have been digitized into the image.

Monitors - High resolution graphics monitors give the best image display, providing the digitizing was done at a good resolution. Three hundred dots per inch is considered very adequate. Higher resolutions require more space and time to transmit. Color display terminals also can be easier for the operator to use by being able to highlight several conditions using different colors.

Optical Disks - The optical disks used are WORM (Write Once Read Many) type platters. The archival quality of the platters has not yet been proven,

because of the time they have been available on the market, but it is expected to be comparable to microfilm. The optical disk, like the magnetic disk is easily duplicated for backup and retention purposes. Consider offsite, storage of a duplicate backup optical disk.

There are two primary sizes of optical disk platters, 12 inch and 5.25 diameters. The hardware for optical disks ranges from a small desk top unit holding one 5.25 platter; to a very large floor unit holding over fifty twelve-inch platters. The large units automatically retrieve platters, much like the old jukeboxes selected records.

While optical disks need to be handled with care, they are less vulnerable to handling than magnetic disks. The laser light used to write and read the data has a focal point just below the surface of the platter. Maricopa County, Arizona utilizes a large "Jukebox" like optical disk system that is also used for other departmental functions.

Magnetic Disks - Here we are addressing magnetic disks, usually, used with personal computers. All of the signature retrieval systems we encountered use non-removable hard disks to store voter data and signature images, storing the image on magnetic disk. The amount of data that can be stored on a hard disk is dependent on the size of the hard disk. At this time, the sizes range from a small, obsolete, 10 megabyte (MB or million bytes) drive to drives that will hold a gigabyte (1 billion bytes) of data. The flexible or "floppy," removable, diskette is frequently used as backup or for temporary storage of images until they are edited and written to the hard disk.

Printers - Laser printers will provide the best reproduction of images. This type of printer is highly recommended for this application.

Backup Tape Units - These units are good for backing up large data files. A word of caution regarding these backup tape units. There is no standard for writing the data to the tape, so a tape created on one manufacturer's machine is un-

likely of being read on a different manufacturer's machine. If your agency already has backup tape hardware for other systems, you may need to require the same type of unit, for compatibility.

Election's staff in Pima County, Arizona caution that you ensure adequate vendor software, and in some cases hardware support is available in your area from your selected supplier.

Materials required

The materials required for a signature retrieval system are the same as those for any computer system. Depending on the hardware, you will need paper, magnetic diskettes, magnetic tape cartridges, optical disk platters, printer ribbons and toner cartridges.

Furniture

Often overlooked in the acquisition of new equipment, is the need for furniture such as desks, work stations and tables on which to mount the equipment. Desks or work stations for data entry should have a height of approximately twenty-seven inches. There are devices that will allow you to adjust the height of the keyboard that can be placed on or mounted below a regular desk or table. You may have to experiment with locating the equipment, but a L-shaped pattern often works well. Chairs should be comfortable and easily adjusted as are the pneumatically controlled chairs.

Be aware of lighting, a window behind an operator can cause uncomfortable glare on a monitor screen, as can overhead lights. There are hoods and anti-glare screens that can be useful in reducing these problems.

Voter Registration Document

Many agencies have discovered that their old voter registration format presented ongoing problems for the signature retrieval system. Described below are some problems previously encountered and their resolution.

Document Format

Some agencies have redesigned their voter registration document using white paper with sharp black printing, to provide the greatest contrast for scanning. This accommodation to the computer system results in a pay back to the agency in a clear easily read image on the monitor screen, when comparison is required.

The reasons for the redesign are multiple, often old documents are in poor condition or have many different formats. Erie County in New York State found that double backing on the original registration forms resulted in scanner misfeeds.

Consistency in format of the document is also beneficial, especially if the signature is digitized and stored separately, from the document. When the whole document is going to be digitized and stored, minimizing printing and lines on the document will reduce the amount of storage space required for the "electronic" image.

When there are large blocks of printed information, such as instructions, on the voter registration form, it is possible with an electronic image to store the instructions, once only. Then you do not have to store it with every document on which it appears.

Signature Block

The signature block can be crucial. Ideally, the block should be one inch in height by at least three inches in length. Use a very light, horizontal line, about 1/2 inch shorter than the block width, centered in the block, on which the voter's signature is to be written. This will allow digitizing the signature without picking up other printed material near the signature block. This provides a cleaner image requiring less disk storage space. Pasco County, Florida found during conversion that they had the following signature problems:

☐ Signatures requiring more space than allowed.

☐ Some signatures were too light.

☐ Sometimes there were no signatures.

Their solution was to send out "signature cards" to the electorate to obtain a signature acceptable for the project. Hillsborough County, Florida suggests collecting signatures at Presidential Elections using purpose designed precinct registers (white with no extraneous material encroaching on signature) and good black ink pens.

Motor Voter

Motor Voter, the registering of voters on a driver's license application has been adopted in some states and is likely to be adopted in more. The format of the motor voter document can affect signature retrieval systems. For instance, the size and color of the document, or the size and location of the signature block may require, additional steps to separate the documents, before scanning. Equipment may have to be adjusted for each different document to allow for changes in color or location of the signature.

Elections administrators should be allowed to provide input for any proposed document changes to accommodate Motor Voter registration. An advantage of this program, according to officials in Clackamas County, Oregon is that the registration crunch before elections will be alleviated.

Uses In Elections

Petition Signatures

The primary use of signature retrieval systems are to check petition signatures to decide that the person signing a given petition is the same person who registered to vote. Prior to obtaining their system, Lee County, Florida had to "Alphabetize petitions and then pull each individual voter record to verify each signature. With this process 100 signatures were verified per hour. With digitization, 100 signatures can be verified in 20 minutes or approximately 220 signatures per hour."

The computer can keep track of the number of valid signatures processed and to determine whether the signer meets residency requirements for the petition. Also whether the candidate, initiative, referendum of recall measure qualifies for the ballot.

Absent Voter Signatures

Comparison checks for validating absent voter applications or returned ballots. Mail ballot elections are more efficiently conducted with computerized signature retrieval.

Nomination Signatures

Candidate nominating papers are checked against the registration signatures.

Polling Place Signatures

Erie, Monroe and Niagara Counties, in New York, provide a roster with facsimile signatures printed next to the voters names for the polling places. When the voter votes on election day, it is then a simple process for the polling place workers to compare the voter's signature to the printed facsimile.

Agencies Using Systems

During preparation of this paper we visited working installations of these systems in Pinellas and Dade Counties in Florida; and Los Angeles, San Diego and Placer Counties in California. Pinellas County was the first election agency to install an operational system. The pioneering efforts started in 1986, by Pinellas County was closely followed by Orange and Dade counties in Florida.

Twenty-three states have told us they either have none or are not aware of any signature systems in use, in their state. We were informed that Iowa, does not require signature comparison for any aspect of their voting process.

Since 1986, many jurisdictions have installed these systems across the United States. Many other Florida Counties have systems as well as jurisdictions in the States of Arizona, California, Georgia, Indiana, Nevada, New York, Oregon and Washington.

Most of the systems in use have been developed or acquired at the local level. Sometimes state officials are unaware of their existence.

Experience

Once the system is installed, all existing active voter registration documents must be scanned either wholly or in part to form the basis of the information that will be recalled during the signature checking process. Some systems have scanners that feed the document through the scanner station. Others have hand held scanners requiring a person to pass the scanner mechanism over the signature area of the voter document.

Many agencies have encountered a variety of difficulties at this stage. Over the years, formats of voter registration documents have changed the location of the signature on the document. Paper color can cause degradation of the scanned image, background color is picked up by the scanner. The digitizing of background causes more disk space to be used, than required for the signature only.

Additionally, over time the actual signature may have faded. This difficulty has been overcome by techniques such as photocopying the original document and enhancing the images on white paper before the signature or document is scanned into the system.

Fatigue of workers scanning the documents is another factor that must be considered when planning the document conversion. Fatigue results in errors on the file that will cause problems later. Based on recommendations, we suggest that workers be given a five minute rest break every hour. This is beyond their regular morning and afternoon breaks and lunch. This leaves about 6.5 productive hours in a normal eight hour work day for conversion. Placer County, California managers insisted that their staff take hourly breaks due to the repetitive nature of the conversion work in order to eliminate errors on the file. The conversion process of the initial scanning of existing documents is mentioned, most frequently, as the main problem area for installing signature retrieval systems.

Brevard County, Florida found that the capture process was difficult on the employees because of the repetition. Their solution was to schedule each employee for a limited time on the conversion task. They could spend more time but it was not mandatory.

Whenever possible, ensure that all necessary equipment is purchased and delivered according to your schedule. Niagara County, New York's conversion process was slowed by the delay in purchase of their in-house scanning equipment.

Misplaced, lost or unscannable documents have frequently been cited as problems, in document conversion. At least one jurisdiction sent new registration forms to electors to fill out, to complete the installation of their system. (Clackamas County, Oregon)

One county suggested having a detailed plan for the conversion effort and to check 100% of the images to make sure they have been identified with the correct voter. (San Diego County, California)

A couple of counties said they had documents with signatures that were too large or light to be digitized. One county reduced the large signatures on a copy machine before scanning. Darkening of light signatures was achieved using a copy machine. (Dade and Pasco Counties, Florida)

Another jurisdiction said the blue paper used for their voter registration document was picked up as background during the scanning. Other printing on the document was digitized with the signature. This problem could only be solved with a new form. (Pinellas County, Florida)

Mojave County in Arizona suggested that you make sure the system you select is compatible with your existing software and hardware.

Be prepared to expend effort and time to backup data and signatures on a regular basis. Backup

will probably have to be done outside normal business hours. (Fulton County, Georgia)

We have also learned some jurisdictions are considering updating the signatures from polling place rosters. (Hillsborough County, Florida)

Benefits

Signature retrieval systems save money and time. When large petitions with thousands or hundreds of thousands of signatures for a state-wide petition are required to be processed, these systems can enable an agency to do this within the legal deadlines required by the state.

Signature retrieval systems are one of the most productive automated systems an election's administrator can install. Productivity improvements of 400% are reported, in checking petition signatures. Thurston County, Washington reports that they were able to reduce staff from four regularly assigned employees to a person working on the task three quarters of their time. Manhour savings resulted in 1440 hours per year.

What follows is a list of areas within your agency where the installation of a signature retrieval system can benefit the management and administration of the agency:

■ Document or signature retrieval and processing speeds were reported which indicated improvements of two to four times over manual processes.

■ Signatures are more accessible to staff when needed.

■ Accuracy of updating the correct record when changes occur is enhanced.

■ Space for record storage in ledgers or filing equipment is reduced. This frees up expensive office space for other uses. If paper retention is required, by law in your area, records can be stored in warehouse type facilities.

■ Speed of processing during election peaks is improved.

■ More ability to meet legal deadlines as the workload increases. In San Diego County, California, prior to system installation AV's took 1.1 minutes each to process. After installation .35 minutes was required for each document. Similarly, petitions went from 3.2 minutes down to 2.2 minutes.

■ Transportation costs, packaging and processing of sending poll ledgers out to precincts can be eliminated by producing a laser printed signature on the precinct register. Monroe County, New York, with 350,000 registered voters, was relieved of pulling poll ledgers, packing and sending them out in hundreds of carrying cases to the polls. Delivery costs, telephone line and operator costs and key punching costs were eliminated. This resulted in savings equalling $50,000 per year.

■ Computerized systems with terminals are easier to work with than heavy ledgers. Frequently with old paper files there are problems with dust, paper fleas, poor lighting all contributing to decreased staff efficiency and possible errors.

■ Copies of computer files or optical disks can be made and stored offsite, providing better backup for the agencies records in case of fire or other disaster.

Based on our on-site interviews and questionnaires all jurisdictions have shown significant savings achieved by installing these systems. Some have reported labor savings that have the systems paying for themselves in one to three major elections.

Costs

Costs can range from about $5,000 for software alone to several million dollars for hardware, software and conversion of documents for a very large jurisdiction. Most vendors sell packages including hardware and software. They offer assistance with training, implementation and file conversion from paper or microfilm to the

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computer. Allow for a certain amount of your time and that of key staff going into the selection, contract negotiation and installation of this equipment.

If you are wondering if your jurisdiction is large enough to justify the expense of this type of system, consider Amador County, California. Located in the foothills of the Sierras they have 17,000 voters and are in the process of converting to a signature retrieval system. They feel that already the system is extremely helpful. They have experienced what many others have regarding conversion problems and warn that you budget adequately, for staff for this effort.

Plan for additional costs, for the conversion effort, because it may be necessary to bring in more workers and to work regular staff overtime. You also may use more supplies at this time than in normal production.

The following chart details some of the costs experienced by some of the jurisdictions responding to the survey. Keep in mind that some agencies implemented more extensive systems than others, as a result costs varied widely. The information is offered so that you may "ballpark" your potential costs if you decide to install this type of system in your agency.

Implementation Strategies

The State of New York, State Board of Elections has developed regulations that New York counties must follow when acquiring a signature retrieval system. This is the only state we know of where this is currently being done.

Dade County, Florida elections officials suggest that you visit jurisdictions of the same size as yours, having the same legal requirements, who have their scanning equipment in place before making a purchase. San Diego County, California suggests that you allocate one day for each visit. Also, visit the site without the vendor.

We are not going to attempt to tell you how to prepare and evaluate a Request for Proposal or other instrument for a bid. The requirements for this process vary widely from one jurisdiction to another. We do suggest that you have a written agreement, approved by your legal counsel.

When you begin your acquisition process you should consider the following when preparing the agreement or contract specifications.

■ How often is whole document needed? (Usually not very often. It probably does not need to be stored in the computer.)

		COSTS			
COUNTY NAME	VOTER TOTAL	HARDWARE/ SOFTWARE	CONVERSION	TOTAL	PER VOTER
Maricopa Co, AZ	1,100,000	$ 1,100,000	$ 100,000	$ 1,200,000	$ 1.09
Pima County, AZ	384,000	$ 236,000	$ 150,000	$ 386,000	$ 1.01
Los Angeles Co, CA	3,300,000	$ 2,300,000	$ 800,000	$ 3,100,000	$ .94
San Diego Co, CA	1,200,000	$ 225,000	$ 50,000	$ 275,000	$ .23
Brevard Co, FL	193,000	$ 112,000	$ 34,313	$ 146,313	$ .76
Palm Beach Co., FL	414,000	$ 65,000	$ 40,000	$ 105,000	$ .26
Monroe Co, NY	350,000	$ 400,000	$ 75,000	$ 475,000	$ 1.36
Clackamas Co, OR	150,000	$ 58,000	$ 6,500	$ 64,500	$ .43

■ Are signatures required at polling places? (If so, can you use a report on which the signature has been printed by the system?)

■ Do the courts accept documents or signatures reproduced from digitized data? (You should check this with your legal counsel.)

■ Know your processing volumes so you can predict what type of response times you will need to accomplish your work.

    ☐ When and how many of your documents come in at specific times? (Most usually come in at busy election times).

    ☐ How many different signature checking functions are required to be done, simultaneously? (Petitions, Absent Voters)

    ☐ Will you need to digitize and retrieve signatures at the same time? (You may need to enter a voter registration document, while checking signatures for candidate filing.)

■ Identify any hardware and software you may currently have so compatibility can be determined.

■ Decide if you need to have backup or extra computer hardware. How seriously would you be affected by an equipment breakdown? How long will it take to get equipment repaired or replaced should part of your system breakdown during a peak election process?

■ Include a comprehensive conversion plan with time schedules. (You may need additional equipment, workers, a fall back or contingency plan and expect problems.)

■ Develop acceptance testing criteria for the system. Include it in your specifications or agreement, before you buy, so the vendors will know what you expect the system to be capable of performing.

■ Visit or talk with election administrators who have signature retrieval systems in operation. Their experience can be very helpful.

■ Allow yourself enough time to install the sys-

tem and to convert your data in an orderly manner. Consider installing the system at a slow processing time.

■ Require that training be provided to several of your staff, specify numbers.

Once a decision to buy a system has been made. Require a solid, written agreement for the installation of the system and conversion of the data.

The vendor usually provides training in the use of the system as part of the contract. Manuals for the ongoing operation of the system also should be required.

Facility modifications to install electrical, phone lines, air conditioning and space need to be determined. They should be completed before the arrival of the equipment. Allow space for staff, equipment servicing and supply storage when deciding needs for the equipment.

The contract should specify when the equipment hardware and software will be delivered. Who will setup the equipment? Who will install software you currently own? Who will work on the conversion? How will the new system work with any system you already have?

The criteria making up the final acceptance and sign off for the new system should be part of the contract. The vendor will know what to expect ahead of time. Consider making partial payments for the equipment throughout the installation process with final payment contingent upon the system working to your satisfaction.

Decide what equipment and software service level is needed. Your level of service may need to change depending on when you are conducting an election and when you are not. On-site service requiring a technician to arrive on-site after a short specified period after placing a call, is the top level of service. Other service options may require you to bring the equipment to the vendor's location. Quickness of response plus on-site customer engineers probably will be the most expensive service agreement you can have. Put service

level requirements in your agreement. Ask for what you need and negotiate with the vendor for what best serves your agency.

Conclusions

Many jurisdictions are maintaining a duplicate copy of the voter registration document on microfilm or microfiche. Some jurisdictions are already using optical disk, for the duplicate copy of the voter document.

We believe, the trend in the future will be to store the voter document image on optical disk. The advantages being, the image does not need chemicals to develop. The image can be immediately available. Data could be keyed from the document image, confirming the image is readable. It also may be possible to scan the image and encode data for the voter data base.

Signature retrieval systems, as with all systems, have problems associated with implementation. Murphy's Law seems always to apply. Based upon our findings the rewards the systems can provide are well worth the effort.

Appendix 1

**Election Signature
Retrieval System
Jurisdiction Contacts**

ARIZONA

MARICOPA COUNTY - 1,100,000 Registered Voters
        Maricopa County Department of Elections
        Mr. Glenn Humbert
        Assistant Director - Data Systems
        111 South Third Avenue
        Phoenix, AZ 85003-2223
        602 506-1552

MOHAVE COUNTY - 55,000 Registered Voters
        Mohave County
        Mr. Claus Behrens
        Registration Supervisor
        P.O. Box 70
        Kingman, AZ 86401
        602 753-3470

PIMA COUNTY - 384,000 Registered Voters
        Pima County Recorder
        Mr. Jay Miller
        Information System Coordinator
        115 North Church Street
        Tucson, AZ 85701-1199
        602 740-8151

CALIFORNIA

AMADOR COUNTY - 17,000 Registered Voters
        County of Amador County Clerk-Recorder
        Mr. Sheldon D. Johnson
        County Clerk-Recorder
        108 Court Street
        Jackson, CA 95642
    209 223-6464

LOS ANGELES COUNTY - 3,300,000 Registered Voters
County of Los Angeles Registrar-Recorder/County Clerk
Mr. Micheal Petrucello
Assistant Registrar-Recorder, Technical Services
P.O. Box 30450
Los Angeles, CA 90030
213 725-5666

SAN DIEGO COUNTY - 1,200,000 Registered Voters
County of San Diego Registrar of Voters
Ms. Ingrid Gonzales
Assistant Registrar of Voters
5201-I Ruffin Road
San Diego, CA 92123
619 694-3402

FLORIDA

BREVARD COUNTY - 193,000 Registered Voters
Brevard County, Supervisor of Elections
Ms. Shirley P. Baccus
Supervisor of Elections
P.O. Box 1119
Titusville, FL 32781-1119
407 264-5005

COLLIER COUNTY - 75,000 Registered Voters
Collier County, Supervisor of Elections
Ms. Mary W. Morgan
Supervisor of Elections
Collier Government Center
3301 Tamiami Trail East
Naples, FL 33962-4971
813 774-8450

DADE COUNTY - 600,000 Registered Voters
    Dade County Elections Department
    Mr. David C. Leahy
    Supervisor of Elections
    111 NW 1 Street, Suite 1910
    Miami, FL 33128
    305 375-3150

HILLSBOROUGH COUNTY - 294,000 Registered Voters
    Hillsborough County, Supervisor of Elections
    Mr. Chuck Smith
    Elections Operations Manager
    419 Pierce Street, Room 195
    Tampa, FL 33602
    813 272-5850

LEE COUNTY - 159,000 Registered Voters
    Lee County, Supervisor of Elections
    Mr. Bernie R. Feliciano
    Deputy Registrar
    P.O. Box 2545
    Ft. Meyers, FL 33902
    813 335-2594

PALM BEACH COUNTY - 415,000 Registered Voters
    Palm Beach County, Supervisor of Elections
    Ms. Jackie Winchester
    Supervisor of Elections
    301 North Olive Avenue, Room 105
    West Palm Beach, FL 33401
    407 355-2650

PASCO COUNTY - 149,000 Registered Voters
    Pasco County, Supervisor of Elections
    Mr. Kurt S. Browning
    Supervisor of Elections
    705 East Live Oak Avenue, Room 212
    Dade City, FL 33525
    904 521-4302

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PINELLAS COUNTY - 435,000 Registered Voters
Pinellas County, Supervisor of Elections
Ms. Dorothy Walker Ruggles
Supervisor of Elections
315 Court Street, Room 117
Clearwater, FL 34616-5190
813 462-3551

SARASOTA COUNTY - 166,000 Registered Voters
Sarasota County, Supervisor of Elections
Mr. E. Michael Berrios
Network Administrator
P.O. Box 4194
100 South Washington Boulevard
Sarasota, FL 34230-4194
813 951-5300

GEORGIA

FULTON COUNTY - 308,000 Registered Voters
Fulton County, Department of Registration and Elections
Mr. John P. Sullivan
Chief, Registration Division
141 Pryor Street SW, Suite 4085
Atlanta, GA 30303-3450
404 730-7072

NEW YORK

ERIE COUNTY - 500,000 Registered Voters
Erie County Board of Elections
Mr. Dan Gregorio
Deputy Commissioner
134 West Eagle Street
Buffalo, NY 14202
716 858-7780

MONROE COUNTY - 350,000 Registered Voters
Monroe County Board of Elections
Ms. M. Betsy Relin / Mr. Ronald J. Starkweather
Commissioners of Elections
39 West Main Street, Room 106
Rochester, NY 14614
716 428-5884

NIAGARA COUNTY - 102,000 Registered Voters
Niagara County Board of Elections
Ms. Lucille L. Britt / Mr. Douglas O. Jayne
Commissioners of Elections
59 Park Avenue
Lockport, NY 14094
716 439-6137

OREGON

CLACKAMAS COUNTY - 150,000 Registered Voters
Clackamas County Elections Division
Mr. Ben Marberry
Elections Manager
835 Portland Avenue
Gladstone, OR 97027-2195
503 655-8510

WASHINGTON

THURSTON COUNTY - 80,000 Registered Voters
Thurston County
Ms. Sheryl Moss
Director of Elections
2000 Lakeridge Drive SW
Olympia, WA 98501
206 786-5408

Appendix 2

**Election Signature
Retrieval System
Vendors**

Arthur Anderson
1345 Avenue of the Americas
New York, NY 10100
212 708-4000

Business Records Corporation
Mr. Ed Charbonneau
1001 Eastshore Highway
Berkeley, CA 94710
510 527-5150

Datavision Corporation
Mr. Bob Brisco
72 Hosmer Place
Post Office Box 664
Marlboro, MA 01752
508 480-0404

DIMS
Mr. John Hice, President
2350 East Main Street,
Suite 202
Ventura, CA 90003
805 653-1990

Fidlar & Chambers
Mr. Larry Lawrence/Mr. Bob Diveley
501 Goodlette Road North
Bldg G, Suite 15
Naples, FL 33940
813 263-5055

Filenet Inc.
Mr. Brian Schlosser/Mr. Ron Baxter
6621 North Scottsdale Road
Scottsdale, AZ 85253
602 951-8814

Genesys Data Technologies, Inc.
Mr. Robert Clark 301 785-0661
11350 McCormick Road
Hunt Valley, MD 21030
800 767-4384

IBM
Mr. David L. Wilson
3109 Martin Luther King Boulevard
Tampa, FL 33607
813 872-2140

and

150 State Street
Rochester, NY 14614
716 726-8152

Identitech, Inc.
Mr. Bob Riley 407 462-2112
1333 Gateway Drive
Mail Stop 1022
Melbourne, FL 32901

Image Business Systems
Mr. David LaCarta, Ms. Diane DeCarlo, Mr. Jim Hendrickson
417 Fifth Avenue
New York, NY 10016
212 696-2500

National Time Sharing
Dr. Charles DeWald, 716 297-0553
Mr. Bruce Cowe, 716 692-2274
1342 Military Road
Niagara Falls, NY 14304

PI Technology Inc.
Mr. Arun Sinha
5775 East Los Angeles Avenue
Suite 103
Simi Valley, CA 93063
805 582-0775

Signaware Inc.
Mr. John St. Clair
300 South Duncan Avenue
Suite 275
Clearwater, FL 34615
813 461-4211
fax 813 449-9713
800 637-6564

SQN Peripherals, Inc.
Mr. Joe Uhland
65 Indel Avenue
Post Office Box 423
Rancocas, NJ 08073
609 261-5500

Systemhouse Inc.
Mr. Bill Devitt, Vice President and General Manager
Mr. Al Lavell, Director, Marketing and Sales
Cerritos Town Center
12750 Center Court Drive, 7th Floor
Cerritos, CA 90701
213 860-3635

Votec
Mr. John Medcalf, San Diego   619 674-5532
Ms. Darlene Van Dam, Los Angeles   818 348-3907
21625 Yucatan Avenue
Woodland Hills, CA 91364
800 827-0435

Appendix 3

Summary of Questionnaire Responses — Jurisdictions Using Signature Retrieval Systems

JURISDICTIONS USING SIGNATURE RETRIEVAL SYSTEMS AS OF MARCH 1, 1992

STATE / JURISDICTION	ARIZONA MARICOPA COUNTY	ARIZONA MOHAVE COUNTY	ARIZONA PIMA COUNTY	CALIFORNIA AMADOR COUNTY	CALIFORNIA LOS ANGELES COUNTY	CALIFORNIA SAN DIEGO COUNTY
MAY USE AS CONTACT	YES	...	YES	YES	YES	YES
REGISTERED VOTERS	1,100,000	55,000	384,000	17,000	3,300,000	1,200,000
POLLING PLACES	55	55	344	28	6,300	1,700
ELECTIONS PER YEAR	70	10	12	2	2	5-6
ABSENTEE VOTERS IN MAJOR ELECTION	5%	5%	4%	10%	10%	25-30%
ENABLING LEGISLATION REQUIRED	NO	NO	YES	NO	NO	NO
COURTS ACCEPT DIGITIZED FACIMILES	YES	...	YES	UNKNOWN	NO	UNKNOWN
VOTER REGISTRATION DOCUMENT						
SIZE OF DOCUMENT	8" x 5"	5" x 8"	5" x 8"	8" x 5"	8" x 5"	8" x 5"
SIZE OF SIGNATURE BLOCK	3"	3" x 1/2"	3/8" x 3"	1" x 3 1/4"	1" x 3 1/4"	1/2" x 2 1/2"
COLOR (TYPE/PAPER)	BLUE & RED/WHITE	BLACK/WHITE	BLUE/WHITE	BLACK & RED/WHITE	BLACK & RED/WHITE	BLACK & RED/WHITE
DOCUMENTS SENT TO POLLING PLACE	NO	NO	NO	NO	NO	NO
ORIGINAL RETAINED	BY BATCH	BY VOTER NAME	BY VOTER NAME	BY VOTER NAME	CASSETTE & FRAME	BY ORDER FILMED
DOCUMENTS RECEIVED - EVEN YEARS	104,000	12,000	18,000	3,600	1,100,000	431,000
- ODD YEARS	60,000	6,000	12,000	1,650	240,000	136,000
PEAK LOAD - DAYS BEFORE ELECTION DAY	30-60	BEFORE PRIMARY	...	90	90	30-60
- PERCENT OF DOCUMENTS	30-40%	25%	...	40-60%	28-42%	30-55%
SIGNATURES CHECKED IN 1990						
VERIFY NAME OR SIGNATURE	NAME	SIGNATURE	SIGNATURE	SIGNATURE	SIGNATURE	NAME & SIGNATURE
ABSENT VOTER BALLOT APPLICATIONS	0	0	0	2,600	287,000	0
RETURNED ABSENT VOTER BALLOTS	11	2,500	9,400	2,500	508,000	313,284
CANDIDATE NOMINATIONS	0	...	2,700	15,000	65,728	508,000
RECALL PETITIONS	7	50	84,000	0	10,145	2,708
INITIATIVE PETITIONS	0	1,400	26,000	7,500	67,814	11,823
REFERENDUM PETITIONS	0	...	18,000	0	...	120,400
AT POLLING PLACES	0	...	...	...	...	SEE ABOVE
MAIL BALLOT ELECTIONS	0	...	...	...	...	0
RANDOM SAMPLING ALLOWED	YES	NO	YES	YES	YES	YES
CONCURRENT SIGNATURE CHECKS REQUIRED	YES	YES	YES	YES	YES	YES
SYSTEM FEATURES						
INTEGRATED WITH VOTER REGISTRATION	YES	YES	NO	YES	YES	YES
DIGITIZE WHOLE FORM OR SIGNATURE	FORM	SIGNATURE	FORM	SIGNATURE	WHOLE FORM IN 1992	SIGNATURE
SIMULTANEOUS SCANNING & RETRIEVING	YES	NO	YES	YES	NO	NO
SIGNATURE IMAGE STORED ON	OPTICAL DISK & FILM	MAGNETIC DISK	SEE DOCUMENT	MAGNETIC DISK	MAGNETIC DISK & FILM	MAGNETIC DISK
DOCUMENT IMAGE STORED ON	MAG DISK,FILM& FICHE	MICROFICHE	OPTICAL DISK	N/A	OPTICAL DISK & FILM	MICROFICHE
AVERAGE BYTES TO STORE - SIGNATURE	50,000	3,000	N/A	LESS THAN 2000	2,600	4,500
- DOCUMENT	50,000	N/A	50 KB	N/A	N/A	N/A
DISK SPACE REQUIRED FOR SIGNATURES	REMOVABLE PLATTERS	80 MB	N/A	160 MB	12 GB	4 GB
DOCUMENTS	...	N/A	325 GB	N/A	N/A	N/A
BACKUP MEDIA FOR - SIGNATURES	OPTICAL DISK	MAGNETIC TAPE	N/A	MAGNETIC TAPE	MAGNETIC TAPE & FILM	MAGNETIC TAPE
- DOCUMENTS	OPTICAL DISK	N/A	OPTICAL DISK	N/A	OPTICAL DISK & FILM	MICROFICE
ALL SIGNATURE IMAGES ONLINE	YES	N/A	YES	YES	YES	YES
ALL DOCUMENT IMAGES ONLINE	YES	N/A	YES	N/A	NO	N/A
SCANNED PER MINUTE - SIGNATURES	50	30	N/A	N/A	75	10
- DOCUMENTS	50	N/A	30	5 OR 6	N/A	N/A
SECONDS TO RETRIEVE - A SIGNATURE	8	3	N/A	LESS THAN 2 SEC	3-4 SEC	1.9
- A DOCUMENT	8	N/A	5-17 SEC	N/A	N/A	N/A
SIGNATURES PRINTED ON VOTER LISTS	NO	NO	NO	NO	NO	NO
OTHER FORMS SCANNED AND RETRIEVED	NONE	NONE	CHG OF ADDRESS CARDS	NONE	NONE	CANDIDATE STATEMENTS
SYSTEM DEVELOPED AND IMPLEMENTED						
DECIDED TO IMPLEMENT	1990	1988	1989	1991	1988	1988
SYSTEM FIRST OPERATIONAL	1990	1988	1990	PLANNED MAR 1992	1990	1989
DEVELOPED SYSTEM IN-HOUSE	YES	NO	NO	NO	NO	NO
TURNKEY SYSTEM ACQUIRED	NO	YES	YES	YES	NO	DIMS
DEVELOPED WITH SYSTEM INTEGRATOR	NO	VOTEC	GENESYS DATA TECH IN	BUSINESS RECORDS COR	SYSTEMHOUSE, INC	NO

JURISDICTIONS USING SIGNATURE RETRIEVAL SYSTEMS AS OF MARCH 1, 1992

STATE JURISDICTION	ARIZONA MARICOPA COUNTY	ARIZONA MOHAVE COUNTY	ARIZONA PIMA COUNTY	CALIFORNIA AMADOR COUNTY	CALIFORNIA LOS ANGELES COUNTY	CALIFORNIA SAN DIEGO COUNTY
SYSTEM DEVELOPED AND IMPLEMENTED - continued						
VENDOR PROVIDED HARDWARE & SOFTWARE	N/A	---	---	YES	YES	YES
VENDOR PROVIDED TRAINING	N/A	YES	YES	YES	YES	YES
TIME REQUIRED TO TRAIN NEW WORKER	3 HOURS	1 HOUR	12 HOURS	4 HOURS	4 HOURS	1 TO 40 HOURS
WRITTEN INSTRUCTIONS PROVIDED BY	STAFF	VENDOR	VENDOR	VENDOR & STAFF	VENDOR & STAFF	VENDOR & STAFF
CONVERSION EFFORT						
DOCUMENT USED FOR INITIAL CONVERSION	ORIGINAL	ORIGINAL	ORIGINAL	ORIGINAL	MICROFILM	ORIGINAL
NUMBER OF DOCUMENTS CONVERTED	1,000,000	55,000	963,000	16,900	4,500,000	1,250,000
SCANNING WORKSTATIONS USED	---	---	---	3	---	2
HOURS PER DAY	---	---	---	12	---	16
TIME REQUIRED TO COMPLETE CONVERSION	4 Months Multi-shift	---	9 MONTHS	1 MONTH	18 MONTHS	5 MONTHS
ESTIMATED SYSTEM COSTS						
APPROXIMATE COST OF SYSTEM	$1,100,000	$25,000	$236,000	$65,000	$2,300,000	$225,000
APPROXIMATE COST OF CONVERSION	$100,000	---	$150,000	$2,500	$800,000	$50,000
SAVINGS	Faster Checking	LABOR CUT 60%	LABOR CUT 70-80%	TOO NEW	LABOR CUT 30%	LABOR CUT 30-80%
SYSTEM HARDWARE						
MAINFRAME, MINI OR FILE SERVER	IBM SERIES/1		IBM PS/2 80 & 70	DELL 325D	IBM 4381	DATA GENERAL MV30000
WORKSTATIONS	COMPAQ DESKPRO		IBM PS/2 80	DELL 316SX	IBM PS/2 30	EPSON/WYSE AT-286
SCANNER OR CAMERA	(CAMERA)		FUJITSU M3096E	SCANMAN HANDHELD	BELL & HOWELL 2115	DIMS MODEL 1
PRINTER	EPSON LQ1170		---	HP LASERJET II	HP LASERJET II	---
IMAGE COMPRESSION	---		HARDWARE MDA-E610	HARDWARE	HARDWARE	SOFTWARE
OPTICAL DISK	---		SONY WDA-E610	N/A	LMSI 1200	---
OCR OR BAR CODE SCANNER	---		---	N/A	CAERE 821	MSI 1200-444H410

STATE	FLORIDA	FLORIDA	FLORIDA	FLORIDA	FLORIDA	FLORIDA
JURISDICTION	BREVARD COUNTY	COLLIER COUNTY	DADE COUNTY	HILLSBOROUGH COUNTY	LEE COUNTY	PALM BEACH COUNTY
MAY USE AS CONTACT	YES	...	YES	YES	YES	YES
REGISTERED VOTERS	193,000	75,000	600,000	294,000	159,000	414,000
POLLING PLACES	126	82	504	212	108	317
ELECTIONS PER YEAR	2-3	4 EVERY OTHER YR	20-30	2-6	2-4	4
ABSENTEE VOTERS IN MAJOR ELECTION	6-10%	15%	4-5%	4-5%	5%	8%
ENABLING LEGISLATION REQUIRED	YES	YES	YES	YES	YES	YES
COURTS ACCEPT DIGITIZED FACIMILES	NOT TESTED	YES	YES	YES	YES	YES
VOTER REGISTRATION DOCUMENT						
SIZE OF DOCUMENT	8.5" x 5"	5 1/2" x 8 1/2"	8" x 5"	4 5/8" x 8 1/2"	8" x 5"	8.5" x 5.5"
SIZE OF SIGNATURE BLOCK	2 3/4" x 1/2"	3/4" x 3 1/2"	3" x 7/16"	5/8" x 3"	1/2" x 4 1/4"	3 3/8" x 11/16"
COLOR (TYPE/PAPER)	GREEN/YELLOW	BLACK/WHITE	BLACK/WHITE	BLUE/WHITE	BLACK/BUFF	GREEN/WHITE
DOCUMENTS SENT TO POLLING PLACE	NO	NO	NO	NO	NO	NO
ORIGINAL RETAINED	NO	NO	NO	NO	NO	NO
(RETRIEVED BY)	BY VOTER NAME	BY VOTER NAME	BY VOTER NAME	BY VOTER NAME	BY VOTER NAME	BY VOTER NAME
DOCUMENTS RECEIVED - EVEN YEARS	13,200	15,500	100,000	66,000	32,000	22,000
- ODD YEARS	9,000	9,000	43,000	16,000	15,000	14,000
PEAK LOAD - DAYS BEFORE ELECTION DAY	30-60	30-60	45-30	30-60	30	30-60
- PERCENT OF DOCUMENTS	30-40%	...	16%	16-33%	50%	13-26%
SIGNATURES CHECKED IN 1990						
VERIFY NAME OR SIGNATURE	NAME & SIGNATURE	NAME & SIGNATURE	SIGNATURE	SIGNATURE	BOTH	SIGNATURE
ABSENT VOTER BALLOT APPLICATIONS	187	22,294	...	0	0	150
RETURNED ABSENT VOTER BALLOTS	13,763	15,271	111,000	25,500	5,768	25,360
CANDIDATE NOMINATIONS	1,944	1,722	2,000	15,000	2,361	2,981
RECALL PETITIONS	1,672	0	...	0	0	0
INITIATIVE PETITIONS	4,586	35,527	65,000	3,000	...	...
REFERENDUM PETITIONS	N/A	...	...	...	42,535	1,215
AT POLLING PLACES	N/A	...	...	...	1,646	2,894
MAIL BALLOT ELECTIONS	N/A	234,700	234,700	234,700	111,854	...
RANDOM SAMPLING ALLOWED	YES	YES	YES	YES	YES	YES
CONCURRENT SIGNATURE CHECKS REQUIRED	YES	YES	YES	YES	YES	YES
SYSTEM FEATURES						
INTEGRATED WITH VOTER REGISTRATION	NO	YES	YES	NO	NO	YES
DIGITIZE WHOLE FORM OR SIGNATURE	SIGNATURE ONLY	SIGNATURE	BOTH	SIGNATURE	SIGNATURE	SIGNATURE
SIMULTANEOUS SCANNING & RETRIEVING	YES	YES	IN DEVELOPMENT	YES	YES	YES
SIGNATURE IMAGE STORED ON	OPTICAL DISK	OPTICAL DISK	MAGNETIC DISK	MAGNETIC DISK	MAGNETIC DISK	MAGNETIC DISK
DOCUMENT IMAGE STORED ON	MICROFILM & FICHE	...	MICROFILM	MICROFILM	OPTICAL, FILM & FICHE	MICROFILM
AVERAGE BYTES TO STORE - SIGNATURE	3,000	1,800	1,025	< 1000	5,000	1,200
- DOCUMENT	N/A	N/A	204	N/A	N/A	N/A
DISK SPACE REQUIRED FOR SIGNATURES	940 MB	1 GB	1 GB	600 MB	6.2 GB	720 MB
DOCUMENTS	N/A	N/A	3 GB	N/A	N/A	N/A
BACKUP MEDIA FOR - SIGNATURES	OPTICAL DISK	MAG TAPE & OPTICAL	CARTRIDGE TAPE	MAG TAPE & DISKETTE	MAGNETIC TAPE	MAGNETIC DISKETTE
DOCUMENTS	...	...	CARTRIDGE TAPE	...	...	...
ALL SIGNATURE IMAGES ONLINE	YES	YES	YES	YES	YES	YES
ALL DOCUMENT IMAGES ONLINE	NO	N/A	YES	YES	YES	YES
SCANNED PER MINUTE - SIGNATURES	3	N/A	60	N/A	N/A	2
DOCUMENTS	N/A	4.16	25	3	2	2.23
SECONDS TO RETRIEVE - A SIGNATURE	3-5	1.5 SEC	1 SEC	1 SEC	10 SEC	15-20 SEC
A DOCUMENT	1.5 SEC	N/A	N/A	N/A	N/A	N/A
SIGNATURES PRINTED ON VOTER LISTS	NO	NO	NO	NO	NO	NO
OTHER FORMS SCANNED AND RETRIEVED	NONE	NONE	NONE	NONE	NONE	NONE
SYSTEM DEVELOPED AND IMPLEMENTED						
DECIDED TO IMPLEMENT	1989	1988	1985	1988	1989	1987
SYSTEM FIRST OPERATIONAL	1989	1989	1986	1990	1989	1988
DEVELOPED SYSTEM IN-HOUSE	NO	NO	YES	NO	NO	NO
TURNKEY SYSTEM ACQUIRED	NO	NO	N/A	SIGNAWARE	NO	NO
DEVELOPED WITH SYSTEM INTEGRATOR	IDENTITECH, INC.	FIDLAR & CHAMBERS	SQN PERIPHERALS	SIGNAWARE	FIDLAR & CHAMBERS	DATAVISION CORP
	NO	NO	NO	NO	YES - SAME VENDOR	NO

JURISDICTIONS USING SIGNATURE RETRIEVAL SYSTEMS AS OF MARCH 1, 1992

STATE JURISDICTION	FLORIDA BREVARD COUNTY	FLORIDA COLLIER COUNTY	FLORIDA DADE COUNTY	FLORIDA HILLSBOROUGH COUNTY	FLORIDA LEE COUNTY	FLORIDA PALM BEACH COUNTY
SYSTEM DEVELOPED AND IMPLEMENTED - continued						
VENDOR PROVIDED HARDWARE & SOFTWARE	YES	---	YES	---	YES	---
VENDOR PROVIDED TRAINING	YES	YES	---	YES	YES	YES
TIME REQUIRED TO TRAIN NEW WORKER	30 MINUTES	1/2 DAY	---	1-2 HOURS	10 MINUTES	15 MINUTES
WRITTEN INSTRUCTIONS PROVIDED BY	VENDOR & STAFF	STAFF	---	VENDOR	STAFF	VENDOR & STAFF
CONVERSION EFFORT						
DOCUMENT USED FOR INITIAL CONVERSION	ORIGINAL	ORIGINALS & COPIES	ORIGINAL	ORIGINALS & COPIES	ORIGINALS & COPIES	ORIGINAL
NUMBER OF DOCUMENTS CONVERTED	198,899	---	700,000	350,000	200,000	400,000
SCANNING WORKSTATIONS USED	---	---	---	---	---	---
HOURS PER DAY	---	---	---	---	---	---
TIME REQUIRED TO COMPLETE CONVERSION	4 MONTHS	6 MONTHS	1 YEAR	10 MONTHS	9 MONTHS	6 MONTHS
ESTIMATED SYSTEM COSTS						
APPROXIMATE COST OF SYSTEM	$112,000	$85,000	$60,500	$52,500	$400,000	$65,000
APPROXIMATE COST OF CONVERSION	$34,000	$6,500	INCL	---	---	$40,000
SAVINGS	LABOR HRS CUT 60%+	COST CUT $0.90/SIG	$74,000 FASTER,MORE ACCURATE	FASTER,MORE ACCURATE	120% FASTER LABOR HOURS CUT 1/3	
SYSTEM HARDWARE						
MAINFRAME, MINI OR FILE SERVER	SAMSUNG 80386	COMPAQ 386	IBM 3090/600	HP VECTRA RS/25C	DTK 386	IBM 3090/200
WORKSTATIONS	SAMSUNG 80386	IBM AT & MITAL 386	IBM PC/AT	HP VECTRA ES/12	MITEK 386	IBM
SCANNER OR CAMERA	PRINCETON GR LS300	HOWTEK COLOR	KODAK 2000	HP SCANJET PLUS	HOWTEK SCANMASTER	DATAVISION
PRINTER	CITIZEN 120 D	HP LASERJET II	IBM 3800	HP LASERJET III	HP LASERJET II	---
IMAGE COMPRESSION	HARDWARE	SOFTWARE	SOFTWARE	SOFTWARE	SOFTWARE	---
OPTICAL DISK	VES 1000	OPTIMUM 1000M	---	---	ATG 6001	---
OCR OR BAR CODE SCANNER	---	---	---	---	---	---

JURISDICTIONS USING SIGNATURE RETRIEVAL SYSTEMS AS OF MARCH 1, 1992

STATE JURISDICTION	FLORIDA PASCO COUNTY	FLORIDA PINELLAS COUNTY	FLORIDA SARASOTA COUNTY	GEORGIA FULTON COUNTY
MAY USE AS CONTACT	YES	YES	YES	...
REGISTERED VOTERS	149,000	435,000	166,000	308,000
POLLING PLACES	78	319	107	282
ELECTIONS PER YEAR	10	26+	5-10	5-10
ABSENTEE VOTERS IN MAJOR ELECTION	LESS THAN 1%	5.5%	7-10%	5%
ENABLING LEGISLATION REQUIRED	YES	YES	YES	NO
COURTS ACCEPT DIGITIZED FACIMILES	YES	YES	YES	YES
VOTER REGISTRATION DOCUMENT				
SIZE OF DOCUMENT	8 3/4" x 5"	8.5" x 7"	8.5" x 4.5"	8" x 5"
SIZE OF SIGNATURE BLOCK	3 7/8" x 11/16"	4 1/8" x 7/8"	3.5 x .5"	0.4" x 3.4"
COLOR (TYPE/PAPER)	GREEN/BUFF	DK BLUE/LT BLUE	GREEN/WHITE	GREEN/WHITE
DOCUMENTS SENT TO POLLING PLACE	NO	NO	NO	NO
ORIGINAL RETAINED	YES	YES	BY VOTER NAME	BY VOTER NAME
DOCUMENTS RECEIVED - EVEN YEARS	30,000	35,000	22,000	80,000
- ODD YEARS	15,000	25,000	9,000	10,000
PEAK LOAD - DAYS BEFORE ELECTION DAY	JAN & FEB	WITHIN 60	30-60	30-90
- PERCENT OF DOCUMENTS	...	25%	25-40%	22-50%
SIGNATURES CHECKED IN 1990				
VERIFY NAME OR SIGNATURE	SIGNATURE	SIGNATURE	SIGNATURE	BOTH
ABSENT VOTER BALLOT APPLICATIONS	0	...	0	...
RETURNED ABSENT VOTER BALLOTS	12,000	9,000	18,000	20,884
CANDIDATE NOMINATIONS	4,000	...	800	54,693
RECALL PETITIONS	0	...	350	...
INITIATIVE PETITIONS	2,500	2,500	43,000	...
REFERENDUM PETITIONS	0	1,650	...	...
AT POLLING PLACES	...	...	...	...
MAIL BALLOT ELECTIONS	...	...	...	...
RANDOM SAMPLING ALLOWED	YES	YES	YES	NO
CONCURRENT SIGNATURE CHECKS REQUIRED	NO	YES	YES	YES
SYSTEM FEATURES				
INTEGRATED WITH VOTER REGISTRATION	YES	YES	NO	NO
DIGITIZE WHOLE FORM OR SIGNATURE	SIGNATURE	SIGNATURE	SIGNATURE	SIGNATURE
SIMULTANEOUS SCANNING & RETRIEVING	YES	NO	NO	YES
SIGNATURE IMAGE STORED ON	MAGNETIC DISK	MAGNETIC DISK	MAGNETIC DISK	MAGNETIC DISK
DOCUMENT IMAGE STORED ON	MICROFILM	MICROFILM	OPTICAL & MAG DISK MICROFILM	...
AVERAGE BYTES TO STORE - SIGNATURE	700	680	5,000	1,300
- DOCUMENT	N/A	N/A	N/A	N/A
DISK SPACE REQUIRED FOR SIGNATURES	620 MB	620 MB	1.2 GB	652 MB
- DOCUMENTS	N/A	N/A	N/A	N/A
BACKUP MEDIA FOR - SIGNATURES	MAGNETIC TAPE	MAG TAPE & DISKETTE	MAGNETIC TAPE	DATA CARTRIDGE
- DOCUMENTS	MICROFILM	MICROFILM	N/A	N/A
ALL SIGNATURE IMAGES ONLINE	YES	YES	YES	YES
ALL DOCUMENT IMAGES ONLINE	N/A	N/A	N/A	N/A
SCANNED PER MINUTE - SIGNATURES	2	1/2 - 1	3	6
- DOCUMENTS	N/A	N/A	N/A	N/A
SECONDS TO RETRIEVE - A SIGNATURE	5	3-4	3 SEC	20 SEC
- A DOCUMENT	N/A	N/A	N/A	N/A
SIGNATURES PRINTED ON VOTER LISTS	NO	NO	NO	NO
OTHER FORMS SCANNED AND RETRIEVED	NONE	NONE	CANDIDATES & PAC's	NONE
SYSTEM DEVELOPED AND IMPLEMENTED				
DECIDED TO IMPLEMENT	1986	1985	1989	1989
SYSTEM FIRST OPERATIONAL	1988	APRIL 1986	1989	1991
DEVELOPED SYSTEM IN-HOUSE	YES	NO	NO	NO
TURNKEY SYSTEM ACQUIRED	NO	SIGNAWARE	FIDLAR & CHAMBERS	SIGNAWARE
DEVELOPED WITH SYSTEM INTEGRATOR	IBM	N/A	NO	NO

JURISDICTIONS USING SIGNATURE RETRIEVAL SYSTEMS AS OF MARCH 1, 1992

STATE JURISDICTION	FLORIDA PASCO COUNTY	FLORIDA PINELLAS COUNTY	FLORIDA SARASOTA COUNTY	GEORGIA FULTON COUNTY
SYSTEM DEVELOPED AND IMPLEMENTED - continued				
VENDOR PROVIDED HARDWARE & SOFTWARE	HARDWARE/SOME SOFT	NO	---	WANG - HARDWARE
VENDOR PROVIDED TRAINING	NO	---	YES	YES
TIME REQUIRED TO TRAIN NEW WORKER	30 MINUTES	---	1/2 HOUR	1 DAY
WRITTEN INSTRUCTIONS PROVIDED BY	STAFF	---	STAFF	VENDOR & STAFF
CONVERSION EFFORT				
DOCUMENT USED FOR INITIAL CONVERSION	ORIGINAL	ORIGINAL	ORIGINAL	ORIGINAL
NUMBER OF DOCUMENTS CONVERTED	150,000+	450,000	228,000	310,000
SCANNING WORKSTATIONS USED	---	7	---	---
HOURS PER DAY	---	---	---	---
TIME REQUIRED TO COMPLETE CONVERSION	6 MONTHS	6 MONTHS	6 MONTHS	ABOUT 1 YEAR
ESTIMATED SYSTEM COSTS				
APPROXIMATE COST OF SYSTEM	UNDER $30,000	$83,000	$60,000	$105,000
APPROXIMATE COST OF CONVERSION	UNDER $10,000	$55,000	---	---
SAVINGS	STAFF&OVERTIME DOWN	100'S LABOR HRS/YR	---	TOO NEW TO MEASURE
SYSTEM HARDWARE				
COMPUTERS	IBM 3090	WANG VS 100	DELL 310	WANG VS 5000
WORKSTATIONS	IBM PS/30	WANG VS 65 & VS 15	MITAC 386	WANG PC 250
SCANNER OR CAMERA	IBM 3118	WANG PIC	HOWTEC SCANMASTER	HP SCANJET II
PRINTER	---	WANG DM 016	HP LASERJET II	HP LASERJET II
IMAGE COMPRESSION	NONE	---	SOFTWARE	SOFTWARE
OPTICAL DISK	---	---	OPTIMEM 1000M	---
OCR OR BAR CODE SCANNER	---	---	---	---

JURISDICTIONS USING SIGNATURE RETRIEVAL SYSTEMS AS OF MARCH 1, 1992

STATE / JURISDICTION	NEW YORK ERIE COUNTY	NEW YORK MONROE COUNTY	NEW YORK NIAGARA COUNTY	OREGON CLACKAMAS COUNTY	WASHINGTON THURSTON COUNTY
MAY USE AS CONTACT	YES	YES	YES	YES	YES
REGISTERED VOTERS	500,000	350,000	101,000	150,000	80,000
POLLING PLACES	1,138	500	185	170	170
ELECTIONS PER YEAR	2	2	2-3	5-6	6
ABSENTEE VOTERS IN MAJOR ELECTION	3.8%	.08%	5%	10-11%	22%
ENABLING LEGISLATION REQUIRED	YES	YES		NO	NO
COURTS ACCEPT DIGITIZED FACIMILES	UNKNOWN	UNKNOWN	UNKNOWN	...	NOT TESTED
VOTER REGISTRATION DOCUMENT					
SIZE OF DOCUMENT	5" x 9.5"	9 1/2" x 4 3/4"	5" x 9"	4" x 6"	5" x 8"
SIZE OF SIGNATURE BLOCK	1/4" x 2 3/4"	1/2" x 3 1/4"	1/3" x 3"	3" x 7/8"	3/4" x 4"
COLOR (TYPE/PAPER)	BLACK/BUFF	BLACK/YELLOW		PURPLE-BLUE/WHITE	BLACK/WHITE
DOCUMENTS SENT TO POLLING PLACE	YES	YES	NO	NO	NO
ORIGINAL RETAINED	IN POLL BOOKS	IN POLL BOOKS	VOTER x ELECT DIST	BY VOTER ID	BY REGISTRATION DATE
DOCUMENTS RECEIVED - EVEN YEARS	38,000	50,000-80,000	25,000	30,000-40,000	15,000-20,000
- ODD YEARS	47,000	30,000-35,000	20,000	25,000-30,000	8,000-12,000
PEAK LOAD - DAYS BEFORE ELECTION DAY	30-60	20	30-60	...	30-60
- PERCENT OF DOCUMENTS	25-42%	30%	30-50%	...	40%
SIGNATURES CHECKED IN 1990					
VERIFY NAME OR SIGNATURE		BOTH	NAME	SIGNATURE	SIGNATURE
ABSENT VOTER BALLOT APPLICATIONS	17,946	10,000	...	20,000	200
RETURNED ABSENT VOTER BALLOTS	11,942	10,000	...	19,400	31,000
CANDIDATE NOMINATIONS	1,027	300	...	1,500	0
RECALL PETITIONS	0	0	...	25	0
INITIATIVE PETITIONS	0	0	...	3,600	0
REFERENDUM PETITIONS	0	0	...	600	0
AT POLLING PLACES	311,102	225,000	65,571	...	0
MAIL BALLOT ELECTIONS		...	...	139,000	20,000
RANDOM SAMPLING ALLOWED	NO	NO	NO	YES	NO
CONCURRENT SIGNATURE CHECKS REQUIRED	YES	YES	...	YES	YES
SYSTEM FEATURES					
INTEGRATED WITH VOTER REGISTRATION	YES	YES	YES	NO	NO
DIGITIZE WHOLE FORM OR SIGNATURE	SIGNATURE	FORM	SIGNATURE	SIGNATURE	SIGNATURE
SIMULTANEOUS SCANNING & RETRIEVING	YES	YES	YES	YES	YES
SIGNATURE IMAGE STORED ON	MAG & OPTICAL DISK	MAG & OPTICAL DISK	OPTICAL DISK	MAGNETIC DISK	MAGNETIC DISK
DOCUMENT IMAGE STORED ON	MICROFILM	OPTICAL DISK	N/A	MICROFILM	...
AVERAGE BYTES TO STORE - SIGNATURE	800-1000	1,800	LESS THAN 1000	900-1000	1,000
- DOCUMENT	N/A	...	N/A	N/A	N/A
DISK SPACE REQUIRED FOR SIGNATURES	20 MB	N/A	159 MB	640 MB	N/A
- DOCUMENTS	N/A	...	N/A	N/A	N/A
BACKUP MEDIA FOR - SIGNATURES	MAG TAPE & OPTICAL	OPTICAL DISK	OPTICAL DISK	MAGNETIC TAPE	MIRROR SYSTEM & TAPE
- DOCUMENTS		OPTICAL DISK	N/A	MICROFILM	N/A
ALL SIGNATURE IMAGES ONLINE	YES	NO	YES	YES	YES
ALL DOCUMENT IMAGES ONLINE	N/A	NO	...	N/A	YES
SCANNED PER MINUTE - SIGNATURES	25-30	20	6	6-8	N/A
- DOCUMENTS	N/A	20	N/A	N/A	8
SECONDS TO RETRIEVE - A SIGNATURE	2	CURRENT DISK 11 SEC	4	2-3	< 1 SEC
- A DOCUMENT	CURRENT DISK	SAME	N/A	N/A	N/A
SIGNATURES PRINTED ON VOTER LISTS	YES	YES	YES	NO	NO
OTHER FORMS SCANNED AND RETRIEVED	NONE	...	NONE	NONE	NONE
SYSTEM DEVELOPED AND IMPLEMENTED					
DECIDED TO IMPLEMENT	1990	1988	1989	1988	1986-87
SYSTEM FIRST OPERATIONAL	1992	1990	1990	FEBRUARY 1990	1989
DEVELOPED SYSTEM IN-HOUSE	NO	NO	NO	NO	NO
TURNKEY SYSTEM ACQUIRED	SIGNIT!	NO	NO	N/A	VOTEC
DEVELOPED WITH SYSTEM INTEGRATOR	NAT'L TIME SHARING	IMAGE BUSINESS SYS	NAT'L TIME SHARING	VOTEC	NO

JURISDICTIONS USING SIGNATURE RETRIEVAL SYSTEMS AS OF MARCH 1, 1992

STATE JURISDICTION	NEW YORK ERIE COUNTY	NEW YORK MONROE COUNTY	NEW YORK NIAGARA COUNTY	OREGON CLACKAMAS COUNTY	WASHINGTON THURSTON COUNTY
SYSTEM DEVELOPED AND IMPLEMENTED --continued					
VENDOR PROVIDED HARDWARE & SOFTWARE	YES	YES	YES	YES	YES
VENDOR PROVIDED TRAINING	YES	YES	YES	YES	YES
TIME REQUIRED TO TRAIN NEW WORKER	16 HOURS	1/2 HOUR	1 DAY	20-30 MINUTES	10 MINUTES
WRITTEN INSTRUCTIONS PROVIDED BY	VENDOR	VENDOR & STAFF	VENDOR	VENDOR	VENDOR
CONVERSION EFFORT					
DOCUMENT USED FOR INITIAL CONVERSION	ORIGINAL	ORIGINAL	ORIGINAL	PAPER COPY	ORIGINAL
NUMBER OF DOCUMENTS CONVERTED	500,000	600,000	100,000	155,000	78,000
SCANNING WORKSTATIONS USED	---	6	---	2	3
HOURS PER DAY	---	24	---	7.5	8.0
TIME REQUIRED TO COMPLETE CONVERSION	4 MONTHS	3 MONTHS	3 MONTHS	5 WEEKS	3 1/2 WEEKS
ESTIMATED SYSTEM COSTS					
APPROXIMATE COST OF SYSTEM	$216,000	$400,000	N/A	$58,000	$54,000
APPROXIMATE COST OF CONVERSION	---	$75,000	$125,000	$6,500	INCLUDED ABOVE
SAVINGS	TOO NEW TO MEASURE	$50,000/YEAR	---	$20,000 1ST YR	1,440 HOURS/YEAR
SYSTEM HARDWARE					
MAINFRAME, MINI OR FILE SERVER	FASTDATA 386	IBM RS-6000	---	UNISYS A12	UC COMPUTERS 386 SX
WORKSTATIONS	FASTDATA 286	IBM PS/2 70	IBM PS/2	VOTEC	UC COMPUTERS 386 SX
SCANNER OR CAMERA	HP SCANJET PLUS	IMPROVISION	HP SCAN-JET	VOTEC (CAMERA)	SANYO VIDEO CAMERA
PRINTER	HP LASERJET II	XEROX 4050	HP LASERJET II	---	HP LASERJET II
IMAGE COMPRESSION	SOFTWARE	SOFTWARE	SOFTWARE	SOFTWARE	SOFTWARE
OPTICAL DISK	---	MAXTOR LF4500	PINNACLE MICRO R650	---	---
OCR OR BAR CODE SCANNER	---	---	WELCH-ALLYN SCANTEAM	---	---

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