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Review of Audit Logs
District 2 County Commission Race
November 2, 2010 General Election
Osceola, County, FL

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By

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BACKGROUND

In August 2011, I was asked by Susan Pynchon, executive director of Florida Fair Elections Coalition (FFEC), to review audit logs from Osceola's November 2, 2010 general election to determine what I could learn about the conduct of the election and performance of the voting system that might affect the accuracy of the results in the District 2 County Commission race, which was very close.

The losing candidate, Armando Ramirez, finished 50 votes behind the winner, John Quinones, out of a total of 8,496 votes cast. According to the official results, Ramirez received 49.71% of the vote, and Quinones received 50.29%. Thus, Ramirez lost by 0.58%. If Ramirez had won 6 additional votes (not from Quinones, but simply additional votes), he would have come within the margin of less than ½ of 1% that would have entitled him to a machine recount.[1] Ramirez also felt there were irregularities during the election that made the results questionable.

As a co-founder of FFEC and research director since its inception, I have procured, reviewed, and analyzed audit logs from various voting systems for counties across Florida. About half the counties in Florida use the same basic system as Osceola County. Further, this Accu Vote OS has been in use for more than a decade in Volusia County, where FFEC is located. Thus, I have had the opportunity to become familiar with the audit logs produced by this system.

Founded in 2004, FFEC is a nonpartisan, nonprofit election reform organization based in Volusia County, FL. As such, we do not sponsor, endorse, or advocate candidates or parties. I want to emphasize that I was not an advocate for either candidate in this race. I was not compensated by anyone for my testimony or for the considerable amount of research leading up to it. Our work at FFEC has been focused on promoting fair, transparent, accurate, reliable, secure, and accessible elections throughout Florida.

Although ultimately I did not testify in this case, I am presenting these results because they reveal important problems both with the conduct of this election and the performance of the voting system. It is my hope that knowledge of the conduct-of-election problems will spur the Osceola elections supervisor to make fundamental changes to her election procedures to ensure accurate and reliable elections in the future. The voting system problems have implications statewide. Software flaws and bugs that were discovered during the course of this investigation need to be brought to the attention of the state, vendor, and county election offices so that they can be addressed prior to the 2012 election.

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[1] FS 102.141(7).

VOTING SYSTEM AUDIT LOGS

A voting system audit log records all events or transactions that occur on a particular component of a voting system.[2] For that reason, they are sometimes referred to as event or transaction logs. Typically, the entries on these logs consist of a sequence number, timestamp (date and time) and a description of the event being recorded. Some logs, depending on their purpose and use, contain other information as well.

Each component of the voting system produces audit logs—the election management system, called GEMS—Global Election Management System, in this case and the individual tabulators, Accu Vote OS and OSX optical scanners and the Accu Vote TSX DREs (direct recording electronics, also called touchscreens). Taken together, the audit logs for these components constitute the audit logs for the voting system.[3]

All components of electronic voting systems are subject to hacking, software bugs, and computer crashes, just like other computerized systems. The vulnerability of these machines to hacking was demonstrated in December 2005, when Hari Hursti, a Finnish computer scientist, showed that he only needed access to a single memory card in order to hack into the voting system and change the results of an election. That voting system was the same as the one used by Osceola, by the way. Up to that point, the vendors had adamantly claimed that this was not possible. The Hursti hack was later confirmed by a University of California study. That seminal event led to a much-greater emphasis on providing security measures to enhance confidence in the results of our elections.

That is where audit logs come in—they help us provide that confidence. They tell us what happened on a particular component of the voting system before, during, and after the election so that we can check to see that the voting system performed properly and that the election officials conducted the election in accordance with the law and the dictates of good practice as recommended by the state and the vendor. Thus, they are essential to establishing the integrity and accuracy of elections.

For this reason, all voting systems certified for use in Florida must produce certain types of audit logs.[4] At a minimum, these audit logs are required to be accurate, complete and not subject to alteration or deletion. As a part of its certification testing, the Bureau of Voting System Certification verifies that the appropriate logs are produced and meet these standards. In addition, Federal and state law requires that audit logs for Federal elections be retained for a period of 22 months.

Uses and Users

Audit logs are used for a number of purposes by various potential users:

- During the election to check that all components are operating properly and to guard against known problems with the voting system;

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[2] David Wagner, "Voting Systems Audit Log Study," University of California, Berkeley, June 1, 2010, p. 6.
[3] See Florida Statute 101.5606(13). There are additional audit logs produced by the Microsoft Windows operating system, but these are the principal audit logs produced by the voting system itself.
[4] Federal certification also requires that voting systems produce audit logs and sets certain standards for the type of audit logs that must be produced, their accuracy and completeness, as well as their invulnerability to alteration and deletion; however, Florida does not require Federal certification but sets its own standards and does its own testing.

- During routine post-election canvassing and audits to ensure that results are accurate and complete;

- During investigation of specific problems that may have occurred during the election;

- As a part of forensic investigations to assess voting system performance, adherence to proper administrative procedures, and compliance with legal requirements. [5]

- To provide data for research on a variety of election-related concerns.

Potential users of audit logs include elections staff, the canvassing board, candidates, political parties, election integrity activists, researchers, vendors, and the state division of elections.

Retention Requirements Under Federal and State Law

Federal law requires that the records from Federal elections—including audit logs—be maintained for a period of not less than 22 months. A Federal election is one in which candidates for Federal office are on the ballot. Osceola's November 2010 general election was a Federal election and falls under those retention requirements.

The Florida Department of State publishes a retention schedule that specifies precisely what records must be kept and for what period of time. The following excerpt covers audit logs (referred to as transaction logs):

> VOTING SYSTEM TRANSACTION LOGS Item #131 This record series consists of records of each transaction conducted on a voting device between the time the device was cleared from one election and the time it is cleared for the next election. Transaction log records will indicate, for example, that a voter cast a ballot at a specified time. The retention period is based on Title 42, U.S.C. 1974, Retention and preservation of records and papers by officers of elections. RETENTION:
>
> a) Record copy. 22 months after certification of election.
> b) Duplicates. Retain until obsolete, superseded, or administrative value is lost. [6]

The retention schedule for election records also addresses records that are kept in electronic format:

> Records retention schedules apply to records regardless of their physical format. Therefore, records created or maintained in electronic format must be retained in accordance with the minimum retention requirements presented in these schedules, whether the electronic records are the record copy or duplicates.[7]

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[5] Wagner, 2010, p. 7-8.

[6] Florida Department of State, "General Records Schedule GS3 for Election Records," September 1, 2010, Division of Library and Information Services, http://dlis.dos.state.fl.us/RecordsManagers, pg. 17

[7] Ibid, pg. vii.

Technical Advisory—Review, Preserve, Retain

On April 22, 2009, the Florida Division of Elections issued a technical advisory addressing the importance of audit logs for insuring the integrity of elections. This came in response to revelations of a problem with essentially the same voting system as the one in use in Osceola County, which resulted in incorrect vote totals and audit logs being inadvertently deleted. In this memorandum sent to all county supervisors of elections, supervisors were instructed to develop a documented process for the review, preservation, and retention of audit logs as a part of their security procedures. To avoid any confusion about what records were covered by the advisory, it quoted the Florida statute that explicitly states that audit logs for both the individual tabulators and the election management system are part of the election records:[8]

> The county's security procedures should consider a documented process for examining the audit logs. These procedures should provide a list of any audit logs with its timeline schedule (e.g., audit log start, audit log end, audit log review, storage, and preservation/retention). …
>
> We recommend that the county create an election definition backup prior to the close of polls on Election Night and preserve the operating systems' logs using documented procedures.

This technical advisories had a three-fold purpose:

1. To warn the counties of the problem
2. To provide appropriate, adequate, and consistent remedial measures
3. To reiterate that the counties bear the responsibility for review, storage, and preservation/retention of audit logs.

While this doesn't mean that all audit logs must be printed, it does mean that the county has the responsibility to determine how the log should be saved and what measures should be taken to avoid the loss of data. Some logs can be reviewed, preserved, and retained without printing them; however, these logs must also be available to candidates, political parties, researchers, and the general public when requested. That means they must be copied—in either electronic or paper form, at the discretion of the requestor, according to Florida public records laws.[9]

Some audit logs, however, cannot be reviewed, preserved, and retained unless they are either printed or saved to another medium. For example, the audit reports from the tabulators are stored on the memory cards themselves, which must be cleared and reprogrammed to be used for subsequent elections; thus, it is necessary to preserve the record before clearing the cards. Further, it is not clear how elections officials would fulfill their responsibility to "review" these audit logs without printing them.

Finally, the county's duty to preserve and retain these records means that it should take reasonably prudent steps to back up these records to guard against accidental destruction or corruption of data. The audit reports from the memory cards can be lost when the memory card battery fails or the data becomes corrupted for other reasons. And, despite claims by the vendor

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[8] Donald Palmer, "Technical Advisory—Audit Logs," Memorandum to All Supervisors of Elections, Division of Elections, Florida Department of State, April 22, 2009.
[9] The issue of retaining and providing electronic records contained a database has been repeatedly addressed by the Florida Office of Open Government at its seminars on public records requests.

that records cannot be altered or deleted, it has been discovered that many of these audit logs have only limited storage capacity and will begin to overwrite earlier entries when they reach a certain maximum size.[10]

OSCEOLA VOTING SYSTEM

For the 2010 general election, the firmware numbers printed on the poll tapes indicate that Osceola used Premier Election Solutions Release 1.21.5, certified November 2009. The Florida Division of Elections website states, however, that the county used Premier Elections Solutions Release 1.20.2 Version 1 (Revised), which was certified August 3, 2010. What is the difference between these two systems? The certificates do not reveal any obvious differences, but the system that DOE believed the county used was updated just a few months prior to the 2010 election.

The voting system used by Osceola County is one that is used by about half of Florida's counties. The original vendor for this system was Global Election Systems. It has since passed through many different owners, including Diebold (DESI), Premier, Election Systems and Software, and Dominion.

The basic components of the system include:[11]

- GEMS—Often called the central tabulator, this is the software that runs the election. It is used to set up the election, create the ballots, program the memory cards for the individual tabulators, upload the memory cards via modem, accumulate the results for all races on the ballot, generate and print the various reports required, produce a number of audit logs, and a host of other actions required to run elections.

- Accu Vote OS—This is the optical scanner used at the precincts (or vote centers—a term that covers the aggregation of precincts into a single voting location) to process and count the ballots. These optical scanners are really quite simple, uncomplicated machines that have been around for decades—think of them as being similar to the first personal computers which did not allow for storage of data except on external media. The firmware (computer program that runs the machine) is installed on the EPROM (erasable programmable read-only memory) chip in this machine. In contrast, the memory card used with this machine is rather complex. It contains all the data for the particular election after being programmed by the GEMS. During the election, the memory card takes the individual votes on the ballots, counts and tabulates them by race, and records and prints the results of the election on that machine. When balloting has ended, the results on the memory card are uploaded via modem to the GEMS. From the time that the memory card is initialized and programmed for the election until it is cleared for the next election, it records all the events that happen on an audit report log, which is stored on the memory card itself. The Accu Vote OS memory card

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[10] See Davtyan, Seda et al. "Pre-Election Testing and Post-Election Audit of Optical Scan Voting Terminal Memory Cards," Voting Technology Research Center and Computer Science and Engineering Departments, University of Connecticut, Storrs, CT. n.d., p. 4. Also, our review showed that various audit logs were, in fact, overwritten when they reached a certain capacity.

[11] Most manuals, guides, and other information about the voting system are considered by the vendors to be proprietary; thus, they are not available directly from the vendor. In order to gain access to this information, I examine copies that have been placed on the Internet and consult studies and reports done by those who do have access to these documents. Both the University of Connecticut and the University of California at Berkeley have been given access to such documents by their respective state departments. Perhaps the most important sources are letters sent by both the state and the vendor.

contains a microprocessor and batteries to allow it to perform all these tasks without losing data.

- Accu Vote TSX—This DRE (direct recording electronics) or more commonly, touchscreen, is used by disabled voters who cannot fill out paper ballots or insert them into a scanner. Votes recorded on these machines are not verifiable as there is no voter-marked ballot that can be retrieved for a recount or audit. Unlike the OS, it has a processor inside that has capabilities similar to that of a modern personal computer. Its memory card is less complex and apparently much like the one for the OSX machine. It performs the same functions as above, except that the voter makes his or choices on a touchscreen that directly records the vote. It produces all the same records as the OS, including the audit log. It saves the audit log on the memory card and in its internal memory. In addition, the TSX has a system event log that records system-related events. During an election, the election audit report includes both system and election events.

- Accu Vote OSX—This is the relatively new digital optical scanner that is used to count early voting and absentee ballots (although it can also be used in the precincts). It has more capabilities than the older OS machines and in many respects is more like the Accu Vote TSX, described above. Like the TSX, it has an operating system of its own and is capable of storing data. It is more similar to present-day personal computers. Therefore, the memory card for this machine is simpler and doesn't require batteries or microprocessors; however, it still holds the information for the particular election and performs the same functions as the memory cards for the OS machines. Unlike the OS machines, the OSX has the ability to save a copy of the audit report in its internal memory as well as on the memory card.

The basic components (hardware) of the voting system usually remain the same over time, although some new features such as ballot-on-demand or high speed printers may be added. But new versions of the software are certified from time to time. This includes different versions or updates of the election management software (GEMS) and the firmware that runs the AV machines.

SCOPE, SOURCES, AND LIMITATIONS

Obtaining the appropriate records for this review was difficult. Most of the records initially requested for review turned out to be incomplete, mis-identified, nonexistent, or otherwise unsatisfactory. The process of identifying missing or incomplete records took considerable time as in some cases it was not apparent that portions were missing until the records were actually examined. In other cases, the elections office insisted that records had been provided when they had not. Thus, many records were not received until just before the trial begun or even on the day of the trial. Some records were never provided.

The problems with the county's stewardship of these public records and the problems with obtaining them are addressed in more detail in the findings section of this report.

The requested audit logs included the following for election night:

> From the Global Election Management System:

- GEMS General Election Log
- AV (Accu Vote) Server Log

- Poster Log
- Accu Vote OS Memory Card Status Report (from election night)
- Accu Vote OSX Memory Card Status Report (from election night)

From the Accu Vote OS and OSX tabulators:

- Zero, results, and election audit report tapes for the Accu Vote OS tabulators used in District 2 precincts
- Zero, results, and election audit report tapes for the Accu Vote OSX tabulators used at all early voting sites
- Zero, results, and election audit report tapes for the Accu Vote OSX tabulators used for processing all absentee ballots

In addition to the above, I examined system audit logs for some of the OSX tabulators as well as Osceola's conduct-of-election report and incident reports.

Obviously, the fact that complete records were not received in a timely manner—and sometimes not all—has affected the scope of this review. I have attempted to qualify findings appropriately in those cases.

Other Sources

In addition to the above records, I also consulted a number of other documents or sources, including technical advisories and opinion letters from the Florida Department of State, product advisories from the vendors (Premier, ES&S, and Dominion), various academic studies and reports, voting system manuals and guidelines, as well as federal and state statutes, retention schedule, and so on. For comparison, I looked at audit logs from other counties with the same system as Osceola, including Volusia and Leon. I also looked at conduct-of-election reports for several counties and consulted an electronic voting specialist and a former Diebold employee. A list of references is included at the end of this paper.

FINDINGS

The audit logs for both the GEMS and the individual tabulators indicated serious problems, both with the conduct of the election and with the voting system. For convenience, I have arranged the findings into two groups—the first is primarily concerned with conduct-of-election problems, and the second with voting system performance problems. Obviously, the two types of problems are intertwined so that one prompts or exacerbates the other.

Conduct-of-Election Problems

Finding 1. On Election Day, three days after the close of early voting, Osceola elections staff opened the election and added ballots to one of the memory cards from Kissimmee Library early voting, without notifying candidates or publishing public notice.

Audit logs show that the Osceola elections office opened the election on this memory card from early voting at the Kissimmee Library on election day and added ballots to it. There appears to have been no public notice of this counting of ballots nor any notice to candidates. No results tape was run prior to adding the ballots so we have no record of the results from the ballots cast during early voting on this machine.

Yet, as stated in an opinion letter from the Florida Department of State, dated August 10, 2010, this memory card should have been ready for upload to the election management system on the Saturday before Election Day:

> *Section 97.021(22), Florida Statutes, defines early voting as the "casting and deposit of a voted ballot in the tabulation system prior to election day at a location designated by the Supervisor of Elections." By its very definition, the ballot is tabulated the day it is cast, which is before election day. The early voting period for federal, statewide, and county elections spans two weeks, beginning on the 15th day before election day and ending on the 2nd day before election day. See s. 101.657, Florida Statutes. That means that the early votes cast are completely tabulated and ready for upload to the election management system two days before election day[12]*

Finding 2. *The audit logs for the above-referenced memory cards from Kissimmee Library early voting show that the memory cards were not "zeroed out" and all ballots rerun on Election Day as stated by the Osceola Supervisor of Elections in her deposition and testimony. Further, the audit logs show that these memory cards are not the original memory cards sealed in the machines prior to the beginning of early voting, but a second set of memory cards put in the machines on October 20th, the third day of early voting. The elections supervisor failed to reveal this important fact.*

Both in her deposition and as further detailed during her testimony during the trial, Supervisor of Elections Mary Jane Arrington stated that the memory cards for the Kissimmee Library machines were "zeroed out" at the elections office on election day and all the ballots were then rerun in front of the canvassing board. She explained that they took this action because a poll worker had mistaken the write-in ballot bin for the unscanned ballots and rerun all the ballots that contained write-ins, which meant these ballots were then counted twice.[13]

Incident reports for Kissimmee Library early voting corroborate the mistaken rescanning of write-in ballots; however, they contradict Ms. Arrington's explanation of the remedial actions taken. Instead they show the following:

1. Neither of the cards was zeroed out on Election Day
2. All the ballots were not re-run; rather ballots were added to one card
3. The memory cards were not the original ones sealed in the machines before the beginning of early voting, but rather a second set that were installed on October 20th, the third day of early voting.

1. Cards were not zeroed out.
When someone attempts to reset a memory card, the machine displays a message to warn the operator that proceeding with this option will cause results to be erased. This message is also saved to the audit report. The following portion of the audit report tape from Machine 1001, Kissimmee Library early voting, shows the resetting of the memory card before voting began on October 20th :

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[12] Palmer, Donald L. "Early Voting and Absentee Ballot Results," DE 10-10 Opinion Letter, Division of Elections, Florida Department of State, dated August 10, 2010.

[13] Deposition, Mary Jane Arrington, 9th Judicial Circuit, Osceola County, Case 10-CA-6903-OC, September 6, 2010, Select Court Reporters, Daytona Beach, FL, p. 47-49.

```
10:15 The audit log was opened
10:15 Election opened.
10:17 Prompt: WARNING! Selecting
this option will erase all
results and set the system to
live election mode!   Do you
wish to proceed?
Selection: Yes.
```

Below are scanned images from the November 2 portions of the audit report tapes for both machines from Kissimmee Library early voting. These cover the time when the supervisor of elections says that the machines were zeroed out. If this were the case, there should be a message to that effect on the tape, but neither tape shows any such message. Instead, both show "election opened" and "ballot count started" messages, just as they did at the beginning of each day of early voting. Thus, the audit report tapes show conclusively that these memory cards were *not* zeroed out on election day:

Machine #107:

```
Nov 02, 2010 (Tue)
19:54 The audit log was opened
19:54 Election opened.
19:54
19:54 Ballot count started.
19:54 Ender card read.
19:54 Election ended.
19:55 Prompt: PRINT LONG REPORT?
Selection: No.
19:58 Prompt: NEED ANOTHER COPY?
Selection: No.
19:58 Totals report printed.
20:16 Upload started.
```

Machine #1001

```
Nov 02, 2010 (Tue)
17:48 The audit log was opened
17:49 Election opened.
17:49
17:49 AC power connected.
17:52 Ballot count started.
18:09 Overvoted Race Detected 11
18:09 Blank-Voted Ballot
19:13 Overvoted Race Detected 20
19:16 Blank-Voted Ballot
19:54 AC power disconnected.
19:55 Ender card read.
19:55 Election ended.
19:56 Prompt: PRINT LONG REPORT?
Selection: No.
19:59 Prompt: NEED ANOTHER COPY?
Selection: No.
19:59 Totals report printed.
20:01 Upload started.
```

2. All ballots were not rerun; rather ballots were added to one of the cards.
The tape for machine #107 shows that the ballot count was started and ended within the same minute so it is unlikely that any ballots were added to this memory card; however, the tape for machine #1001 indicates that the ballot count was restarted and ballots were run for about two hours.[14]

We cannot tell from the audit report tape how many ballots were fed into the machine because the audit report tape only records when a ballot is rejected—that is, overvoted or blank—but clearly, not all 3,032 cards cast on this machine could have been re-fed during this time. Furthermore, if they had been rerun without resetting the memory card, it would have doubled the cards cast and results on this machine—but it doesn't appear that this happened. A check of the report filed with the state at the end of the early voting period shows that the total turnout for Kissimmee early voting roughly matches what was reported at that time.[15]

3. The memory cards are the second cards used in the machines.
Finally, we know that these cards are not the original memory cards that resided in the machines on the first day of early voting for several reasons. First, we can see on the top of each of the audit report tapes that the cards are "Copy 01."[16]

```
        General Election
        Osceola County

        November 2, 2010
DATE                    Nov-02-2010
VOTE CENTER ID             2080
        Kissimmee Library
MACHINE ID or SERIAL:      1001
D/L VERSION                   1
COPY                         01
```

Whenever memory cards are programmed for an election, the first card for a machine will be designated as Download Copy 00. If another copy is needed, it will be Copy 01, and so on. As a security feature, the system will not permit the use of the same copy number for a different card until after the election is over. It is possible, however, that for some reason elections staff might keep the original card at the elections office as a backup and send the duplicate to the voting location. But we can see that these are indeed the second cards used during early voting because the zero tapes were not run until October 20th, even though early voting began October 18th. Further, the summary at the top of the tape shows that only one election zero tape was run for this card.[17]

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[14] The times on the audit report tapes are off by approximately an hour so the actual times would be 4:52 p.m. to 6:55 p.m.

[15] It is difficult to reconcile turnout numbers with any precision due to the fact that each page of the two-page ballot in this race was treated by the machine as though it were a separate ballot. Thus, turnout should be about half of the actual cards cast. But this isn't precise because it seems that some voters may not have inserted their second page through the machine.

[16] Copy of tape received had yellow highlighter over "Kissimmee Library," which is what gives it this muddy appearance when scanned in black and white.

[17] Interestingly, when the Osceola IT director was asked why the audit report tapes showed the zero tape was run on October 20, he said he did not know. See "Deposition, Alan Ortega," 9th Judicial Circuit, Osceola, FL, Case No.,10-CA-6903-OC, reported September 6, 2011, p. 53-54. Also, the zero tapes from Kissimmee Library early voting were never provided to me.

On the file given to the state at the end of early voting, 307 people are listed as having voted at Kissimmee Library early voting during the first two days—October 18 and 19. With a two-page ballot, this translates into 614 cards. It certainly would have been possible to run that number of ballots within the two-hour period. Regardless of what prompted the installation of new memory cards at this location, it is clear that the Osceola elections staff knew for a week and a half that they would have to re-run ballots. Yet in that time, no one notified the candidates or the public about the problem or the scheduled retabulation of ballots.

A review of the incident reports for Kissimmee Library (Hart Memorial) early voting supports Ms. Arrington's explanation that write-in ballots were mistakenly rescanned; however, the reports show that this happened not at the end of the early voting process but at the very beginning, on October 18. Incident reports indicate other potentially serious technical problems at this voting site during the first two days—problems with the EVID used to check in voters, an uncounted jammed ballot which could not be found by the workers, and problems with the ballot-on-demand printer that resulted in incorrectly printed timing marks. Any of the above problems or ones which remain unknown to us may have led to the decision to use new memory cards. If we had the audit report tapes from the original cards, we might be able to glean some clues about what happened, but none were provided even though the request covered the audit report tapes from all the memory cards used in the election.

According to the incident reports, however, there were problems after the insertion of the new memory cards that might have affected the accuracy of the results on these second memory cards as well and might explain why the SOE thought all of the ballots were being rescanned. A provisional ballot was scanned instead of being put aside for consideration by the canvassing board. Also, the site had a very unusual technical problem—its IP address was the same as the IP address for Poinciana Library early voting. The IP address is what allows computers to identify other commuters and, thus, communicate with them. This problem was discovered when a ballot being printed for a Poinciana Library voter printed out on the Kissimmee Library printer. Incident reports show that the Osceola IT director, Alan Ortega, came out to the Poinciana Library site and reset the IP number there.

Finding 2. *The GEMS was closed down on election night without backing up the election, printing a statement of votes cast (SOVC), cards cast report, or Accu-Vote Memory Card Status report by upload time. According to both the state and the vendor, these reports should be run to ensure that all cards have been uploaded successfully because partial and failed uploads have occurred on this system that cannot otherwise be detected.*

Osceola elections staff closed GEMS on election night without backing up the election and without reviewing or printing the reports required by the state and suggested by the vendor. In fact, the audit log shows that the election was not backed up until after 5:00 p.m. the day after the election. Common sense and good practice require at the very least backing up the election and printing memory card status reports and an SOVC before closing GEMS on election night. This is necessary to know that all precincts have been uploaded successfully. Also, the canvassing board and elections staff need the SOVC to do their jobs, that is, to compare the poll tape results to the actual uploads. Candidates and the public use the preliminary statement of votes cast to compare its totals to those announced publicly on election night at the polls and the elections office and to make decisions about requesting retabulations in the event of a close election.

Partial and failed uploads have been noted on these systems even when the AV unit and the records from the precinct show that the upload occurred successfully. The only way to be sure that all memory cards are uploaded fully and accurately is to run these reports and review them. [18]

A May 29, 2008 product advisory from Premier Election Solutions (the predecessor to the current vendor) warns customers about a sharing violation problem that results in partial uploads. The problem occurred on the same system as the one Osceola uses. In the advisory, the vendor suggests its customers take the following actions to avoid losing votes:

> *Premier Election Solutions recommends basic election canvass procedures which should be used at all times....These procedures include, at a minimum, the viewing and/or printing of the "AccuVote®-OS Status" and "AccuVote-TS Status" reports to ensure all memory cards have been uploaded, verifying the "Cards Cast" shown on the "Election Summary Report" matches the expected value from the pollbooks, and checking the audit logs for any abnormal conditions.[19]*

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Note that the advisory recommends what it calls "basic election canvass procedures which should be used at all times." In other words, these procedures should be used regardless of whether a problem is suspected. The Osceola GEMS general election log, however, shows that Osceola did not follow these "basic election canvass procedures." Its Accu Vote OS, OSX, and TSX Memory Card Status Reports were not printed until November 22, well after the certification of the election. This is verified by the system events log as well. The SOVC, which contains the results from the precincts as well as the results from early voting and the absentees, was not printed until November 4. But it appears that this document was deleted on November 5, along with the previous uploads, prior to the re-upload of memory cards. This document is extremely important because it is the only results record that can be directly checked against the totals tapes from the precincts, early voting memory cards, and absentee balloting batches to see if they have been accurately uploaded. It is this document that most candidates consult to determine if they should contest a close election. The GEMS general election log shows that a Cards Cast Report was not printed until December 15.

In contrast, an examination of the Leon County GEMS general election log shows that within two hours of midnight on election night its staff printed the following reports:

- Accu Vote-OS Status Report,
- Accu Vote TS Status Report,
- Statement of Votes Cast, and
- Cards cast report

In addition, election staff backed up the election to the hard drive before closing.

Figure 1. Leon County's 2010 GEMS General Election Audit Log

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9898 11/02/10 21:57:15 User Mark: Printing Summary Report -1
9899 11/02/10 21:57:15 User Mark: Printing Summary Report
9900 11/02/10 22:04:02 User Mark: Previewing Report: AccuVote-OS Status Report
9901 11/02/10 22:05:39 User Mark: Previewing Report: AccuVote-TS Status Report
9902 11/02/10 22:05:54 User Mark: Previewing Report: AccuVote-OS Status Report
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[18] Palmer, 2009.
[19] Premier Election Solutions, Product Advisory Notice, PAN 2008-009, May 29, 2008.

9903 11/02/10 22:28:14 User Mark: Created standard export results file -C:\Documents and Settings\earleym\My Documents\FDOE\leon11022010_results.txt
9904 11/02/10 22:28:37 User Mark: Created standard export results file -C:\Documents and Settings\earleym\My Documents\Web\11022010_results.txt
9905 11/02/10 22:28:50 User Mark: Printing Summary Report -1
9906 11/02/10 22:28:50 User Mark: Printing Summary Report
9907 11/02/10 22:30:18 User Mark: Previewing SOVC Report
9908 11/02/10 22:31:06 User Mark: Previewing SOVC Report
9909 11/02/10 22:31:27 User Mark: Previewing SOVC Report
9910 11/02/10 22:31:59 User Mark: Previewing SOVC Report
9911 11/02/10 22:33:12 User Mark: Printing SOVC Report
9912 11/02/10 22:36:19 User Mark: Printing SOVC Report
9913 11/02/10 22:37:40 User Mark: Printing Summary Report -1
9914 11/02/10 22:37:40 User Mark: Printing Summary Report
9915 11/02/10 22:38:02 User Mark: Created standard export results file -C:\Documents and Settings\earleym\My Documents\FDOE\leon11022010_results.txt
9916 11/02/10 22:38:17 User Mark: Created standard export results file -C:\Documents and Settings\earleym\My Documents\Web\11022010_results.txt
9917 11/02/10 22:40:53 User Mark: Created standard export results file -
9918 11/02/10 22:41:17 User Mark: Edit standard import format definition - WebSite
9919 11/02/10 22:46:51 User Mark: Created standard export results file -C:\Documents and Settings\earleym\My Documents\Web\DETAIL11022010_results.txt
9920 11/02/10 22:47:05 User Mark: Created standard export results file -C:\Documents and Settings\earleym\My Documents\FDOE\leon11022010_results.txt
9921 11/02/10 22:47:30 User Mark: Edit standard import format definition - WebSite
9922 11/02/10 22:47:39 User Mark: Created standard export results file -C:\Documents and Settings\earleym\My Documents\Web\11022010_results.txt
9923 11/02/10 22:47:48 User Mark: Printing Summary Report -1
9924 11/02/10 22:47:48 User Mark: Printing Summary Report
9925 11/02/10 22:48:36 User Mark: Printing SOVC Report
9926 11/02/10 23:00:00 User Mark: Backed up election to C:\Documents and Settings\All Users\Documents\GEMS Backups\2010 General\2010 General ballots ENIGHT FINAL.gbf
9927 11/02/10 23:03:14 User Mark: Previewing Cards Cast Report
9928 11/02/10 23:03:30 User Mark: Previewing Cards Cast Report
9929 11/02/10 23:06:03 User Mark: Printing Card Cast Report
9930 11/02/10 23:06:03 User Mark: Printing Cards Cast Report
9931 11/02/10 23:06:22 User Mark: Closing GEMS

Audit records from Volusia County show that it likewise printed these reports and backed up its election before closing on election night.

In his deposition, Osceola's IT manager, Alan Ortega, states that technical advisories are just "advisory," not directives. But he is mistaken. Product advisories from the vendor and technical advisories from the state are essentially warnings. Failure to heed these warnings could have dire consequences for the county elections office. Once counties have been informed of specific problems and told to take certain remedial actions, then they have a duty to take those actions or bear responsibility for any bad consequences that result from their failure to do so. In a sense, these are like the warning signs put up by the rides at amusement parks. They inform the consumer about risks, not only for the altruistic purpose of preventing injuries, but also to absolve the company from legal responsibility.

Finding 3. Election day results on GEMS were destroyed three days after the election (November 5) when elections staff added votes to memory cards that had already been uploaded to the election management system. Because important reports to verify and document uploads from election night were not run, any contemporaneous record of results from election night was destroyed.

According to all the audit logs, on November 5, three days after Election Day, ballots were added to precinct, early voting, and absentee memory cards that had already been uploaded to the system on election night. The Osceola supervisor of elections has said that unscanned ballots were added to these cards. Memory cards from 4 of the 7 vote centers in District 2 were re-opened using the supervisors' card to resume the election, ballots were added, and new results tapes were run.[20] Votes were also added to one of the memory cards from early voting—BVL library, and one of the batches of absentees (2005).

The memory card and other materials from precincts on election day and early voting are sealed for a reason—to ensure the integrity of the results and the ability to conduct a meaningful audit and/or recount if necessary. Ballots not scanned at the precinct prior to closing on election day should *never* be added to a memory card that has already been uploaded. Unscanned ballots should be run to a separate memory card and uploaded separately.

As seen on the following excerpt from the Volusia County Preliminary Statement of Votes Cast, November 2, 2010 election, the GEMS has a reporting category for "Unscanned"; thus, it is not necessary to upload cards more than once: [21]

Figure 1. Statement of Votes Cast, Preliminary Results, November 2, 2010, Volusia County, Florida, Date: 11/03/2010, Time: 00:01:03, Page 16 of 1520

Total	2050	765	37.32%
Early Voting OS			
Early Voting OS	0	29504	-
Absentee	0	0	-
Other Non-Polling	0	0	-
Total	0	29504	-
Absentee			
Early Voting OS	0	0	-
Absentee	0	32185	-
Other Non-Polling	0	0	-
Total	0	32185	-
Provisional			
Early Voting OS	0	0	-
Absentee	0	0	-
Other Non-Polling	0	0	-
Total	0	0	-
Unscanned			
Early Voting OS	0	0	-
Absentee	0	0	-
Other Non-Polling	0	0	-

In my experience, this is not only common practice, but common sense. The proof that adding unscanned ballots to previously uploaded cards is not good practice is that the GEMS system is set up to *prevent* second uploads from happening—either inadvertently or fraudulently.

Preventing second uploads of cards is an important security protection built into the system. In order to override GEMS protections, Osceola elections personnel first had to delete records from election day—records they were required to keep—in order to upload these cards a second time. This included not only clearing the original results for these cards, but also deleting the GEMS reports containing the original results from the system—specifically the Statement of Votes Cast (SOVC) and the Election Summary Report.

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[20]   For the OS machines, none of the results tapes from November 5 are shown on the, although we have copies of these tapes. That problem is discussed under voting system performance problems.

[21] It should also be noted that most counties have very few unscanned ballots. If there are many, it indicates a problem, either with the ballot or the machines.

Finding 4. *From November 4 to November 8, the central tabulator (GEMS) was left open, with the user signed in. Thus, during the crucial period when votes were being cleared and reuploaded and audit reports were being deleted and rerun, anyone with access to the room could have made changes to the election data. This is an unacceptable breach of security.*

From just after 1:00 p.m. on November 4 to just after 1:00 p.m. on November 8, the GEMS was left open, with the user logged in. It was during this period, November 5, that many of the uploads from election night were cleared and new results were uploaded and important audit reports were deleted and re-run. Yet, the system remained open so that anyone with access to the room did not even have to enter a password in order to get into the system and make whatever changes he or she might wish to make. And there would be no way to distinguish between the legitimate actions taken by the authorized user and an interloper.

This is a serious breach of security. It is extremely important that the GEMS remain password-protected at all times—but especially while the election is still live. Sure, people make mistakes, but effective security procedures take that into account and institute redundant checks to ensure that such catastrophic breaches do not occur. This suggests that the Osceola supervisor of elections needs to revamp her security procedures.

Finding 5*. The Osceola elections office failed to review, preserve, and retain important elections records, as required by state and Federal statute. Of the GEMS audit logs requested, only one—the GEMS General Election Log appeared to be complete and to be the copy of record. The remainder were either incomplete or were copies obtained from backup files—not the copy of record required to be retained for 22 months.*

As discussed above, the state requires voting systems to produce audit logs because these are essential for verifying the accuracy and integrity of elections. State and Federal statutes require that the audit logs for Federal elections be retained for not less than 22 months. In April 2009, the Florida Division of Elections issued a technical advisory concerning audit logs to all supervisors of elections. They did so because of problems with these audit logs being inadvertently deleted had occurred in a California election. The counties were instructed to develop procedures for reviewing, preserving, and retaining these audit logs as a part of the security procedures that they must file with the state.

Yet, it is clear that Osceola County's elections staff did not meet their responsibilities with regard to reviewing, preserving, and retaining audit logs. Of the audit logs requested, nearly all were incomplete or missing altogether. Some had to supplied from backup copies, and thus were not the copy of record as specified in the Florida retention schedule. Not reviewing the copies as instructed had serious implications: Because they did not examine the audit logs, they failed to detect numerous problems with the voting system. These are enumerated and discussed in the next section of findings.

Specifically, the audit logs supplied for review had the following deficiencies:

- **AV Server Log —Incomplete copy of record, backup provided just prior to trial**
The AV Server Log shows the time of the uploads and the number of cards cast for each of the vote centers (precincts and groups of precincts). The Poster Log shows when these vote center uploads are posted to the GEMS system. So these logs are important to verify that all uploads are successful and complete. Error messages on these logs show when uploads fail or when other problems occur.

The AV Server Log first provided begins at 8:05 on election night, well after most of the precincts had finished uploading. Of the seven vote centers in the District 2 county commission race, only two are shown on the AV server log—vote centers 48 and 63. The remaining five were ostensibly uploaded prior to the beginning time on the log. Of the 16 cards from the OSX units for early voting and absentee balloting, only half (8) are shown as uploaded on the AV server log. All of the missing cards are from early voting: both machines from Main Office, both machines from Kissimmee Library, both machines from Poinciana, and one machine from Celebration. The Celebration machine that is shown as uploaded is the one that no votes on it. Thus, the OSX machines not shown as uploaded on this AV Server log ultimately account for more than 23,500 ballots.

- **Poster Log—Incomplete copy of record, backup provided just prior to trial**

The Poster Log begins earlier than the AV server log—at 7:45; therefore, we are able to see the upload of three more vote centers. We also have confirmation of two more OSX memory cards-- both from Poinciana Library early voting. Unfortunately, the poster log does not show the number of ballots for each upload so while we see that they are uploaded we cannot ascertain that they were fully and accurately uploaded.

The loss of important portions of the AV Server and Poster logs was apparently due to a known problem with this system—that is, that these logs can only contain a limited number of entries. Once they have reached capacity, the oldest entries are overwritten in order to make room for new entries. This problem has allegedly been addressed in the newest version of the system. To prevent inadvertent loss of audit logs, the vendor recommended backing up the log to another location at intervals and/or printing. But the Osceola elections staff did not save the AV server log until December 1, and it wasn't printed until June 3, 2011. [22]

- **Statement of Votes Cast (SOVC) from Election Night—Copy of Record deleted; never provided to candidates or public**

As discussed previously, the GEMS general election log shows that the SOVC was never run on election night as required by the state and recommended by the vendor. Also, we showed earlier that other counties did, in fact, review and run their SOVCs before closing the election at the end of election night. The SOVC is the only document that breaks down the results by precinct so that candidates, public election observers, and the canvassing board can check the uploaded results against the poll tapes run at the polling places.

The SOVC was backed up to another location on November 4, two days before the election. On November 5, the SOVC from election night was deleted from the GEMS prior to the reuploads of several vote centers. Thus, the copy of record that was required to be saved by Federal law was destroyed.

Requests for the November 4th SOVC were never fulfilled. At the trial, a copy of an SOVC that was purported to be the November 4 copy was finally supplied, but as the copy was not dated November 4, it is impossible to tell if this is indeed the same document.

- **Accu Vote OS and OSX Memory Card Status Reports (election night)—Copies of Record overwritten**

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[22] While Osceola elections staff clearly didn't take the appropriate actions to prevent the loss of these audit logs, it is important to note that a system whose audit logs can be inadvertently lost should not be certified for use in Florida.

For each memory card used in the election, the memory card status report shows whether it has been uploaded, the date and time of the upload, and the number of cards uploaded. Both the state and the vendor recommend that the memory card status reports for all memory cards used in the election are run before closing on election night in order to ascertain that all memory cards have been uploaded successfully and fully. This is extremely important because it has been shown that the poster log and machine tape may indicate that a memory card has been uploaded when it has not.

Because this was not done, when the memory cards were uploaded again on November 5, it overwrote out any record of the original upload of the memory cards on November 2. Thus, the memory card status reports that we were given are not the copy of record from the election; that document has been overwritten and irretrievably lost.

- **Accu Vote OSX Zero, Results, and Audit Report Tapes—Incomplete; some not provided**

    1. All audit report tapes for early voting and absentee balloting are incomplete. Beginning portions of these tapes were automatically archived by the machine because entries exceeded the capacity of the memory card. These beginning portions of the tapes were not provided.

    2. Zero and results tapes for Kissimmee Library early voting were not provided until the day of the trial; zero, results, and audit report tapes for memory cards used for first two days of early voting at Kissimmee Library were never provided; in fact, the existence of previous memory cards at Kissimmee Library was never disclosed.

    3. Zero and results tapes for Poinciana Library early voting were never provided.

- **Accu Vote OS Zero, Results, and Audit Report Tapes (for District 2 race)**

    1. No audit report tape was preserved for Precinct 61—Battery failed in memory card.
    2. Results tape for Precinct 61 has no readable date—Apparently a problem with the printer

Finding 6. The Osceola elections office failed to meet its obligations under Florida's public records law to provide requested records in a timely manner and in the format requested. Provided records were incomplete or furnished only after repeated requests, in many instances not until the first day of the trial. Some records relevant to establishing the accuracy of the vote count were not supplied at all.

As discussed in Finding 5, most of the provided records were incomplete or misidenttified. Many records were not supplied until just before the trial or even on the first day of the trial. Many were never provided. The supervisor of elections argued that she did not "produce" some of the requested records because she did not print them. But, as we have seen, the machines produce the audit records; the supervisor of elections must preserve and retain them. In the case of data contained in an electronic database, the retention schedule makes it clear that these must also be retained; further, the public records statute indicates that the requestor is entitled to ask for these in a format of his or her choice, provided that the document can be produced in that format.

The elections office's failure to fulfill these public records requests in a timely manner impeded the review of the audit reports, but more important, this failure made it difficult for the losing candidate in the District 2 race to obtain relevant information for his contest of election. As a case in point, the machine tapes from Kissimmee Library early voting were not provided until the first day of the trial, despite repeated requests for these specific records. Yet, the information on these tapes was essential to show that testimony on the re-running of ballots from this location was inaccurate and incomplete. These tapes corroborate other evidence that contradicts testimony that the ballots from this location were re-run and that there were not the original memory cards in these machines. Certainly, these facts are relevant to this contest of election because they place in doubt the validity of the more than 2,700 votes at this location.

Voting System Performance Problems

The inspection of the audit report tapes for both the OS and OSX memory cards revealed serious inaccuracies and discrepancies that call into question the reliability of these important audit logs that guard the electronic ballot boxes that hold the votes. These included discrepant times and dates and failure to log important events.

As mentioned earlier, the purpose of audit logs is to allow us to have confidence in the accuracy and integrity of our elections. Obviously, that purpose cannot be achieved unless the audit logs are actually *used..* Audit logs are not complicated, highly technical documents. They are fairly easy to understand records, written in English, that require only a very rudimentary understanding of the voting system and basic terminology. The problems discussed below would have been evident to the supervisor of elections and her staff if they had reviewed their audit logs as prudence, the state, and the vendor all dictated.

Finding 1. The audit report tapes for the Accu Vote OS memory cards failed to record the printing of totals tapes from November 5th, and also failed to note in the summary the correct number of totals tapes printed for that card. This is a very serious deficiency that calls into question whether the audit report tapes are recording all important events as required for certification.

Perhaps the most serious problem that can occur with the audit report tapes is to find important events that were somehow not recorded, as that is their function—to record all the events on the memory cards in sequence, with an accurate time and date. Yet we have results tapes printed for the OS memory cards for three of the seven vote centers in the District 2 county commission race (Vote Centers 48, 63, and 65) that do not appear on the audit report for those memory cards. And it is likely that if we had the audit report tape for Vote Center 61, which has been lost due to battery failure, it also would not show an entry for a results tape we have. When we look at the number of elections results tapes printed, as shown on the summary label at the top of the audit report, we find that it lists only 1, even though 2 tapes were eventually printed. All of the results tapes that do not appear on the audit reports were printed on November 5 after votes were added to these cards.

It is hard to overstate how serious this problem is. The most basic function of the audit reports from the individual tabulators is to act as a sort of "window" that allows us to know what happened with respect to the memory card. It is supposed to be a real-time report of all significant events that took place on the memory card during the election, with a description and timestamp for each. What is "real-time"? It means that the entries were recorded as they happened, not afterwards. In a sense, they are electronically "printed" to the log just as you would print to a piece of paper.

Recorded events include: running the zero and results tapes, starting and ending the ballot count, running the ender card, uploading results, making duplicate cards, rejecting overvoted ballots and blank ballots, power failures, memory card failures, checksum errors (which indicate that the count is corrupted), and a host of other actions and problems. These events can give us information about whether poll workers and election officials used proper and secure procedures and complied with certain election laws as well as whether the voting equipment functioned properly.

Thus, it should not be possible to have a significant event occur and not be recorded on the audit report tape, and the printing of a results tape is one of the most important events that can happen on these cards. And if it is possible to print a results tape without it appearing on the audit report tape, what other important events might be omitted? Checksum errors, perhaps, which show that the count is corrupted? Resetting the memory card at some point after voting has started so that all prior balloting is wiped out? Both of the previous problems have actually occurred in the course of elections, resulting in inaccurate returns. The audit report should alert us to these and other problems.

Finding 2. The times given on the audit report tapes for the Accu Vote OS memory cards for the printing of zero and results reports are different from the times for these events given on the respective zero and results reports. This should be impossible. Further, the impact of this problem is worsened by a known flaw that produces incorrect information in the headings of the tapes.

The OS audit reports for the vote centers in the District 2 race are off from 6 to 32 minutes for the results tapes and from 2 to 14 minutes for the zero tapes. In all cases the audit report shows times substantially after those shown on the other report tapes.

As previously stated, the audit report should record events at the time they happened and exactly as they happened—even if those times turn out to be incorrect. For example, when a results tape is requested, the AV should query the unit for the time and print that time on both the results tape and the audit report. If the time on the unit is set incorrectly, that incorrect time should be recorded on both tapes. *It should not be possible for them to be different.* If the time is different, then the mechanism for recording the time is not functioning properly. Either the machine is not using the same time query for the tapes or the time on the audit report tape is subsequently being altered. This fatally compromises the integrity of the audit report tape. The audit report can no longer be used to verify that these reports are indeed from the same card and that the information on them has not been inadvertently or fraudulently modified. In my experience, audit reports for the OS machines have faithfully shown the times on other reports from the same memory card.

This situation is exacerbated by a known problem with the headings on these tapes. In June 2010, the vendor put out a product advisory concerning an issue with this firmware that resulted in information on the header being scrambled such that the machine number is overwritten by the precinct number and the download copy number likewise is reported inaccurately. While the vendor was seeking to fix the problem, it suggested to counties that they instruct poll clerks to look on the AV machine to find the right machine number, mark through the incorrect number, and write in the correct number on the tapes when they are printed. They can then initial the change as one would do when correcting an error on a check, for example.[23] Osceola elections

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[23] Election Systems and Software, Technical Bulletin PRBAVOSPC0001, June 14, 2010, re: Accu Vote OS, Firmware 1.96.7 or later.

office personnel did not take these recommended actions; thus, the machine numbers that would allow us to associate the zero and results tapes with a particular machine and memory card are not on these tapes.

For me, the most disturbing aspect of this problem is more far-reaching than the Osceola 2010 election. There are only two possibilities for events and records of events being discrepant—the audit reports have been altered or they were wrong at the time they were produced. If they can be altered that means that they are vulnerable to intentional or unintentional alteration and do not meet the requirements for state certification. If they were wrong at the time of the event being recorded, then the mechanism for recording events is flawed and cannot be trusted to be accurate. Either option is extremely serious and renders the audit reports unreliable and not useful for the intended purpose—acting as a sort of security camera on the memory card.

Finding 3. *Sixteen of the seventeen Accu-Vote OSX machines used for counting early voting and absentee ballots produced audit reports that give the wrong time for* all *events. These same sixteen OSX machines also produced results tapes with the wrong date, although the date was correct on the audit report.*

Of the 17 memory cards used in the OSX machines that counted early voting and absentee ballots, 16 produced results and audit report tapes that are discrepant—that is, do not agree on dates and times—and do not agree with system audit logs. In fact, it appears that all the entries on 16 audit report tapes have erroneous times. Only one of the OSX memory cards used in the election produced zero, results, and audit report tapes that appear to be accurate and are consistent with each other and with system audit records.

Results Tapes with Wrong Date. For 16 of 17 of the OSX machines, the results tapes are dated November 3, 2010, instead of November 2, 2010, even though the upload stub at the bottom of the results tape shows the upload took place on November 2 and the GEMS logs also show they were uploaded on November 2.

By itself, this would not be particularly noteworthy as the times and dates on zero and results tapes are occasionally wrong. Most of the time, wrong timestamps on these mean that someone has set the date and time wrong on the Accu Vote unit where the clock resides.[24] When that happens the wrong date and time should be reflected on all tapes run from that memory card. But in this case, the zero tapes all show the correct dates—usually October 18 for the early voting tapes and October 27 for the absentee balloting tapes.

To correct a wrong date or time, I would normally examine the audit report tape—which should likewise be wrong as it should be impossible for it have something different from other tapes from the same memory card—and compare entries from that log that appear on GEMS logs with the correct time to determine the difference between the times or dates given on the memory card and the actual time or date. For example, I could calculate how many hours the memory card is off by looking at the audit report entry for the time the results were uploaded from the card to the central tabulator and comparing it to the time given for the upload on the AV Server and Poster Logs.

In this case, however, examination of the audit report tapes shows that the entries for printing the totals tape are dated November 2. Remember—the audit report tape should faithfully and

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[24] It can, however, indicate more serious problems—such as a corruption of memory data for some reason.

accurately report the date and time when the event itself was recorded on the memory card. So it should show the wrong date. But it doesn't.

After I mentioned this problem in my deposition, it appears that someone at the elections office contacted the vendor and asked for an explanation. That letter, dated September 1, 2011, is attached.[25] The explanation from Dominion Voting Systems is troubling in several respects. First, the letter makes it clear that the vendor was already aware of the problem. I checked a couple of conduct of election reports for other counties using the OSX and discovered that the problem had indeed been discovered by at least one other county (Leon) at the time of the November 2 election. This county confirmed the problem with other counties and consulted the vendor—all of this happened before the certification of the election on November 12. Yet ten months after the election, the Osceola County IT director had still not been informed by the state or the vendor about the problem or its cause. A temporary fix for this problem is relatively simple—especially since the results tapes from the OSXs are only run at the elections office— cross out the incorrect date, write in the correct date, and have canvassing board members initial the change. This failure to inform the county speaks volumes about the systemic problems with Florida elections.

What Dominion doesn't address is why the audit report shows the correct date for the results tape instead of the date given on the results tape. Once again, this indicates that the timestamp for events on the audit report can be different from those on other tapes from the same card, which renders the audit report tapes useless for the purpose intended—that is, verifying the integrity and accuracy of the information on the other tapes printed from the memory card.

Wrong Times—An Even More Significant Problem. The sixteen OSX memory card audit reports with discrepant dates for the results tape also had the wrong times for all events that could be checked. And these times were also different from those shown on the respective zero and results tapes from the same memory cards. For the most part, the transaction logs (part of the audit report) show that events occurred about an hour later than they actually happened. I determined that it is the audit reports that are wrong—not the zero and results reports—by comparing the upload times on the audit reports with the upload times shown on the AV server, poster logs, and memory card status reports.[26]

Is this problem essentially the same as the wrong date problem and thus explained by the vendor's letter? No. According to the vendor's letter, the results tapes have the wrong date when they are within the 5-hour window described in the vendor's letter (which, by the way, covers all of election night). But the errant OSX audit report tapes *always* have the wrong time, regardless of when the event occurred—morning, noon, or night, before, during, or after election day—and they always disagree with their respective zero and results tapes as well as with the GEMS audit logs. Thus, it has nothing to do with the five-hour window and is not explained by the vendor's letter. Note that the vendor does not mention the time problem at all so it isn't clear whether the vendor is aware of this problem.

What may give us a clue to how this happened is that the OSX, unlike the OS, has a system event log, like the TSX. This log records operating system events, such as calibration of the scanner, updating software, and setting the date and time (which is not shown on the OS election audit

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[25] Letter to Alan Ortega from Edwin B. Smith, Dominion Voting Systems, Denver, CO, September 1, 2011.

[26] I checked to see on what date daylights savings ended to see if that could have had an effect on the time disparity, but I found that daylight savings didn't end until November 7, 2010.

report). Fortunately, we have several examples of system audit logs for the OSXs. The system audit report for Machine 1091 serves as a good example. This memory card contains Absentee Ballot Batch 5, which was uploaded three times—Election Day, November 5th, and at the time of the certification November 12th.   In May and in July the system audit log shows that the time and date were set on the OSX. There are no other indications that the time was re-set. The times on this system log seem to match those on the audit report tape from the memory card used on this machine during the election. Subsequently, I found that the other system audit logs also appear to be an hour ahead.

As mentioned at the beginning of this report, there is an operating system log that records the major events occurring on the computer that is running the GEMS software. An examination of this log—which was not provided until well after my deposition, by the way—shows that its events are likewise an hour ahead.

The vendor representative's explanation for the date problem gives us some information about how the date and time are stored in the OSX:

> *The System Date/Time and Local Date/Time are stored separately in the OSX. The OSX system date is set to UTC (Universal Coordinated Time). The OSX Local Date/Time is adjusted by time zone from UTC. So when it is 8:45 p.m. on 11/2/2010 on the Florida peninsula it is 1:45 a.m. in UTC on the following day (11/3/2010)."*

At first this explanation seems compelling—the election audit report and the system audit report must be picking up the time from the System time instead of from the local time just as the election results tape is picking up the wrong date from the System Date/Time. Remember—the zero and results tapes have the right time so it seems that local time is set correctly on these machines. But the election audit report and system audit report show times that are one hour off, not five hours off so how can this be the solution?

Unlike the wrong date on the results card, the wrong times on the audit reports and the discrepancies between them and other audit logs are very serious and require investigation by the vendor and the state. While it is always possible for voting machines to have the wrong dates and times—human beings do make mistakes—it should not be possible for those dates and times to be *different* on reports generated from the same memory card for the same election. This is fundamental. Without reliable audit logs that meet state requirements, these machines should not have been used in this or any other election. It would be a very serious matter if the vendor were aware of these problems prior to the election and failed to disclose them. Florida law requires audit logs—and it requires them to be complete, accurate, and unalterable. Obviously, these audit reports fail that test.

It is also significant that one of the OSX memory card audit reports contains the correct date and times and agrees with all other audit documents. To date, I have not discovered any reason why it should be accurate and the others are not.

Finding 4. In the 2010 general election, other Florida counties have reported having problems with the OSX reading some kinds of inks or pencil used by voters. This problem has occurred in the past and is a persistent problem with the OSX and other scanners.

In this review of Osceola audit logs, it was necessary to look at documents from other counties. The conduct-of-election report from Leon County, Florida, for the November 2010 general

election indicates that its OSX machines had trouble reading some absentee ballots that were marked with pencil. It says that these would have been correctly read by the older OS machines. The relevant excerpt is given below:

OSX TECHNOLOGY
This new version of the OS unit has many positives to it, not the least of which is its ability to handle multiple ballot styles and high volumes of ballots. However, it is far more sensitive to the environment, paper thickness, paper coatings, and marking devices. We experienced a high rejection rate on absentee ballots marked in pencil that would have been accepted by the OS unit. As a result, hundreds upon hundreds of absentee ballots had to be recreated. Also, the base for the OSX is extremely small in comparison to the OS base. It holds several hundred less 8.5 x 11 inch ballots and did not handle the 8.5 x 17 inch ballot consistently well at all.

A similar problem occurred in Sarasota during L&A testing of its OSX machines for a municipal election [year] when the machine failed to read ballots marked in blue ink even though the absentee ballot instructions said that black or blue ink could be used.

It has long been known that ballot scanners, like other scanners, sometimes have difficulty with various kinds of markers that might be used by voters who do not have a marking device supplied by the elections office. These include gel inks and pencil. In fact, we discovered that Orange County, Florida, lost hundreds of votes cast by absentee in 2006 because its Optech scanner did not pick up marks made with low-carbon-based inks—such as gel inks. Our investigation of the problem discovered that the problem had existed at least since 2000 and had resulted in the loss of many votes. This problem was acknowledged by Orange County and the vendor. So this problem is not unprecedented.

Under Florida law, optical scanners must be set to reject blank ballots and alert voters to the problem as it is very unusual for a voter to show up for an election and not mark his ballot at all. With absentee ballots, the voter is not present to examine and correct his ballot. Thus, it is up to the canvassing board to examine ballots that are spit out of the machine as blank to determine if they are actually blank. If the ballot is not blank and the intent of the voter can be discerned, then the ballot is duplicated (using a established, documented process) and those votes are counted.

The ballot for this election consisted of two pages, front and back. So many of the blank ballots are no doubt second pages of the ballot that actually were blank as it is usual to experience drop off in participation as one progresses through the ballot.27

Considering the documented problem in Leon County, which uses exactly the same system as Osceola, it is very likely that many of the absentee ballots in Osceola County likewise were not readable by the OSX. Were these ballots inspected by the canvassing board and then duplicated so that they could be read by the machine?

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[27] There are, of course, exceptions to this rule. High profile races further down the ballot may have fewer undervotes than some upballot races.

CONCLUSIONS AND RECOMMENDATIONS

This review of the audit logs and other election records from Osceola's 2010 general election revealed pervasive, systemic problems in the conduct of the election as well as significant flaws in the voting system. In my opinion, these problems are serious enough to cast doubt on the reliability of the results, particularly in a very close contest such as the District 2 race.

Generally, I found that the conduct-of-election procedures and practices often failed to meet state requirements, vendor recommendations, and widely accepted best practices. At their own admission, the supervisor of elections and her top staff were not familiar with user documentation for their voting system and, thus, did not follow vendor-recommended procedures. Election staff also ignored technical advisories from the state and product notices from the vendor, considering them, in their words, merely "advisory," not "directives." The purpose of these warnings, however, was two-fold: (1) to allow the county to take remedial actions, and (2) to make the county responsible for any negative consequences should it fail to take appropriate actions.

The Osceola County Supervisor of Elections failed to develop and follow a process for reviewing, preserving, and retaining audit logs for the election management system and individual tabulators, as mandated in the state's technical advisory on audit logs sent to all SOEs in 2009. The elections supervisor and staff argued that their failure to print a particular log constituted not "producing" the log. But it is the voting components that are required to produce the logs; it is the duty of the elections supervisor to review, preserve, and maintain them. Printing is irrelevant. Overall, the Osceola elections staff did not seem to understand the importance of the audit logs to establishing the integrity and reliability of their election or their duty to act as custodians of these records for the 22-month retention period. As a consequence, the record copy of a great many audit logs from this election were intentionally or unintentionally altered or deleted.

Elections staff also failed to detect voting system problems that would have been evident had they reviewed audit logs as required by the state and recommended by the vendor. These problems showed that the audit report logs from both the OS and OSX machines were not accurately recording all events on the tabulators, as they are required to do in order for the voting system to be certified by the state for use in Florida elections. Without accurate and complete audit logs, it is impossible to verify the accuracy and reliability of this or any election. This finding alone would be enough to place in doubt the results of Osceola's election.

Finally, the failure of the Osceola elections office to provide requested public records fully, in the format requested, and without undue delay as required under Florida's public records law, not only impeded this review of audit logs but, in my opinion, also denied important information to the losing candidate that may have tended to bolster his case that the accuracy of the results was in doubt. This was particularly troubling when the withheld records would have supplied evidence that elections staff testimony was inaccurate and omitted important information, such as in the case of the Kissimmee Library early voting tapes.

I hope the Osceola elections supervisor will take this opportunity to make substantial changes to processes and procedures in order to meet state requirements and adhere to accepted standards of practice. Without fundamental changes in staff training, security procedures, and election processes, the Osceola elections office is likely to face even worse election disasters in the future.

For the state of Florida, the flaws in the audit logs are very serious. Audit logs that cannot be relied upon to be accurate, complete, and unchangeable do not meet the requirements for state certification and should not be used in Florida elections. Yet, the flaws suggest the possibility that

the design of the audit report function itself is problematic and may not be sufficient to ensure these minimum standards are met. With the 2012 general election nearing, it is imperative that the state move quickly to investigate audit log problems, require appropriate changes, and test the changes to ensure that they address the problems without introducing new flaws into the system.

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