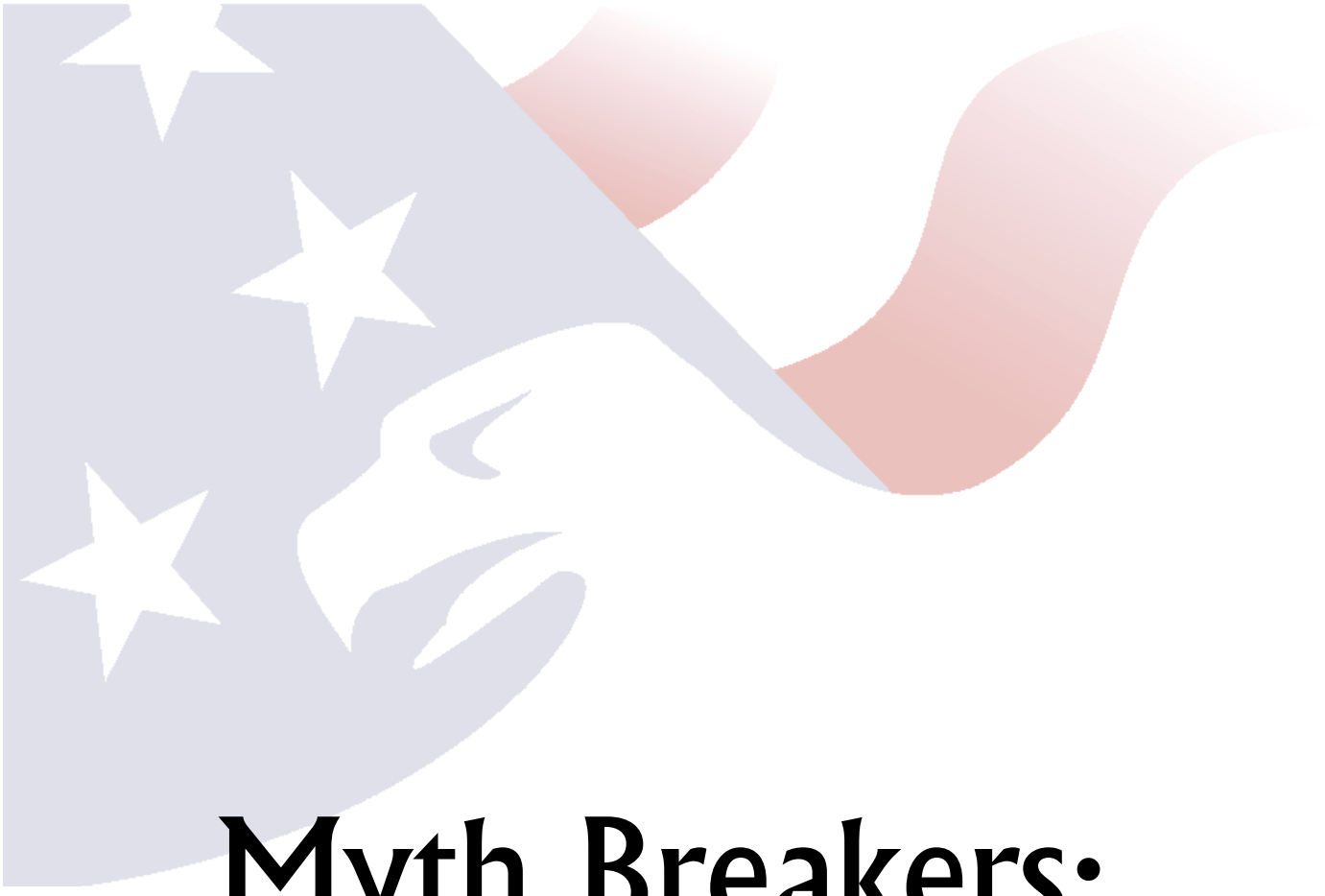

Myth Breakers:

Facts About Electronic Elections

Essential Information

for Those Entrusted with Making Decisions

about Election Systems in the United States

Newspapers reported serious voting problems starting with the first day of early voting in the 2004 General Election and continuing through Election Day and beyond.

Voters' selections changed in front of their eyes on the touch screens of paperless voting machines. Electronic poll books failed to work properly. Tabulation equipment began subtracting votes after accumulated totals reached 32,000. Voting machines lost votes, miscounted votes, and mysteriously added votes. Machines broke down, froze up, paged through ballots backwards, and skipped past important races.

www.VotersUnite.Org
Second Edition, Version 1.6
www.VotersUnite.Org/MB2.pdf

Preface

The first edition of this compendium originated as a result of an email conversation I had with an election official. I had become more and more bewildered by the resistance to a voter-verified paper audit trail (VVPAT) on election equipment. Discovering that she was in favor of a VVPAT, I asked her why so many were resistant.

Her reply was enlightening. She pointed out that, with the recent eruption of information and opinions on electronic elections, it's extremely difficult to tell which "studies" are legitimate and which are rumor. Then she said, "Add in a dose of politics — the comments about Diebold Execs and Bush ties – and you have a real mess. Make sense?"

It did. Most of the officials responsible for making election system decisions don't have time to do the extensive, time-consuming research required to learn the enormous variety of information that has become available about voting systems. Those in one state may not be aware of the problems election officials in other states are encountering with the equipment they are using.

For example, how many officials responsible for our elections know such tidbits as these?

- Hinds County, Mississippi had to hold its November 2003 election all over again because so many of the paperless electronic voting machines (Direct Record Electronic – DRE) broke down that they couldn't determine the will of the voters.
- Neglecting to keep the DRE batteries charged between elections cost Arapahoe County, Colorado over $100,000 in battery replacements just before a recent election.
- If it takes an hour to do the Logic and Accuracy testing on one DRE, San Diego county would have to spend 1275 person-days testing before every election in order to comply with California law.

This slightly renamed "revised edition" has been updated to include additional facts that have emerged since the first edition was completed.

Information is always essential to making wise decisions. That premise is the basis for this collection of facts, which is sort of a consumer's guide to voting systems. As the events surrounding elections have become more publicized – especially after the 2004 General Election — it has become clear that electronic elections bring with them many, many problems.

This booklet is simply a collection of relevant information; **it is by no means an exhaustive work on the issue.** I offer it in the hope that it will help those reading it to make wise decisions regarding our election systems.

Respectfully,

Ellen Theisen
VotersUnite!
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Acknowledgments

Thanks to the following people, whose contributions to this document were invaluable:

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About the Author

Ellen Theisen has a B.A. degree in Mathematics and an M.A in Religious Studies. She has written software documentation for 22 years, working independently for the last 15 years. Her work includes hundreds of documents for dozens of products developed by dozens of companies. Types of documents include software design specifications, functional specifications, software-developer guides, tutorials, user manuals, online help, and data sheets. She has also assisted in designing the user interface, performed formal testing on some of her clients' products, written sample programs to use in tutorials, and written macros in Visual Basic for Applications (VBA). You can see more details at www.ellentheisen.com.

In July of 2003, she became aware of the movement toward electronic voting. Her two decades of experience with software and the software development process made her gravely concerned. She became involved with VerifiedVoting.org and worked more than full time as one of the core team from August 2003 until March 2004, at which time she co-founded VotersUnite!

Volunteers have distributed the first edition of "Myth Breakers for Election Officials" to thousands of election officials, legislators, journalists, and others.

Contents

Overview

Election transparency is the fundamental basis of election integrity.

In transparent elections, all the processes of handling and counting ballots are completely open to public view. Nothing is hidden, nothing is secret – except, of course, each individual's voting choices.

Election fraud and miscounts have occurred throughout history, and they will continue to occur. Transparency is the only way to minimize them, but with electronic voting, transparency is eclipsed. Electronic processes that record and count the votes are not open to public scrutiny. Courts have ruled that election software is a trade secret, so even a losing candidate with a computer consultant cannot view it.

With electronic voting, the most important and vulnerable election processes – storing and tallying the votes – are performed in secret, without public oversight. These processes were not developed by government officials charged with ensuring election integrity, but by anonymous software engineers, hired by vendors and not publicly accountable for the results of their work.

One would expect overwhelming benefits to accompany this sacrifice of transparency and the resulting loss of public control over election processes. **That's the myth.** Ironically, overwhelming disadvantages accompany the sacrifice. The logical question is "Why make the sacrifice?" It's a question more and more people are asking.

The facts presented in this document dispel many of the myths surrounding electronic voting. It is crucial to lay these myths to rest quickly, for as long as they are held by decision-makers, our democracy is at risk.

Electronic elections are not transparent

1 Facts about The Help America Vote Act (HAVA)

HAVA[1], passed by Congress in the Fall 2002, was an attempt to prevent problems like those encountered in the 2000 Presidential election. It offered funding for counties to upgrade their voting systems. One of its few mandates was to require voting methods that would allow the disabled to vote independently. As states and localities rush to comply with HAVA, many decision-makers are operating on common misunderstandings of the law. The sections below provide facts that correct some of the major misconceptions.

HAVA Does Not Require the Use of DREs[2]

Section 301(a)(3) of HAVA requires that each polling place provide at least one voting method that allows disabled individuals to vote in privacy. Accessibility is required; DREs are not.

> (3) Accessibility for individuals with disabilities.--The voting system shall—
>
> > (A) be accessible for individuals with disabilities, including nonvisual accessibility for the blind and visually impaired, in a manner that provides the same opportunity for access and participation (including privacy and independence) as for other voters;
> >
> > (B) satisfy the requirement of subparagraph (A) through the use of at least one direct recording electronic voting system **or other voting system** equipped for individuals with disabilities at each polling place; and

Voting systems that record votes electronically (Direct Record Electronic – DRE) are only one of the many available voting systems that provide accessibility for disabled individuals. Alternative voting systems that allow the disabled to vote unassisted are available and cost a fraction of the price of DREs. For example:

- Electronic ballot-marking devices, such as the AutoMark by ES&S.[3]
- The Vote-PAD, a non-electronic accessible device for marking paper ballots.[4]
- Free ballot-printing software offered by Open Voting Consortium to run on PC systems.[5]

HAVA Does Not Prohibit Punch Card Systems

A common misconception is that HAVA bans the use of old voting systems. This is not true, although old systems must be supplemented with ballots that allow disabled individuals to vote independently and they must provide a manual audit capacity. A state must replace old systems **only** if it accepts Title I funds to upgrade voting systems. Section 301(c)(1) is very clear:

> In general.--Nothing in this section shall be construed to prohibit a State or jurisdiction which used a particular type of voting system in the elections for Federal office held in November 2000 from using the same type of system after the effective date of this section, so long as the system meets or is modified to meet the requirements of this section.

While state legislation, executive orders, or judicial orders require certain jurisdictions to replace their punch card systems, **HAVA does not make that requirement.** In fact, HAVA Section 301(a)(1)(B) specifically allows the use of punch card systems in conjunction with an educational program to help prevent over-voting and teach voters how to correct their ballots.

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1 http://www.fec.gov/hava/law_ext.txt

2 Direct Recording Electronic voting machine. Votes are recorded on electronic media rather than paper.

3 http://www.essvote.com/HTML/home.html; see page 46 of this document

4 http://www.vote-pad.us; see page 46 of this document

5 http://www.openvotingconsortium.org/; see page 47 of this document

HAVA Preserves States' Right to Use Paper Ballots

Some election officials are under the impression that HAVA requires them to abandon paper-based systems. This is completely false. Not only does HAVA preserve the right to use paper ballots, it also requires paper for audits.

While HAVA does not specifically require a voter-verified paper trail, it does mandate that voting systems be able to produce a "permanent paper record with a manual audit capacity."

HAVA also explicitly preserves jurisdictions' rights to use paper ballots. Section 301(c)(2) specifically says that the term "verify" may not be construed to forbid the use of paper ballots. It states:

> (2) Protection of paper ballot voting systems.--For purposes of subsection (a)(1)(A)(i), the term "verify" may not be defined in a manner that makes it impossible for a paper ballot voting system to meet the requirements of such subsection or to be modified to meet such requirements.

HAVA "Audit" Requirement is Not a Meaningful Recount

HAVA Section 301(a)(2) states the audit requirements for voting systems:

> (2) Audit capacity.--
>
> (A) In general.--The voting system shall produce a record with an audit capacity for such system.
>
> (B) Manual audit capacity.--
>
> (i) The voting system shall produce a permanent paper record with a manual audit capacity for such system.
>
> (ii) The voting system shall provide the voter with an opportunity to change the ballot or correct any error before the permanent paper record is produced.
>
> (iii) The paper record produced under subparagraph (A) shall be available as an official record for any recount conducted with respect to any election in which the system is used.

While HAVA requires that all voting systems produce a paper record in order to provide a manual audit capacity, the paper record of a DRE is interpreted by voting machine vendors and some election officials to refer to an end-of-day printout of either the totals or the ballot images. However, Darryl Wold, former chairman of the Federal Elections Commission, claims that a system audit requires an independent check on the accuracy of the system and that only paper records inspected and approved by voters provide the means for that independent check.[6]

Computer experts point out that if a DRE makes errors in recording or storing votes, its end-of-day printouts will be incorrect and no meaningful audit can be done. When a machine produces results a second time, it's merely a reprint, not a recount.

In fact, when a full hand recount of the 2004 gubernatorial race was conducted in Washington State, all parties realized the futility of printing and counting the ballot images and agreed to simply re-accumulate the electronic vote data.[7]

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[6] **The HAVA Requirement For a Voter Verified Paper Record.** Darryl R. Wold; July 23, 2003 http://www.verifiedvoting.org/resources/documents/HAVA_Requirement_for_VVP_Record.pdf

[7] http://www.co.snohomish.wa.us/documents/Departments/auditor/elections/results/general/DREAgreement.pdf

HAVA Allows Partial Replacement of Old Systems

If the state does not meet the deadline for replacing punch card systems and lever systems, the state simply repays any replacement funds received for the **precincts** that did not meet the deadline. Section 102(d) states:

> (d) Repayment of Funds for Failure To Meet Deadlines.--
>
> (1) In general.--If a State receiving funds under the program under this section fails to meet the deadline applicable to the State under subsection (a)(3), the State shall pay to the Administrator an amount equal to the noncompliant precinct percentage of the amount of the funds provided to the State under the program.
>
> (2) Noncompliant precinct percentage defined.--In this subsection, the term "noncompliant precinct percentage" means, with respect to a State, the amount (expressed as a percentage) equal to the quotient of--
>
> (A) the number of qualifying precincts within the State for which the State failed to meet the applicable deadline; and
> (B) the total number of qualifying precincts in the State.

HAVA Preserves States' Rights to Establish Voting Equipment Standards

While HAVA established the Election Assistance Commission (EAC) and charged it with developing guidelines and voting system standards, new standards have not yet been developed, so the standards developed by the Federal Election Commission in 2002 are still the current set. Furthermore, compliance with the EAC guidelines is not required in order to receive HAVA funds for voting equipment upgrades or purchases.

This means that **states retain control over whether or not they upgrade voting equipment to the FEC 2002 standards**, which at the time of this writing are the current standards. In fact, very few of the present systems meet these three-year old standards. Nearly all equipment only meets obsolete standards developed in 1990. Refer ahead to page 19 for a discussion of the inadequacy of the 2002 standards.

Section 221(b) says the voting system guidelines to be developed by the Technical Guidelines Development Committee to assist the states in purchasing new equipment are "voluntary."

Section 311(a) says the EAC guidelines are intended to assist the states in meeting the voting system requirements and specifically calls the guidelines "voluntary." And Section 251(d) says that compliance with the EAC standards is not a condition of receiving funds to meet the requirements:

> Adoption of Commission Guidelines and Guidance Not Required To Receive Payment.--Nothing in this part may be construed to require a State to implement any of the voluntary voting system guidelines or any of the voluntary guidance adopted by the Commission with respect to any matter as a condition for receiving a requirements payment.

2 E-Voting Problems in Recent Elections

Errors and malfunctions are inescapable with electronic election equipment, just as they are with any other type of mechanical or electronic device. Failures of paperless Direct Recording Electronic (DRE) systems almost always leave unanswered questions. While optical scan systems also fail, they provide a way to recover since those systems include paper ballots that can be recounted. Audits of computerized systems, by examining original documents, are mandatory for financial institutions and brokerage houses, but such audits are not mandatory for elections.

Ten Common Electronic Election Problems

While many people are advocating the use of a voter-verified paper audit trail (VVPAT) on DREs, VVPAT wouldn't have been sufficient to fix many of the problems that counties have faced when they used DRE systems. This fact causes many people to question the wisdom of using paperless DREs at all, even if they have a printer attached.

Many different types of e-voting problems have occurred in recent years. Hundreds of elections have been impacted by malfunctions, which have disenfranchised voters and called the results of elections into question. In some cases, paper backup was available, and election officials were able to determine the voters' intents. In other cases, there was NO paper backup, and localities have either certified the elections anyway or conducted a second election to replace the first.

Hundreds of electronic election malfunctions have been reported in newspapers in recent years, more than 125 of them from the 2004 general election alone.[8] Here are a few of examples of common problems serious enough to be reported in the news.

1) Electronic Voting Machines Lose Ballots

Carteret County, North Carolina. November, 2004. Unilect Patriot DRE
A memory limitation on the DRE caused 4,438 votes to be permanently lost.[9]

Unilect claimed their paperless voting machines would store 10,500 votes, but they only store 3,005. After the first 3,005 voters, the machines accepted -- but did not store -- the ballots of 4,438 people in the 2004 Presidential election.

Jack Gerbel, president and owner of Dublin-Calif.-based UniLect, told The Associated Press that there is no way to retrieve the missing data. Since the agriculture commissioner's race was decided by a 2,287-vote margin, there was no way to determine the winner. The State Board of Elections ordered a new election,[10] but that decision is being challenged in the court.

At the time of this writing, a debate is waging over whether or not to hold a new election, which is estimated to cost $3 million and draw a low turnout. [11]

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[8] **VotersUnite! Election 2004 Problem Log.** http://www.votersunite.org/electionproblems.asp?sort=date&selectstate=ALL&selectproblemtype=Machine+malfunction

[9] **Computer loses more than 4,000 early votes in Carteret.** Charlotte Observer. November 4, 2004. Associated Press. http://www.charlotte.com/mld/observer/news/local/10099907.htm

[10] **N.C. agriculture commissioner candidate appeals new statewide election.** North County Times. January 4, 2005. By Gary D. Robertson - Associated Press. http://www.nctimes.com/articles/2005/01/05/election2004/20_40_441_4_05.txt

[11] **Certify Troxler.** Winston-Salem Journal. December 21, 2004. http://www.journalnow.com/servlet/Satellite?pagename=WSJ%2FMGArticle%2FWSJ_ColumnistArticle&c=MGArticle&cid=1031779782822&path=!opinion&s=1037645509163

Palm Beach County, Florida. November 2004. Sequoia DRE

Battery failure causes DREs to lose about 37 votes.

> Nine voting machines ran out of battery power and nearly 40 votes may have been lost. ... The nine machines at a Boynton Beach precinct weren't plugged in properly, and their batteries wore down around 9:30 a.m., said Marty Rogol spokesman for Palm Beach County Supervisor of Elections Theresa LePore.
>
> Poll clerk Joyce Gold said 37 votes appeared to be missing after she compared the computer records to the sign-in sheet. Elections officials won't know exactly how many votes were lost until after polls close.[12]

2) Electronic Election Equipment Inexplicably Adds Ballots

In the first two months after the 2004 General Election, phantom votes (more votes than voters) were reported in Florida, Nebraska, New Mexico, Ohio, South Carolina, and Washington.[13] At the time of this writing, reports of additional phantom votes continue to flood into the news.

Mecklenburg County, North Carolina. November, 2004. Microvote DRE

Results show nearly 3,000 more votes than voters.

According to election-office data downloaded by the Charlotte Observer, 102,109 people voted early or returned valid absentee ballots. But unofficial results show 106,064 people casting early and absentee votes for president.[14]

Officials suspected that some results may have been counted twice. But they were wrong. A news release from the Mecklenburg County Board of Elections shows that some candidates gained votes in the manual recount of the paper tapes printed by the machine.[15] The machine or the accumulation software simply tallied wrong.

Lancaster County, Nebraska. November, 2004. ES&S Optical Scanner.[16]

Optical scanners double-count ballots.

As the optical scanners read the election-day ballots, they occasionally added votes. While County Election Commissioner David Shively explained that the software was reading ballots twice, ES&S referred to the misread as a mechanical problem.

Inexplicably, both Shively and the Nebraska deputy secretary of state for elections, Neal Erickson, agreed that "the malfunctions were not the type that taint vote counts." When the officials tested the six machines, it became clear that two were not correctly counting the ballots.

> That came as a surprise, Shively said, because all were tested late last week and performed well.

After consulting with ES&S, Shively decided to use the two absentee-ballot machines to speed up the election-day counting, but the problem was apparently contagious. The double-counting problem began plaguing almost all the machines.

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[12] **Nearly 40 Votes May Have Been Lost In Palm Beach County.** Associated Press. November 2, 2004.

[13] http://www.votersunite.org/info/previousmessups.asp

[14] **County retallies early-vote results.** The Charlotte Observer. Nov. 4, 2004. By Richard Rubin and Carrie Levine. http://www.charlotte.com/mld/charlotte/news/politics/10094165.htm

[15] **Board of Elections Audits Early Voting Results; Revises Unofficial Results Released by the Mecklenburg Board of Elections.** November 4, 2004. http://www.votersunite.org/info/mecklenburgnewsrelease.pdf

[16] **Problem machines spur call for recount.** Lincoln Journal Star. November 14, 2004. By Nate Jenkins. http://www.journalstar.com/articles/2004/11/14/election/doc4189b9c7f14bf764391458.txt

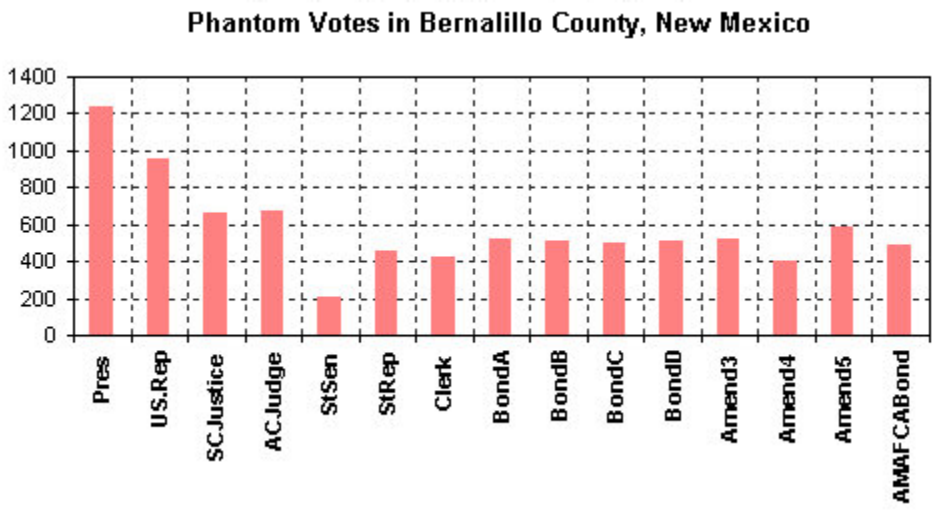
Bernalillo County, New Mexico. November, 2004
Over 8,000 phantom votes appear in the canvass report.

The New Mexico certified election results reported 2,087 phantom votes (more votes than ballots cast) for president statewide. These phantom votes were concentrated in Bernalillo County. The official canvass report shows 187 precincts in Bernalillo County reporting presidential phantom votes — a total of 1,239 votes.[17]

For example:

- Precinct 558 reported 178 early voting ballots and a total of 319 votes for president. That's 141 phantom votes, nearly as high as the number of ballots.
- Precinct 512 reported 166 ballots, with 318 votes for president. In that precinct, Bush alone received 206 votes, 50 more than the number of ballots.

In the presidential race and 14 down-ticket contests examined and shown in the chart below, a total of **8,656 phantom votes** were reported in the certified canvass report.



In October of 2004, Bernalillo County Clerk Mary Herrera admitted that phantom votes had been added to several elections over the past two years. She also said her vote-counting experts have always found the phantom votes before they were added to the final tally.[18] But not in this election.

New Mexico Secretary of State Rebecca Vigil-Giron says phantom votes are not possible, pointing out that her independent auditors didn't find irregularities like this.[19] Nevertheless, they are present in her certified canvass report.

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[17] **Bernalillo County Canvass of Returns of General Election Held on November 2, 2004.** State of New Mexico. http://www.sos.state.nm.us/PDF/Bernalillo.pdf

Brief Summary of Bernalillo County Election Data. January 5, 2005. By Ellen Theisen.

[18] **County clerk say phantom votes won't be a problem.** KRQE Albuquerque. October 26, 2004. http://www.krqe.com/expanded3.asp?RECORD_KEY%5BLargeHeadline%5D=ID&ID%5BLargeHeadline%5D=7425.

[19] **Vote Recount Fight 'Is Not Over'.** Albuquerque Journal. December 24, 2004. By Andy Lenderman. http://www.abqjournal.com/elex/278376elex12-24-04.htm

3) Tabulation Software Reaches 32,767 Votes and Counts Backwards

Broward County, Florida. November 2004. ES&S DRE System
Vote tabulation software loses 70,000 votes for Amendment 4.

> The bug, discovered two years ago but never fixed, began subtracting votes after the absentee tally hit 32,500 -- a ceiling put in place by the software makers. "Clearly it's a concern about the integrity of the voting system," said Broward County Mayor Ilene Lieberman, a canvassing board member who was overseeing the count. "This glitch needs to be fixed immediately."
>
> The problem, which resulted in the shocking discovery of about **70,000 votes** for Amendment 4, a measure allowing a referendum on Las Vegas-style slots at parimutuels in Miami-Dade and Broward, came to light just after midnight Wednesday when Broward's canvassing board shut down.[20]

Orange County, Florida. November, 2004. ES&S Optical Scan System
Vote tabulating software omits counting 8,400 votes.[21]

The precinct results posted on the Orange County elections office Web site showed that Democrat John Kerry beat Republican President Bush by 9,227 votes in Orange County, but the posted results were off by 8,400 votes. The margin was actually only 827 votes.

> The cause of the error, Orange officials said Thursday, was a software program that could not tabulate more than 32,767 votes in a single precinct. A similar discrepancy affected vote totals posted online for the U.S. Senate race between Republican Mel Martinez and Democrat Betty Castor.

Guilford County, North Carolina. November, 2004. ES&S DRE System
Vote tabulating software changes two outcomes in Guilford County.

In Guilford County, ES&S early voting machines also had capacity problems. The totals were so large, the tabulation computer threw some numbers away. Retallying changed two outcomes and gave an additional 22,000 votes to Kerry.[22]

Ken Carbullido, Vice President of ES&S Product Development, explained the problem to Guilford County. In very technical language, he wrote that when the vote totals reached 32,767 (32K), the system began subtracting from the totals.[23]

> The 32,767 capacity limitation at a single precinct level is a function of the design and definition of the results database used by ERM [Election Reporting Manager]. The data storage element used to record votes at the precinct level is a two byte binary field. 32,767 is 2 to the 15th power, which is the maximum number held by a two byte word (16 bits) in memory, where the most significant bit is reserved as the sign bit (a plus or minus indicator). Additionally, ERM precinct count level data is stored in a binary computer format known as two's complement.....

In the letter, Mr. Carbullido admitted the company knew about the problem but had not advised the county.

---

[20] **Gambling vote glitch mars tally.** Miami Herald. November 5, 2004. By Erika Bolstad And Curtis Morgan. http://www.miami.com/mld/miamiherald/10103931.htm

[21] **Distrust fuels doubts on votes: Orange's Web site posted wrong totals.** Orlando Sentinel. November 12, 2004. By David Damron, Sentinel Staff Writer. http://www.votersunite.org/article.asp?id=3803

[22] **Winner so far: Confusion.** The Charlotte Observer. November 5, 2004. By Mark Johnson. http://www.charlotte.com/mld/observer/news/local/10104576.htm?1c

[23] http://www.votersunite.org/info/GuilfordESS.pdf

4) Votes Jump to the Opponent on the Screen

Maryland. November, 2004. Diebold DRE

Some voters manage to correct the vote-jumping on the screen, some don't.

On election day, TrueVoteMD registered 383 reports involving 531 incidents of problems encountered by voters. Among a myriad of other problems detailed in the report, many voters reported votes switching on the screens. Here are some excerpts:[24]

> Voter Ethel Kerscher at Leisure World Clubhouse in Montgomery County was directed by an election judge to use another machine after she noticed that her vote had been switched from one candidate to another. She submitted her ballot on the second machine, but left the polling place shaken and upset.
>
> Voter David Solomon at the Good Hope Community Center in Montgomery County tried twice to vote for his preferred candidate, but each time the "X" appeared next to another candidate's name. After getting the assistance of an election judge, he tried a third time and believes he was successful—but is not certain.
>
> Voter Robin Wayne Hood at Havre de Grace H.S. in Harford County tried to change his erroneous selection for president and, while doing so, accidentally submitted his ballot—worse still, before he had made selections for the other races. "A machine should not be allowed to do my voting for me," he protested.

Snohomish County, Washington. November, 2004. Sequoia DRE

Voters find vote-jumping difficult to correct.

> Voters in at least four polling precincts in Snohomish County said they encountered problems with the electronic voting machines. When they touched the screen to vote for a candidate, voters said an indicator showed they had selected the opposing candidate.
>
> Those voters told KING5 News it took at least four attempts before the indicator showed the correct candidate.[25]

Bernalillo County, New Mexico. October, 2004. Sequoia DRE

Votes for Kerry jump to Bush.

When the same problem occurred in Bernalillo County, New Mexico, it took some voters as many as three times to get the machine to register their votes for Kerry instead of switching the selection to Bush.

> Kim Griffith voted on Thursday— over and over and over.
>
> She's among the people in Bernalillo and Sandoval counties who say they have had trouble with early voting equipment. When they have tried to vote for a particular candidate, the touch-screen system has said they voted for somebody else.
>
> It's a problem that can be fixed by the voters themselves— people can alter the selections on their ballots, up to the point when they indicate they are finished and officially cast the ballot.
>
> For Griffith, it took a lot of altering.[26]

---

[24] **When the Right to Vote Goes Wrong.** TrueVoteMD. November, 2004. http://www.truevotemd.org/Election_Report.pdf

[25] **Scattered reports of voters being blocked and machine malfunctions.** November 2, 2004. KING5 News. http://www.king5.com/topstories/stories/NW_110204ELBelectronicvotingproblemsLJ.1aac5fda.html

[26] **Some Early Voters Say Machines Mark Incorrect Choices.** ABQJournal. October 22, 2004. By Jim Ludwick, Journal Staff Writer. http://abqjournal.com/elex/246845elex10-22-04.htm

5) DREs Provide Incorrect Ballots

Maryland. March 2004.
The U.S. Senate contest was omitted from ballots in three counties.

> Jeffrey Liss had finished making his selections on Maryland's Democratic-primary ballot and strolled out of the polling place at Chevy Chase Elementary School on the morning of March 2, Super Tuesday. On the sidewalk, he spied a campaign posted for Senator Barbara Mikulski, who is running for her fourth term. Funny, he thought, he didn't remember voting in the Senate race.
>
> Liss went back inside to talk to an election official. And another, and another. He was told he must have overlooked the Senate race on the electronic touch-screen voting machine. But Liss, a lawyer, finally persuaded a technician to check the apparatus. Sure enough, it wasn't displaying the whole ballot.
>
> According to voter complaints collected by Mikulski, who won in the primary, her race didn't appear on ballots in at least three Maryland counties.[27]

Orange County, California. March 2004
Incorrect access codes gave voters incorrect ballots.

> Poll workers struggling with a new electronic voting system in last week's election gave thousands of Orange County voters the wrong ballots, according to a Times analysis of election records. In 21 precincts where the problem was most acute, there were more ballots cast than registered voters.
>
> At polling places where the problem was most apparent because of turnouts exceeding 100%, **an estimated 1,500 voters cast the wrong ballots**, according to the Times' analysis of official county election data. Tallies at an additional 55 polling places with turnouts more than double the county average of 37% suggest at least 5,500 voters had their ballots tabulated for the wrong precincts.[28]

6) Election-Specific Programming Miscounts Votes

Franklin County. Indiana. November, 2004. Fidlar Optical Scan System
Democratic votes were counted as Libertarian.

Optical scan equipment counted straight-party Democratic votes as Libertarian votes. County officials and Fidler technicians agree that an election programming error in the Fidlar optical scan system caused the miscount. One outcome was overturned when the program was corrected.[29]

Carroll County, North Carolina. November, 2004. ES&S Optical Scan System
Vendor mis-programming caused the miscount.

The chip supplied by ES&S for the election was incorrectly programmed and miscounted the votes for the JP District 2 race between Rocky Whitely and Duane Coatney. Once ES&S supplies a new chip for the optical scanners, the county will rescan the ballots for that contest. [30]

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[27] **The Vexations of Voting Machines.** Time Magazine. May 3, 2004. By Viveca Novak. http://www.time.com/time/archive/preview/from_redirect/0,10987,1101040503-629410,00.html

[28] **7,000 Orange County Voters Were Given Bad Ballots.** Los Angeles Times; March 9, 2004; By Ray F. Herndon and Stuart Pfeifer. Reproduced at: http://www.votersunite.org/article.asp?id=1476

[29] **Fidlar admits election blip.** Quad City Times. November 13, 2004. By Tory Brecht. Reproduced at http://www.qctimes.com/internal.php?story_id=1039447&t=Local+News&c=2,1039447

[30] **Computer glitch blamed for miscount in JP voting.** Star Tribune. November 10, 2004. By Anna Mathews, CCN staff writer. http://www.greenforesttribune.com/articles/2004/11/10/news/s1.txt

Lake County, Illinois. April, 2003. ES&S Optical Scan System
Vendor mis-programmed again.

> The problem was caused by a programming error that failed to account for "no candidate" listings in some races on the ballot, Clerk Willard Helander said Thursday. As a result, election results were placed next to the names of the wrong candidates in **four** different races, including in Waukegan's 9th Ward.
>
> ... Helander blamed the problem on Election Systems & Software, the Omaha company in charge of operating the county's optical-scan voting machines. She said a company official told her the programmers were unaware the county would have "no candidate" listings on its ballot.[31]

7) DREs Break Down During the Election

Maryland. November, 2004. Diebold DRE
Miscellaneous break downs plague voters.

Excerpts from the TrueVoteMD report show some of the malfunctions that disenfranchised voters in Maryland.[32]

> Voter Lavellette White at Francis Scott Key Middle School in Montgomery County tried to vote for the school board, but when she made her selection the screen went dark and the machine spit out her ballot card. The election judge told her there was nothing he could do.
>
> Voter Michael Heyman at Maryvale Elementary School in Montgomery County reported that the machine froze when he attempted to review his ballot prior to submission. The election judge told him that it was a persistent problem with that particular machine. The judge removed a sticker from the machine and inserted a key to reboot. At first the machine would not eject the smart card, but finally it did and voting continued.

Mahoning County, Ohio. November, 2004. ES&S DRE
Machines broke down in 16 precincts; others needed calibration.

Many problems plagued the ES&S iVotronic touch screen voting machines in 16 of the 312 Mahoning County precincts.

> Some of the machines malfunctioned. Others had problems with the personal electronic ballot cartridge placed into the machines before each vote to count the ballots ... Also, there were 20 to 30 machines that needed to be recalibrated during the voting process because some votes for a candidate were being counted for that candidate's opponent.
>
> About a dozen machines needed to be reset because they essentially froze.[33]

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[31] **Returns are in: Software goofed — Lake County tally misled 15 hopefuls.** (reproduced) Chicago Tribune; April 4, 2003; By Susan Kuczka, Tribune staff reporter. http://www.vote.caltech.edu/mail-archives/votingtech/Apr-2003/0096.html

[32] **When the Right to Vote Goes Wrong.** TrueVoteMD. November, 2004. http://www.truevotemd.org/Election_Report.pdf

[33] **Errors plague voting process in Ohio, Pa.** Vindicator. November 3, 2004. Vindicator staff. http://www.vindy.com/basic/news/281829446390855.php
Back up! We need back up! Roanoke.com. November 11, 2004. By Brian Gottstein. http://www.roanoke.com/columnists/gottstein/13719.html

Broward County, Florida. October, 2004. ES&S DRE

Break downs require voters to come back the next day.

> Hundreds of voters showed up to vote early at Howard Forman Health Park, so many that a decision was made to keep the voting facility open until 11 p.m.
>
> Some people waited in line from early in the day until after the sun went down. Unfortunately, for a group of about 50 people, the waiting did not pay off. A mechanical problem with the voting machines caused election workers to close down polling place.
>
> The group of 50 frustrated voters will have the opportunity to be first in line to vote today. Poll workers took down their numbers and names and will move them to the head of the line.
>
> For one couple, it may not be enough. They were voting on Sunday because they planned to leave on vacation today. Now they will have to choose to cancel their trip, or give up their chance to vote.[34]

8) Electronic Voting Machines Fail to Start Up

Bexar County, Texas. October, 2004. ES&S DRE

> Uncharged batteries in several ES&S touch-screen voting machines hampered early morning voting at a southeast Bexar County precinct for about two hours today, officials said. Poll workers at Sinclair Elementary School realized just before 7 a.m. that the voting machines were dead.
>
> By 9 a.m., county technicians had powered up the machines, but not before dozens of people had left, either in frustration or because they were late for work.[35]

Orleans Parish, Louisiana. November, 2004.

In Orleans Parish and nearby parishes, ten polling places were reported to have machines that weren't working on election-day morning.[36]

9) Registration Data Transmission Fails

Many counties used "electronic poll books" during the 2004 election, so that poll workers could connect computers to the general voter registration database and look up voters online rather than in a paper poll book. But as early voting got underway, failure after failure turned this supposed convenience into long waits and possible disenfranchisement for many voters. These failures occurred in Shelby County, TN; Broward, Hillsborough and Pinellas Counties, FL; Bexar and Tarrant Counties, TX; two thirds of all Georgia counties, and:

- Orange County, Florida, where a computer crash prevented voter verification.[37]
- Adams County, Colorado, where officials could not connect their laptop computers to the central voter registration database.[38]

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[34] **Voters Turned Away After Waiting Hours.** WPLG Local 10. November 1, 2004. http://www.local10.com/news/3878344/detail.html

[35] **Voting problems minor, but frustrating.** San Antonio Express. November 11, 2004. By Tracy Idell Hamilton, Staff Writer. http://www.mysanantonio.com/news/metro/stories/MYSA110204.online.votingproblems.1a8d060b.html; Reproduced at: http://www.votersunite.org/article.asp?id=3650

[36] **Parish by parish list of voter machine problems called in by viewers.** WWLTV.com. 10:27 AM CST November 2, 2004. http://www.wwltv.com/local/stories/wwl110204electionmishap.18e9b314.html

[37] **Few Glitches Reported in Early Fla. Voting.** The State. October 19, 2004. By Jill Barton, Associated Press. http://www.thestate.com/mld/thestate/news/politics/9952991.htm

10) Memory Cards and Smart Card Encoders Fail

Collin County, Texas. November 2004. Diebold DRE [39]
Flawed memory cards were sent to Canada to retrieve the data.

Diebold touch screen voting machines locked up on election day. Election officials couldn't retrieve the results of the 63 ballots held on the memory card. County technicians couldn't retrieve the results. Diebold technicians in McKinney (home of Diebold Election Systems) couldn't retrieve the results. So the county sent the memory card to Diebold labs in Canada where technicians were able to get the totals.

As the editorial points out, "The mere fact that a piece of Collin County's election record left the country should be cause for concern. "

Volusia County, Florida. November 2004. Diebold Optical Scanner
Memory cards were inspected in the summer, failed in the fall.

> Memory-card breakdowns in six machines left political contests in limbo for hours. The county had the memory cards inspected by Diebold in the summer of 2004 in preparation for the busy election season. Ion Sancho, the elections supervisor in Leon County, said officials with Diebold told him that the new, higher-capacity memory cards tend to have more glitches than older cards.[40]

San Diego County, California. March 2004 Diebold Precinct Control Module
Encoders allow multiple votes ... or none.

At least one voter was able to vote twice on her "smart card," and at least 250 polls opened late because poll workers were unable to start up the encoders. Hundreds, perhaps thousands, of people were turned away – many of them disenfranchised because they were unable to return to the polls at a later time that day. [41] Later reports estimated that this problem delayed the voting at 40% of the polls and may have occurred at as many as 80% of the polling places.[42]

While these problems were originally blamed on poll workers, a report[43] released on April 12, 2004 by Diebold Election Systems shows that 186 of 763 encoders failed on election day because of hardware or software problems or both, with only a minority of problems attributable to poll workers. Diebold also admitted that tabulation errors during the October recall election were due to software bugs. The following example shows that the problem has not yet been fixed.

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[38] **Early Voting Begins In Colorado.** October 18, 2004. By Steven K. Paulson, Associated Press Writer. http://news4colorado.com/campaign2004/local_story_292161858.html

[39] **Editorial: Put It on Paper — Election snafu points up problems for all-electronic voting.** Dallas Morning News. November 11, 2004. http://www.dallasnews.com/sharedcontent/dws/news/city/collin/opinion/stories/111204dnccocollinvote.9eeb3.html

[40] **Computer glitches slow Volusia results: County officials ask the machines' supplier to investigate why memory cards failed Tuesday.** Orlando Sentinel. November 4, 2004. By Kevin P. Connolly, staff writer. Reproduced at http://www.votersunite.org/article.asp?id=3694

[41] **Poll workers, voters cite tied-up hotline, poor training, confusion.** Union Tribune; March 7, 2004; By Jeff McDonald and Luis Monteagudo Jr. http://www.signonsandiego.com/news/politics/20040307-9999-1n7vote.html

[42] **Correspondence, written report regarding Touchscreen voting system used for the first time March 2, 2004 by the County of San Diego.** From: Walter F. Ekard; Chief Administrative Officer http://www.signonsandiego.com/news/politics/county/20040310-1315-report.html

[43] **Diebold reports multiple problems: Registrar wants reason for e-voting.** Tri-Valley Herald; April 13, 2004; By Ian Hoffman, Staff Writer. http://www.verifiedvoting.org/article.asp?id=1839

Twiggs County, Georgia. November 2004. Diebold Precinct Control Module
Unexplained encoder problems.

> Twiggs County voters arrived at the polls today to find they could not cast their votes on the computerized voting machines. The voting machines were down in all five precincts this morning because of an encoder problem from 7 a.m. until about 9 a.m., according to Twiggs Chief Registrar Linda Polk.[44]

Other Electronic-Election Phenomena

Many other strange phenomena have occurred in the electronic equipment used for elections. A few examples are presented below.

1) Election Officials Provide a Default Presidential Candidate

Travis County. Texas. October 2004. Hart Intercivic DRE

A "default" selection is a selection automatically pre-set by the software. It remains selected unless the user specifically chooses to change it. To provide a default selection on a DRE voting machine is to give a voter a ballot with a candidate already marked.

Yet, election officials in Austin set up the eSlate DREs with Bush/Cheney as the default choice for president/vice-president. Voters who voted a straight party Democratic ticket watched their presidential votes changed to Bush on the review screen. Officials said voters caused this by pressing the wrong button on the second screen of the eSlate machine.

> Gail Fisher, manager of the county's Elections Division, theorizes that after selecting their straight party vote, some voters are going to the next page on the electronic ballot and pressing "enter," perhaps thinking they are pressing "cast ballot" or "next page." Since the Bush/Cheney ticket is the first thing on the page, it is highlighted when the page comes up – and thus, pressing "enter" at that moment causes the Kerry/Edwards vote to be changed to Bush/Cheney. [45]

2) Totals Dip into the Negative Numbers

Mahoning County, Ohio. November 2004. ES&S DRE

Sixteen of the county's 312 precincts experienced problems on election day. Some of the machines malfunctioned, others had malfunctioning "personal electronic ballot cartridges" which are placed into the machines before each vote to give the voter a ballot and record the votes.

When some of the races showed **total votes of negative 25 million** in five or six precincts, Mahoning County Board of Elections blamed it on errors by the precinct officials' failing to follow protocol.[46]

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[44] **Twiggs voters face problems at polls.** The Courier Herald. November 2, 2004. By Jason Hobbs. Reproduced at http://www.votersunite.org/article.asp?id=3647

[45] **County Responds to Voting Machine Problems. Austin Chronicle.** October 22, 2004. By Lee Nichols. http://www.austinchronicle.com/issues/dispatch/2004-10-22/pols_feature18.html

[46] **Errors plague voting process in Ohio, Pa.** Vindicator. November 3, 2004. Vindicator staff. http://www.vindy.com/basic/news/281829446390855.php

3) Voters Cast Non-Existent Ballots

Honolulu, Hawaii. September 2004. Hart Intercivic DRE.

New eSlate electronic voting machines allowed voters to choose a Green Party ballot, even though there were no Green Party candidates. The error disenfranchised 22 voters.

> State elections officials said the computerized voting machines provided by Hart Intercivic allowed voters to "click on" a political party, even though there weren't any candidates running from that party on their island.
>
> So a couple of dozen Green Party ballots were recorded, even though there were no candidates.
>
> "We brought that up to the vendor already. They will change that for the next election," [elections spokesman Rex] Quidilla said.[47]

4) DREs Require Voters To Scroll Through The Ballot Backwards

Mercer County, Pennsylvania. November, 2004. Unilect Patriot DRE.

Many problems plagued the Unilect Patriot touch screens in Mercer County, even though they had passed the pre-election testing. Mercer County's director of elections admitted that a computer software "glitch" caused touch-screen voting machines to malfunction in about a dozen precincts. Article excerpts with highlighting added:

> "I don't know what happened," said James Bennington, who had been assured Friday that **all 250 of the county's touch-screen units had been checked and rechecked.** The county has 100 voting precincts.
>
> Keith Jenkins, director of the county's computer department, agreed that it was a software malfunction and said repeated calls to UniLect Corp., the company that sold the machines to the county in 2001, failed to resolve the problem.
>
> Precincts in Hermitage, Farrell, Wheatland, West Middlesex, Shenango Township and Sharon experienced the most serious machine difficulties, some from the moment the polls opened at 7 a.m. **Some machines never operated, some offered only black screens and some required voters to vote backwards, starting on the last page of the touch-screen system and working back to the front page.**[48]

5) Report Shows 300 Registered Voters For Every Precinct in One County

LaPorte County, Indiana. November 2004. ES&S reporting system

A software flaw in the reporting system showed 300 registered voters in every precinct. Since the column that gives the turnout depends on the registration numbers, the county had to wait for a software patch from ES&S before they could determine voter turnout.[49]

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[47] **Primary Election Runs Into Problems.** HITV 4. The Hawaii Channel. September 24, 2004. http://www.thehawaiichannel.com/news/3760175/detail.html

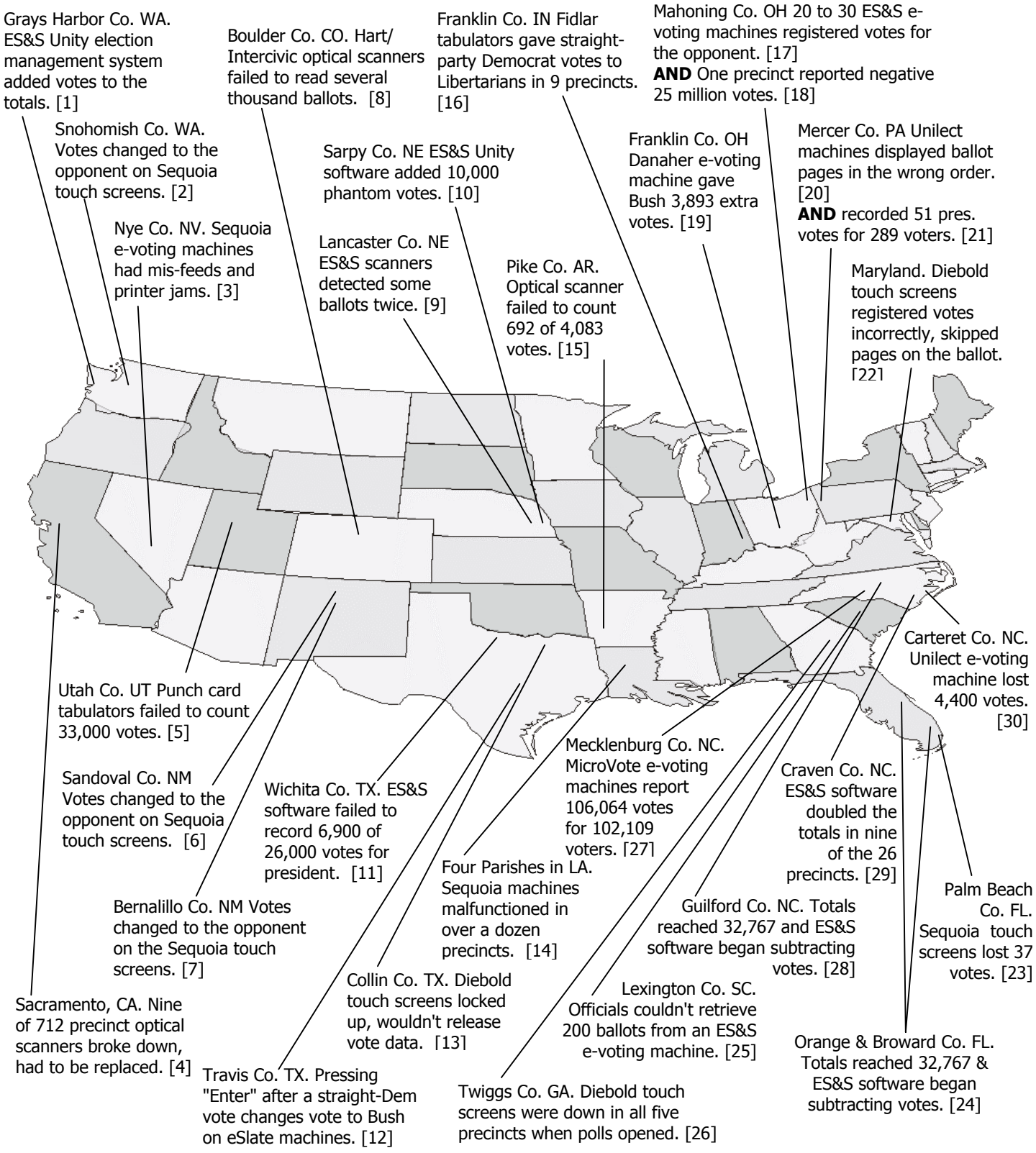
[48] **Errors plague voting process in Ohio, Pa.** Vindicator. November 3, 2004. Vindicator staff. http://www.vindy.com/basic/news/281829446390855.php

Back up! We need back up! Roanoke.com. November 11, 2004. By Brian Gottstein. http://www.roanoke.com/columnists/gottstein/13719.html

[49] **Voter turnout still not known.** Herald Argus. November 4, 2004. By Kori Kamradt, County Reporter. http://www.heraldargus.com/content/story.php?storyid=5304

Election 2004

A Partial List of Incidents Reported in the News



[1] **Gray's Harbor County re-count boosts Gregoire.** KGW News. Nov. 16, 2004. By Rebecca Cook, AP. http://www.kgw.com/sharedcontent/APStories/stories/D86D7FA80.html

[2] **Scattered reports of voters being blocked and machine malfunctions.** KING5 News. Nov. 2, 2004. http://www.king5.com/topstories/stories/NW_110204ELBelectronicvotingproblemsLJ.1aac5fda.html

[3] **Some snags reported in early voting in rural Nevada county.** Las Vegas Sun. Oct. 26, 2004. Associated Press. http://www.lasvegassun.com/sunbin/stories/nevada/2004/oct/26/102610184.html

[4] **Long lines, no ballots for some.** Sacramento Bee. Nov. 3, 2004. By Will Evans and Christina Jewett. http://www.sacbee.com/content/politics/ca/election/story/11304757p-12219794c.html

[5] **Missed votes due to error in machine.** Salt Lake Tribune. Nov. 16, 2004. By Mark Eddington. http://www.sltrib.com/utah/ci_2454128

[6] **Concerns rise on early voting.** The Rio Rancho Observer. Oct. 26, 2004. By Eric Maddy, staff writer. http://www.observer-online.com/articles/2004/10/26/ news/story2.txt

[7] **Some Early Voters Say Machines Mark Incorrect Choices.** Albuquerque Journal. Oct. 22, 2004. By Jim Ludwick. http://abqjournal.com/elex/ 246845elex10-22-04.htm

[8] **Printer played role in Boulder voting woes.** Rocky Mountain News. November 10, 2004. By Berny Morson. http://rockymountainnews.com/drmn/election/article/0,1299,DRMN_36_3317633,00.html

[9] **Problem machines spur call for recount.** Lincoln Journal Star. November 14, 2004. By Nate Jenkins. http://www.journalstar.com/articles/2004/11/14/election/doc4189b9c7f14bf764391458.txt

[10] **Countinghouse Blues. Too many votes.** WOWT6 News. http://www.wowt.com/news/headlines/1161971.html

[11] **Waiting in Wichita.** Times Record News. Nov. 4, 2004. By Robert Morgan. http://www.timesrecordnews.com/trn/local_news/article/0,1891,TRN_5784_3303816,00.html

[12] **County Responds to Voting Machine Problems.** Austin Chronicle. Oct. 22, 2004. By Lee Nichols. http://www.austinchronicle.com/issues/dispatch/2004-10-22/pols_feature18.html

[13] **Editorial: Put It on Paper.** Dallas Morning News. Nov. 11, 2004. http://www.dallasnews.com/sharedcontent/dws/ news/city/collin/opinion/stories/111204dnccocollinvote.9eeb3.html

[14] **Parish by parish list of voter machine problems called in by viewers.** Nov. 2, 2004. WWLTV.com. http://www.wwltv.com/local/stories/wwl110204electionmishap.18e9b314.html

[15] **Election study finds widespread ballot-counting problems.** Scripps Howard News Service. Dec.20, 2004. By Thomas Hargrove. http://www.knoxstudio.com/shns/story.cfm?pk=MISCOUNT-ELECT-12-20-04&cat=AN

[16] **Glitch causes Franklin Co. recount.** IndyStar. Nov. 11, 2004. http://www.indystar.com/ articles/3/193880-4433-093.html

[17] **Back up! We need back up!** Roanoke.com. Nov. 11, 2004. By Brian Gottstein. http://www.roanoke.com/columnists/gottstein/13719.html

[18] **Ohio Is Set to Reckon With Outstanding Ballots.** Los Angeles Times. Nov. 9, 2004. By Ralph Vartabedian and Henry Weinstein. http://www.latimes.com/news/nationworld/politics/scotus/la-na-ohio9nov09,1,1213424.story ?coll=la-news-politics-supreme_court

[19] **Computer error at voting machine gives Bush 3,893 extra votes.** Akron Beacon Journal. November 5, 2004. Associated Press. http://www.ohio.com/mld/beaconjournal/news/state/10103910.htm?1c

[20] **Back up! We need back up!** Roanoke.com. Nov. 11, 2004. By Brian Gottstein. http://www.roanoke.com/columnists/gottstein/13719.html

[21] **Democrats' leader decries voting glitches.** Vindicator Sharon Bureau. November 6, 2004. By Harold Gwin. http://www.vindy.com/basic/news/288078640794824.php

[22] **Maryland e-voting controversy continues in presidential race.** Washington Technology. November 3, 2004. By William Welsh. http://www.wtonline.com/news/1_1/daily_news/24878-1.html

[23] **Nearly 40 Votes May Have Been Lost In Palm Beach County.** Nov. 2, 2004. Associated Press. http://www.votersunite.org/article.asp?id=3659

[24] **Distrust fuels doubts on votes.** Orlando Sentinel. Nov. 12, 2004. By David Damron. http://www.orlandosentinel.com/news/orl-locvotetotals12111204nov12,1,2450210.story

[25] **Lexington town leaders criticize slow vote count.** The Roanoke Times. Nov. 4, 2004. By Tim Flach. http://www.thestate.com/mld/thestate/news/local/10094010.htm

[26] **Twiggs voters face problems at polls.** The Courier Herald. Nov. 2, 2004. By Jason Hobbs. http://www.votersunite.org/article.asp?id=3647

[27] **County retallies early-vote results.** The Charlotte Observer. Nov. 4, 2004. By Richard Rubin and Carrie Levine. http://www.charlotte.com/mld/charlotte/news/politics/10094165.htm

[28] **Letter from ES&S to Guilford County Board of Elections.** Nov. 8, 2004. http://www.votersunite.org/info/GuilfordESS.pdf

[29] **Election problems due to a software glitch.** Sun Journal. Nov. 5, 2004. By Sue Book. http://www.newbernsj.com/SiteProcessor.cfm?Template=/GlobalTemplates/Details.cfm&StoryID=18297&Section=Local

[30] **Glitch could force state to vote again.** The Charlotte Observer. Nov. 9, 2004. By Michelle Crouch. http://www.charlotte.com/mld/charlotte/10133265.htm

3 Breaking the Myths about Testing and Certification

Words from Experts

Many state and local election officials insist that their election equipment is accurate and reliable because it has passed a rigorous testing and certification process before it is used in an election.

Chapter 2 has demonstrated that the process is severely inadequate. Consider also the response of Dr. Douglas Jones[50] to a radio commentator's assertion that if we can design computerized aircraft, we should be able to design computerized voting systems.

> The standard rule of thumb for software development in avionics is that you spend 10 times as much of your money on testing and certification as you spend on product development. The voting systems arena is nowhere like that. There's no parallel there at all.

The absurdity of trusting the current testing and certification process is made abundantly clear in the testimony of Dr. Michael I. Shamos before the Environment, Technology, and Standards Subcommittee of the U.S. House of Representatives' Committee on Science on June 24, 2004.[51]

> I am here today to offer my opinion that the system we have for testing and certifying voting equipment in this country **is not only broken, but is virtually nonexistent.**
>
> It must be re-created from scratch or we will never restore public confidence in elections.

It is noteworthy that the remarks of Dr. Shamos reflect the consensus of the experts at the hearing: Carolyn Coggins, Director of ITA Services at one of the independent labs that test voting equipment; Dr. Hratch G. Semerjian, Acting Director of the National Institute of Standards and Technology; Thomas R. Wilkey, Former Executive Director of the New York State Board Of Elections and Chair of the National Association of State Election Directors (NASED) Voting Systems Board.

During the questioning period, Congressman Vernon Ehlers asked Dr. Shamos, "What can be done to improve these processes before the 2004 election?" Dr. Shamos replied:

> I do not believe that Congress can act meaningfully in the 130 days that remain before the 2004 election. Even if it could, the states would be powerless to comply in so short a time.

No one present disagreed.[52]

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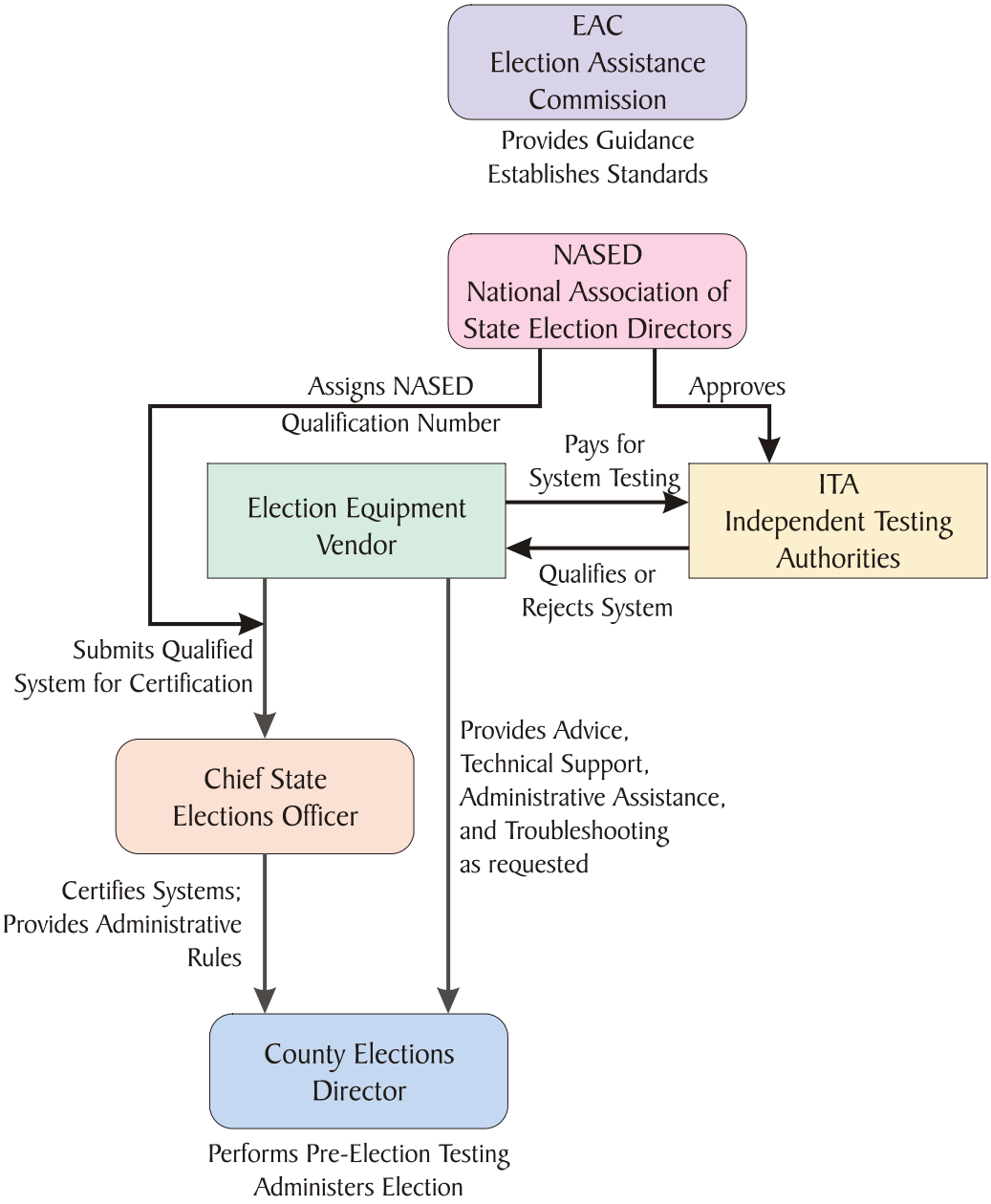
[50] Dr. Jones is an Associate Professor of Computer Science at the University of Iowa, has served on the Iowa Board of Examiners for Voting Machines and Electronic Voting Systems since 1994, and has consulted with the ACLU (Illinois Chapter), Miami-Dade County, and the Brennan Center for Justice on voting related issues.

[51] **Testimony of Michael I. Shamos before the Environment, Technology, and Standards Subcommittee of the U.S. House of Representatives' Committee on Science.** June 24, 2004. (highlighting added) http://www.house.gov/science/hearings/ets04/jun24/shamos.pdf

Dr. Shamos is the Co-Director of the Institute for eCommerce at Carnegie Mellon University. He has served as an examiner of electronic voting systems and consultant on electronic voting to Pennsylvania, Nevada, and Delaware. He is a strong proponent of paperless systems.

[52] Watch the Webcast at http://www.house.gov/science/webcast/index.htm

A Look at the Current Process



Electronic Equipment: Testing, Certification, and Election Administration

In his testimony to the Congressional Subcommittee, referenced on the previous page, Dr. Shamos gave a concise overview of the testing and certification process and the problems. Excerpts from his testimony are included through the following sections (all highlighting is added).

Inadequacy of the Standards

Most states have laws or administrative rules that require election systems to be "qualified" by NASED[53] before they can be certified for use in the state. In the qualification process, an Independent Testing Authority (ITA), approved by NASED, tests voting equipment against the voluntary Federal Voting System Standards approved by the Federal Election Commission and more recently the Election Assistance Commission established by HAVA.

If the system meets or exceeds the standards, the system is placed on the list of NASED "Qualified" machines and is assigned a NASED qualification number. Hardware and software are tested separately by different ITAs and are assigned separate NASED numbers. If any changes are made to a system, the vendor must apply anew.

Dr. Shamos' comments on the standard against which the ITA's test voting equipment:

> The process of "qualification" is testing to determine whether a particular model of voting system meets appropriate national standards. Unfortunately, no such standards currently even exist. The Federal Voting System Standards (FVSS), formerly known as the FEC Standards, are incomplete and out of date.
>
> For example, one of the principal election security worries is the possibility of a computer virus infecting a voting system. Yet the FVSS place virus responsibility on the voting system vendor and do not provide for any testing by the Independent Testing Authority (ITA). ... It is hardly reassuring to have the fox guarantee the safety of the chickens.

Nearly all voting machines currently in use have been tested against the 1990 standards — not even the current 2002 standards, which Dr. Shamos calls "incomplete and out of date."[54] To add perspective, in 1990 the 486 microprocessor was state-of-the-art, only a few people had heard of the Internet, and the Windows operating system, which many qualified voting systems now use, did not yet exist.

Secrecy of the Qualification Process

According to the NASED description of the qualification process:

> The ITAs will not respond to outside inquiries about the testing process for voting systems, nor will they answer questions related to a specific manufacturer or a specific voting system. All such inquiries are to be directed to **The Election Assistance Commission** on behalf of NASED.[55]

The testing and qualification process is conducted under a confidential contract between the ITA and the vendor applying for qualification. The process is kept secret from election officials, the media, and the general public. Vendors contact the ITAs to enter the testing process; all contracts and contacts about the process are directly between the vendor and the ITA. All inquiries about the process must be directed to the EAC, and the EAC is responsible for the coordination among the FEC, NASED, jurisdictions, and the ITAs.

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[53] National Association of State Election Directors

[54] **NASED Qualified Voting Systems. 12/05/03 – Current.** http://www.nased.org/ITA%20Information/NASEDQualifiedVotingSystems12-03-12-04.pdf

[55] **National Association of State Election Directors General Overview for Getting a Voting System Qualified.** Page 5. http://www.nased.org/ITA%20Information/NASEDITAProcess.pdf

Dr. Shamos' comments on the qualification process:

> Even if there were suitable standards, it is a significant question how to assure the public that a particular machine meets them. The current process of qualification testing by Independent Testing Authorities certified by the National Association of State Election Directors (NASED) is dysfunctional. As proof I need only cite the fact that the voting systems about which security concerns have recently been raised, such as Diebold Accuvote, were all ITA-qualified. **Some of these systems contain security holes so severe that one wonders what the ITA was looking for during its testing.**
>
> One may wonder, but one cannot find out. The ITA procedures are entirely opaque. ... I find it grotesque that an organization charged with such a heavy responsibility feels no obligation to explain to anyone what it is doing.

It is important to note that the ITAs test **a machine's design** against the federal standards. There is no process (except perhaps the vendors') for testing and qualifying individual machines. **So, while a design may be qualified, the individual machines used in elections are not.**

State Certification — Seeing if the Functions are There

Certification is performed by the states and involves checking the functionality to make sure that it meets the state's needs, for example, the ability to do candidate rotation on the ballot, to allow cross-over voting, or to perform other functions required by state law.

Dr. Shamos' comments on the state certification process:

> The existence of Federal standards and ITAs has actually had a counterproductive effect. Many states that formerly had statutory certification procedures have abdicated them in favor of requiring no more from a vendor than an ITA qualification letter, and in some cases even less. Alabama, for example, requires no certification at all but relies on a written guarantee by the vendor that its system satisfies the state's requirements. My own state, Pennsylvania, abandoned certification in 2002 because it believed the ITA process was sufficient. **We are less safe in 2004 than we were 20 years ago.**

Trusting that the NASED qualification means the product is suitable for use in elections, most state certification teams do nothing to ensure that the equipment meets federal standards. They do nothing to check the software for viruses or malicious code. They do not examine its security features. They do not understand its internal workings; they cannot, since trade secret laws prohibit them.

The Myth of Pre-Election Testing

Most localities are required to perform Logic and Accuracy (L&A) testing on every voting machine before every election. For example, in California:

> At every election, all voting equipment is required to be tested by the local elections official conducting the election. This testing includes "Logic and Accuracy" testing, a process during which voting equipment is tested with a known number of votes and must produce exactly that result in order to be certified for use in the election. [56]

Pre-election testing is conducted at the county level. Its primary purpose is to ensure that the software has been set up properly to accurately count the specific ballots for that election. It is notable that election administrators receive no training in software or hardware testing, yet they are responsible for testing not only the software but also the interaction between software and the mechanical devices on which the software is installed.

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[56] **Major Issues And Questions Addressed By The Task Force.** California Ad Hoc Task Force; March 2003 http://www.ss.ca.gov/elections/taskforce_report_2.htm

Dr. Shamos' comments on pre-election testing:

> The machines may work according to specification but if they have not been loaded with the appropriate set of ballot styles to be used in a polling place they will be completely ineffective.

The ballot styles to which Dr. Shamos refers are constructed through a process called "ballot programming." Ballot programming is done uniquely for each election; it produces a ballot definition file (BDF). BDFs are unique for each election; they define all the contests and candidates for each precinct. Data in the files tell the underlying voting machine software how to interpret a voter's touches on a screen or marks on an optical scan ballot (including absentee ballots) and how to record those selections as votes. **In other words, BDFs turn votes into electronic vote data.** BDFs are the primary focus of the testing that county officials do before each election.

As Dr. Shamos indicated, the BDF is a key component of the voting system, yet it is never subjected to an outside review. The lack of independent oversight of these files is a major security vulnerability. If BDFs are incorrectly prepared, the wrong candidate could be elected.

Programming election data is a very complex process, especially in counties with hundreds of different ballot styles. Some election districts lack the technical expertise to prepare BDFs, and instead depend on the vendor or outside programmers for the preparation. Others prepare the BDFs themselves. In both cases, however, BDFs undergo minimal testing and no independent audit before being used to determine the results of an election. Little wonder that many serious election disruptions have been caused by ballot definition errors. Since such errors are initially noticed because of suspect results, it is highly likely that other BDF errors have gone unnoticed. Some may have affected election outcomes.

All of the proven ballot definition errors occurred on optical scan equipment and were caught by a manual recount of the ballots. In Chapter 2, "Election-Specific Programming Miscounts Votes" on page 9 gives three examples from the 2004 general election. Here are five examples from previous elections:

- In New Mexico, 67,000 absentee and early-voting ballots were counted incorrectly. [57]
- In Texas, a difference in ballot data on different machines resulted in miscounts in 18 races.[58]
- In Florida, 2,642 Democratic and Republican votes were counted as Republican.[59]
- In Texas, victories for two commissioners were initially given to the wrong candidates.[60]
- In North Carolina, 5,500 party-line votes, both Republican and Democrat, were uncounted.[61]

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[57] **Human error is cause of N.M. election glitch.** Government Computer News; November 20, 2000; Vol. 19 No. 33. http://www.gcn.com/vol19_no33/news/3307-1.html

[58] **Glitch affects 18 races Problems in counting early votes could alter some election outcomes.** Dallas Morning News. May 8, 2002. Ed Housewright, staff writer.

[59] 6/2/04 Conversation with Barbara Montpetit, Supervisor of Elections. Original reference was from *Black Box Voting,* Chapter 2. "Sometimes the old ways are best." The Bradenton Herald, 17 September 2002.

[60] 06/03/04. Conversation with Scurry County Elections Director, who said the problem was caused by the ES&S 650 chip with the ballot programming on it, and that they had to get a new one from ES&S. Original reference was from *Black Box Voting,* Chapter 2. Houston Chronicle, 8 November 2002; "Ballot glitches reverse two election results"

[61] **Winners' may be losers.** The News and Observer; November 12, 2002; By Wade Rawlins and Rob Christensen. Reproduced at: http://66.102.7.104/search?q=cache:iy0f4rgd7oMJ:www.ncdot.org/news/dailyclips/2002-11-12zz.html+%22%27Winners%27+may+be+losers%22+wayne&hl=en

Since DREs (paperless electronic voting machines) provide no way to conduct an independent audit of the results, **BDF errors on DREs are virtually undetectable.** Given the known problems with BDFs on optical scan voting systems, it is reasonable to assume that similar but undetected errors have also occurred with DREs.

- January 2004, Broward County, Florida.[62] The 134 blank ballots recorded by DREs are still unexplained. Did 134 voters go to the polls, with only one contest on the ballot, and cast blank ballots as election officials assume, or did a BDF error cause votes to be lost as has happened on optical scan machines?
- November 2002, Georgia. Dramatic upsets in the races for Governor and U.S. Senator could not be investigated because the voting machines were DREs. The outcomes may have been correct, but how do we know the BDF was not flawed?

If BDFs are flawed, a hand recount of the original ballots is the only way to correct the results. When optical scan ballots are recounted by the machine (by running them through the optical scanner a second time), the results typically match the initial tally. But while odd results might suggest a flaw in the BDF of a paperless system, even if further testing proved the flaw, there would be no way to recover the intent of the voters.

Accurate election results require accurate BDFs. Some counties have hundreds of ballot styles, and each one must be programmed correctly since a human error in any definition could be magnified by the number of voters using that ballot.

Pre-election testing is completely inadequate. Optical scanners are tested by running a small set of test ballots —hardly enough to test every possible combination for every ballot style. Testing on DREs may involve simply pressing each button on the screen to make sure they all work correctly. Testing has failed to detect the many election data errors that have disrupted many optical scan elections. If an error occurs during an election, a new BDF is created and used to tally the final result, but without a manual audit of the votes, there is no way of knowing if the new BDF is correct. **It could simply give results that are within reason and therefore unquestioned.**

The extreme complexity of election definition data, the complete lack of security procedures used to create them, the hopelessly inadequate testing: these problems raise serious questions about the accuracy of electronic vote counting — on both DREs and optical scanners.

The Realities of Conducting Logic & Accuracy (L&A) Testing on DREs

In Jefferson County, Washington, the only electronic voting equipment is a single central-count optical scan machine. The county auditor's office spends as long as eight hours preparing the test plan and filling out the ballots that will be used for the test. Then the test, which is performed in public, takes about an hour. Once the test is completed, all the tested components are stored in a box locked with a security device until the election.

The importance of the L&A testing is undisputed, as a snafu in Bernardino County, California demonstrated:

> In November 2001, the failure of Registrar of Voters managers to fully perform logic testing on the computer coding for the ballot counting machines resulted in votes for some candidates going to other candidates. All 82 elections were subjected to a hand recount, with the results in 13 local water and school board races overturned. Registrar Ingrid Gonzales resigned months later.[63]

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[62] **Electronic vote recount stumps Broward officials.** Sun-Sentinel; January 10 2004; By Jeremy Milarsky and Lisa J. Huriash, Staff Writers

[63] **Ballot counting resumes in San Bernardino County after four-hour delay.** The Press-Enterprise; March 3, 2004; By Sharon McNary. http://www.pe.com/breakingnews/local/stories/PE_News_Local_websnafu03.9ff35.html

In a county with multiple DREs at each polling place, the time and effort required for adequate L&A testing increases significantly. For example, to comply with California law, the Registrar of San Diego County must test 10,200 DREs before every election. If it took an hour to test one DRE, San Diego County would have to spend 1275 **person-days** testing before every election.

In addition, securing the tested components until election day becomes a significant challenge, and, in fact, the components in San Diego were not secured before the March 2004 primary election. They were sent home with poll workers after the training sessions, and the poll workers transported them to the polling places.[64]

The following information is adapted from the Computer Professionals for Social Responsibility (CPSR) description of testing DREs: [65]

> Each "ballot" of a logic and accuracy test for a DRE must be entered into the DRE by hand – by voting the test ballot on the DRE itself. DREs present two special problems for logic and accuracy testing:
>
> 1. The process is time-consuming, so a small number of ballots is used – often too small to catch important mistakes. Thus, in order to minimize the cost associated with testing, the effectiveness of the testing may be sacrificed.
> 2. It is difficult to correctly generate a series of test ballots on a DRE without a single error. It is much more likely that an election worker will make a mistake in entering test ballots than that an actual voter will make such a mistake, because the voter only has to remember one set of votes: the votes they wish to make. The DRE tester has a much more difficult problem. Consequently, election workers must conduct DRE logic and accuracy tests with extreme deliberation and caution, as even a single error requires that the entire logic and accuracy test be repeated. **In practice, this results in logic and accuracy tests that are smaller yet, to the point where the test is testing for little besides a stuck button or a completely nonfunctional DRE.**

Consequently many DRE counties use the automated tests provided by the vendor, but these tests do not simulate election-day voting, nor do they run through the same program code used in a live election.

If DREs Fail the L&A Test …

> While many states provide for pre-election testing of machines, in the event of a large-scale failure they can find themselves without enough working machines to conduct an election. *Dr. Michael I. Shamos*

Ideally, every L&A test would show that the machines are operating correctly. However, there is a possibility that one or more machines could fail. Consider the ramifications of having the tests on even one DRE show that it was losing ballots or recording votes incorrectly.

- It would be necessary to take the machine out of service or have it repaired.
- If the software appeared to be flawed, the flaw would be present in all DREs using that same software, so all of them would have to be taken out of service or repaired.
- It is likely that it would be too late to have a software patch developed, tested, certified, and installed in time for the election.

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[64] **County ordered to offer voters paper ballots.**
North County Times; February 12, 2004; By Gig Conaughton, Staff Writer
http://www.nctimes.com/articles/2004/02/13/news/top_stories/2_12_0422_53_18.txt

[65] **CPSR Comments on the California Touch Screen Task Force Report.** August 1, 2003; Computer Professionals for Social Responsibility. http://www.cpsr.org/issues/vote-catouchscreen.html
For information on the task force report, go to: http://www.ss.ca.gov/elections/taskforce.htm

- It is also likely that it would be too late to print paper ballots for the entire county to use for the election.
- It might be necessary to use uncertified software and hope it isn't flawed. Forced into such a corner, several California counties used Diebold's uncertified Precinct Control Modules in the March 2004 primary election. Some results are described on page 12 of this document.

How's it Working?

For the answer, refer back to the 30 detailed examples in Chapter 2, or the sampling of problems shown on the map on page 15. Or read through the 125+ machine malfunctions briefly described in the Election 2004 problem log at VotersUnite.Org.[66] Or browse through the files of malfunctions sorted by vendor.[67] Virtually all of the systems referenced on these pages and in these files were NASED-qualified, state-certified, and subjected to pre-election testing.

For example, in Lancaster County, Nebraska, two out of six qualified, certified, and fully tested optical scanners miscounted votes in the 2004 general election:

> When the officials began testing the six machines, it became clear that two were not correctly counting the ballots. "That came as a surprise, [County Election Commissioner David] Shively said, because **all were tested late last week and performed well."** [68]

In Pennsylvania's 2004 general election, too, the pre-election testing was to no avail:

> Mercer County's director of elections said it was a computer software glitch that caused touch-screen voting machines to malfunction in about a dozen precincts Tuesday. ... Election workers in Mercer County raced to take paper ballots to polling places in the Shenango Valley after a series of computer errors.
>
> "I don't know what happened," said James Bennington, who had been assured Friday that all 250 of the county's touch-screen units had been **checked and rechecked.**[69]

Sometimes, however, the tests fail. But what happens next, at least in New Mexico, is up to the discretion of the election directors.

In the 2004 primary election in Dona Ana County, New Mexico, optical scan machines **failed the pre-election testing and were used in early voting anyway.** In pre-election testing, counters that track the total number of ballots passed through the machine showed incorrect numbers. The counters in four out of five machines were incorrect, showing as many as 20 or 30 votes more than the actual number of ballots tested. Yet the machines were used in early-voting anyway.[70]

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[66] http://www.votersunite.org/electionproblems.asp

[67] http://www.votersunite.org/info/messupsbyvendor.asp

[68] **Problem machines spur call for recount.** Lincoln Journal Star. November 14, 2004. By Nate Jenkins. http://www.journalstar.com/articles/2004/11/14/election/doc4189b9c7f14bf764391458.txt

[69] **Errors plague voting process in Ohio, Pa.** Vindicator. November 3, 2004. Vindicator staff. http://www.vindy.com/basic/news/281829446390855.php

[70] **Company denies problem with voting program.** Clovis News Journal. June 3, 2004. By Jack King: CNJ Staff Writer. http://cnjonline.com/engine.pl?station=clovis&template=storyfull.html&id=6358
I followed up with Susanna Martinez, the district attorney mentioned in the article. She provided the additional details in this description.

4 Election Complexities Increased by Electronic Voting

In addition to the security and accountability problems that others have documented in detail (see page 54), numerous other practical and operational problems result from the use of electronics in elections. Contrary to many election officials' hope that electronic voting will make elections run more smoothly and simplify election processes, electronics add a significant number of unfamiliar and unexpected complexities.

Software Complexities

A Word about Source Code and Programming

While the vast majority of Americans use software programs, most of them know little about how the software is created. Since much of the debate surrounding electronic voting involves discussion of software, the following information is included for those unfamiliar with software.

Many technologists are calling for open source code in voting machines. But election officials and legislators may not be clear on what source code is or why open source code is important.

Source code is the list of instructions that cause the computer to display screens, record votes, tally votes, and perform all other functions both visible and invisible. So, for example, when the voter presses the VOTE button, that action triggers a list of instructions for the machine to follow internally. Currently, only the vendors know what those instructions are, and the courts have ruled that those instructions on how to handle votes are a trade secret. In other words, courts have decided that the competitive advantage that secret source code gives to the vendors has a higher priority than the right of the public to know how their votes are being counted.

"Open" source code means the instructions would not be a secret. Anyone would be able to look at them. Although the instructions are written in programming language, and few election officials or legislators may be able to understand it, there are many programmers who would understand the language. Nevertheless, finding bugs by reading source code is not an easy task, especially when you consider that complex programs contain thousands, sometimes millions, of lines of instructions and are often not well documented.

Here is an example of C++ source code that sorts a set of numbers.

```
void Sort( INT* ItemArray, INT ArraySize )
{
   INT     Temp;
   INT     i = 0;
   INT     j = 0;
   INT     Offset  = ArraySize;
   BOOLEAN InOrder = FALSE;
   do {
      Offset  = ((8 * Offset) / 11) ;
      Offset  = ((Offset == 0) ? 1 : Offset);
      InOrder = TRUE;
      for (i = 0, j = Offset; i < (ArraySize - Offset); i++, j++) {
         if (ItemArray[i] > ItemArray[j]) {
            InOrder = FALSE;
            Temp = ItemArray[i];
            ItemArray[i] = ItemArray[j];
            ItemArray[j] = Temp;
         }
      }
   } while (!( (Offset == 1) && (InOrder == TRUE) ));
}
```

Having secret source code is comparable to having vendors write up the procedures they use to count ballots and then refusing to show anyone -- even legislators and election administrators -- what those procedures are. And then allowing the vendors to go into a locked room, carry out those secret procedures, and return to public view only to announce the results of the election.

Having open source code is comparable to having vendors show everyone the procedures they wrote up, and then allowing them to go into a locked room, carry out those procedures without anyone watching, and return to announce the final results.

ES&S iVotronic — Case Study of a Tiny Programming Bug

All software has bugs, but the opportunity to examine a bug in voting software is rare. Fortunately, we had a chance after a news article was published May 13, 2004 telling about a "serious bug" found by Orlando Suarez in Miami-Dade's ES&S election equipment nearly a year earlier. ES&S had known about this serious bug for **nearly a year** and had not fixed it.[71]

The audit log and the vote image report are unreliable. For example, the audit log failed to report machines at the precinct and reported "phantom" machines instead. It assigned votes from the missing machines to the "phantom." The vote image report failed to report machines AND failed to report votes. Suarez says:

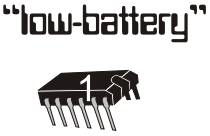
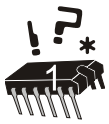
> In my humble opinion (and based on my over 30 years of experience in the information technology field)," Suarez wrote, "I believe that there is/are a **serious** 'bug' in the program(s) that generate these reports making these reports unusable for the purpose that we were considering (audit an election, recount an election and if necessary, use these reports to certify an election).

With the help of Miami-Dade County and Dr. Douglas Jones, a University of Iowa computer science professor who serves on the Iowa Board of Examiners for voting machines, ES&S discovered two interacting bugs that show up when the battery is low.

We'll just look at the first bug[72] — two lines of source code were in the wrong order. This may seem like a 'small' bug, but consider how important it is to give instructions in the correct order. For example:

1. Jump off the bridge.
2. Tie the bungi cord around your feet.

Here's what happens to trigger the ES&S iVotronic bug:

1 	**The battery voltage is too low.** The battery might have run down, or it might have been defective in the first place.
2 	**A low-battery message is written to the memory inside the iVotronic.** This is normal. The iVotronic tracks all events, including "low-battery" events.
3 	 Here's the bug: The software writes the "low-battery" message BEFORE it moves to a new, blank space in the memory. So, the low-battery message overwrites the previous event message, causing the data to be garbled. Fortunately, they tell us, this bug doesn't overwrite any vote records, just event log records.

Simply reversing the order of the instructions fixed the bug. Similarly, when a vendor makes a "small upgrade" to voting software, it could wreak havoc with the operation of the system.

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[71] **Count Crisis? Elections official warns of glitches that may scramble vote auditing.** Miami Daily Business Review. May 13, 2004. By Matthew Haggman. http://www.law.com/jsp/article.jsp?id=1084316008117

[72] For details about both bugs and their interaction, go to http://www.votersunite.org/info/auditbug.asp

Safeguarding Votes: Paper vs. Electronic Data

Electronic records and paper records are comparable in one way — they are both information. After that, the similarities quickly disappear.

Recording data We can record information **directly** onto a paper record, but we can only record electronic data **indirectly** with the assistance of a computer program that interprets what we mean and records it in a language the computer can understand.

Viewing data We can view information on paper records **directly**, but we can only view electronic data **indirectly** with the assistance of a computer program that reads the data for us and presents it to us in our own language.

Changing data Electronic records can be altered by any of the following methods. Paper records cannot.

- Passing a magnet above the physical medium holding the data.
- Sending a command through the phone lines.
- Sending a command through electrical lines.
- Sending a command via wireless communications, such as a cell phone.

Electronic records can be altered **undetectably** — by someone in the next room or a thousand miles away— while paper records cannot.

Size of data Electronic records have almost no size at all compared to paper records. Data for thousands of ballots will fit on a cartridge the size of a credit card. The same number of paper ballots would fill a grocery bag or two.

One aspect of a computerized voting system has no easy equivalent in the world of paper ballots: the counting process itself. Not only is the vote data electronic, but the counting process is also.

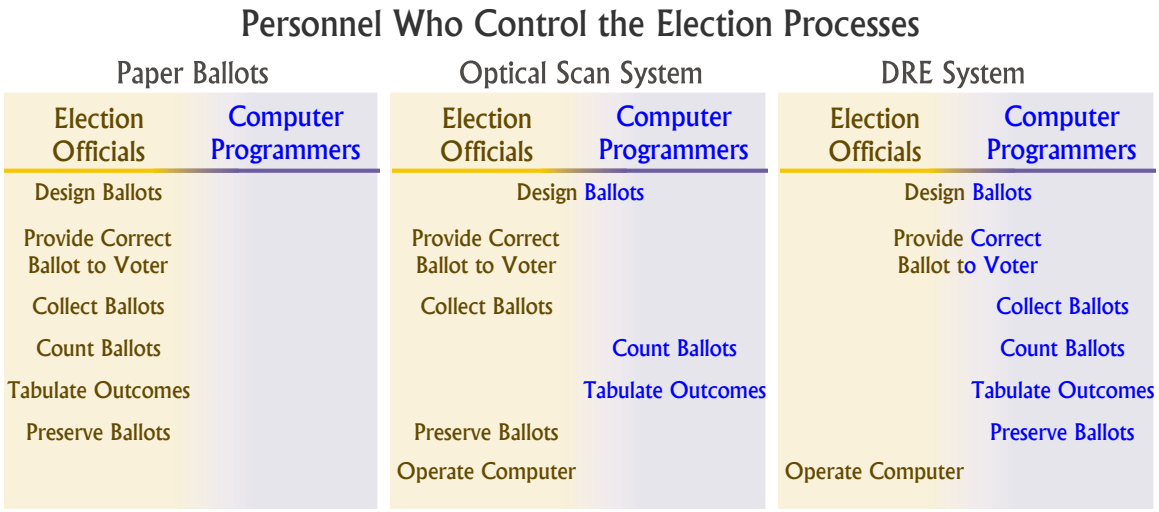
This means that election directors' procedures developed to safeguard and count paper ballots **cannot** be fully translated into procedures for safeguarding and counting electronic vote data. **In fact, election directors have no procedures for counting electronic data.** All those procedures are electronic processes contained in the software; they are trade secrets of the election equipment vendors.

Complexities that Make Government Oversight a Myth

Officials Cannot Oversee the Vote-Counting Process in Electronic Elections

Election officials cannot oversee what they cannot see. Election officials who use software to count and tally votes have given up control of those processes to the programmers who encoded the software. Legislatures that allow the use of electronic equipment without mandating manual audits of the election results are giving programmers control of the election processes.

- In optical scan and punch card voting systems, votes are counted by software processes that courts have declared to be trade secrets of the election equipment manufacturers.
- In DRE systems, not only are votes counted by the secret software processes, but the votes are also recorded by secret processes.
- In all these systems, election management software is used to accumulate the votes into the final results. Unless the accumulation software has been developed by the state (as it has in Oklahoma), the accumulation processes are also trade secrets.



Furthermore, while county officials have always overseen registration and voter sign-in books in the past, registration is becoming computerized, in some cases outsourced to private companies.

Election Directors Rely on Vendor Technicians During Elections

Generally, election officials have experience in election administration and have no background or expertise in software. Since administering an electronic election requires a great deal of technical expertise and knowledge of the software used in the election, election officials across the country must rely on assistance from vendors.

Even those rare election officials who have an in-depth understanding of software do not — and by court rulings, are not allowed to — have an in-depth understanding of the software they use to conduct elections.

While election officials take an oath to uphold the integrity of the election, vendors do not.

Because of election officials' unfamiliarity with the election equipment they are using, vendor technicians are involved in virtually every aspect of elections. They are often unsupervised, and election officials trust them implicitly. Since they contract to do work that election officials do not have the experience to do, they always work without the informed oversight of the officials.

> "A common practice for local election officials is to let election companies run their election — make up their ballot, set up their machines, and even count their tallies. This is a dangerous practice."
>
> *~ Ted Selker, Cal Tech/MIT Voting Technology Project.* [73]

- **Vendor technicians frequently do the ballot programming, which determines how marks on a paper ballot or touches on a screen are translated into electronic vote data.[74]**

  Carroll County, North Carolina. November, 2004. A ballot programming error by ES&S caused the ballots to be counted incorrectly. ES&S will supply a new chip for the Model 115 optical scanners and the county will rescan the ballots. [75]

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[73] **Touch to Vote: More Americans to Vote on Electronic, Touch-Screen Systems in November.** ABC News. July 18, 2004. http://www.abcnews.go.com/sections/WNT/Politics/e-voting_040718-2.html

[74] An ES&S representative told me that ES&S does ballot programming for 1200 counties in the U.S.

[75] **Computer glitch blamed for miscount in JP voting.** Star Tribune. November 10, 2004. By Anna Mathews, CCN staff writer. http://www.greenforesttribune.com/articles/2004/11/10/news/s1.txt

- **Vendor technicians even reprogram ballots directly from the county's equipment.**

  Miami Dade County, Florida. April 2002. An ES&S technician opened the ballot program on the memory cards to change a header. At the same time, he bumped the first candidate to the last position. "When the technician saved the edit, a prompt most likely popped up on the monitor asking him if he was sure he wanted to change the order of the names. The technician ignored the prompt and confirmed the change."[76]

- **Vendor technicians test and prepare the equipment for the elections.**

  Napa County, California. March 2004. "Prior to the election, a Sequoia technician ran test ballots through the machine to calibrate its reading sensitivity, but failed to test for gel ink."[77]

- **Vendor technicians provide technical supervision during an election.**

  San Diego County, California. March 2004. Diebold provided 200 "Rovers" who were each assigned to monitor a set of polling places in their designated area. [78]

- **Vendors release election results to the media.**

  Walker County, Georgia. March 2004. "A Diebold computer technician began providing incorrect numbers to news organizations. The botched returns were fed to the media for more than two hours after the polls closed before the problem was corrected." [79]

- **Vendor technicians retrieve data from memory cards.**

  Collin County, Texas. November 2004. When election officials could not retrieve the results of the 63 ballots held on a Diebold memory card, they sent the card to Diebold experts in Canada, who retrieved the data.[80] Memory cards are electronic ballot boxes. So, a ballot box was mailed to Canada, violating all chain-of-custody procedures.

- **Vendor technicians investigate when election equipment breaks down.**

  Snohomish County, Washington. September 2004. Twenty touch-screen voting machines broke down during the primary. Sequoia technicians spent a week in Everett testing the machines that broke down, as well as the ones that did not. They did not uncover the cause of the problem. [81]

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[76] **Technician's Error, Not Machines, To Blame In Dade Election Mix-Up.** The Miami Herald. April 4, 2002. By Oscar Corral. [Purchase through Miami Herald online archives: http://www.miami.com/mld/miamiherald/archives/]

[77] **Lost E-Votes Could Flip Napa Race.** Wired News; March 15, 2004; By Kim Zetter. http://www.wired.com/news/evote/0,2645,62655,00.html

[78] **Correspondence, written report regarding Touchscreen voting system used for the first time March 2, 2004 by the County of San Diego.**
From: Walter F. Ekard; Chief Administrative Officer
http://www.signonsandiego.com/news/politics/county/20040310-1315-report.html

[79] **Ballot card problems delayed election returns (Georgia).** Walker County Messenger; March 4, 2004; Eric Beavers. Reproduced at: http://www.votersunite.org/article.asp?id=1417

[80] **Editorial: Put It on Paper — Election snafu points up problems for all-electronic voting.** Dallas Morning News. November 11, 2004. http://www.dallasnews.com/sharedcontent/dws/news/city/collin/opinion/stories/111204dnccocollinvote.9eeb3.html

[81] **20 voting machines broke down.** Everett Herald. October 6, 2004. By Jerry Cornfield, Herald Writer. http://www.heraldnet.com/stories/04/10/06/loc_voting001.cfm

- **Vendor technicians troubleshoot and supervise file management activities on the central tabulator during an election.**

  Morris County, New Jersey. June 2004. The tabulation system was unable to read the data from the touch screen machines because the C drive was full. The vice-president of Sequoia led County Clerk Joan Bramhall's technicians through a process that deleted unnecessary information on the drive and "refreshed" the computer. Then they were able to read the cartridges.[82]

- **Vendor technicians, unsupervised and unquestioned, repair election equipment.**

  Santa Clara County, California. November 2003. Following the election, Sequoia sent over a group of technicians to make adjustments to voting machines that experienced battery problems. For three weeks, the workers, employed by a Sequoia subcontractor, took apart the machines, removing their circuit boards and making adjustments.

  Santa Clara County officials didn't know the name of the subcontractor and hadn't verified the identities of the workers it hired when the San Jose Mercury News made an inquiry. They also hadn't documented the changes being made to the machines.

  To find out such information, "you'd have to contact Sequoia," said Assistant Registrar of Voters Elaine Larson.[83]

- **Vendor representatives have even been known to conduct entire elections.**

  Greenwood County, South Carolina. August 2004. "As part of the federal grant agreement, **ES&S will conduct the county's first election using the iVotronic,** said Connie Moody, director of voter registration and elections for Greenwood County. The equipment will not go into use until November, she said, when **county election staff functions mostly as observers and consultants**."[84]

Lack of Information about Malfunctions Handicaps Election Officials

Equipment problems that occur in one county are rarely communicated to other counties using that same equipment. This lack of information about their equipment limits the ability of election officials to administer their elections effectively. Sometimes it is simply because no communication mechanism is in place to allow election officials to share information easily.

For example, in March of 2004, Indiana officials discovered that ES&S had — in violation of state law — installed uncertified, unauthorized software in touch-screen voting machines used by three Indiana counties in the previous November's election. The Board of Elections demanded that the systems be restored to the earlier version, which was certified.

Because I had previously researched a machine malfunction in Wake County, North Carolina, I knew that the certified version was the predecessor to the version that had failed so miserably in Wake County in 2002.[85] So, it was almost a sure bet that it would fail in Indiana as well. I figured

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[82] **Montville and Chatham mayors ousted.** Star-Ledger. June 9, 2004. By Lawrence Ragonese and Kristen Alloway. http://www.nj.com/elections/ledger/index.ssf?/base/news-3/108676553355551.xml (paid archives). In a follow-up with Ms. Bramhall, I was told that the Sequoia VP had done the troubleshooting.

[83] **Electronic voting's hidden perils.** Mercury News. February 1, 2004. By Elise Ackerman. http://www.mercurynews.com/mld/mercurynews/news/special_packages/election2004/7849090.htm

[84] **Local residents will get to test voting machines.** Index-Journal. August 19, 2004. By Wallace McBride, senior staff writer. Reproduced at: http://www.votersunite.org/article.asp?id=2554

[85] **E-Vote Machines Drop More Ballots.** Wired News. February 9, 2004. By Kim Zetter. http://www.wired.com/news/evote/0,2645,62206,00.html

Indiana officials may not have been investigating North Carolina elections, so I called to tell them what I knew. Sure enough, they were very glad to find out. Later I read in the news that, after some heated sessions with the election commission, ES&S admitted the earlier version "might not tabulate the votes."[86]

In other cases, essential information is not communicated as it should be because the vendors fail to follow through on their promises to inform their customers of problems.

The ES&S iVotronic audit bug was first publicized in May of 2004.[87] In July, ES&S said they were informing their customers about the bug.

> ES&S spokeswoman Jill Friedman Wilson said the company will continue to communicate with customers about the glitch and the patch. "We will be working with every customer, and to the extent the solution applies to the equipment they use, help them with it," she said. [88]

But ES&S failed to inform its other customers. John Gideon, my associate at VotersUnite.Org, contacted election officials in Marion County, Indiana and Bexar County, Texas, both of whom use the flawed machines. Both were completely unaware of the audit bug.

I wonder how many of the election officials who need to know actually do know that:

- The ES&S iVotronic audit bug referenced above may impact their ability to audit their elections.
- The Sequoia WinEDS system used in Bernalillo County has added phantom votes in every election since it was installed.[89]
- The Unilect Patriot DRE machines have to be specifically set to record more than 3,005 votes. Otherwise, they accept them from voters and throw them away.[90]
- The MicroVote system used in Mecklenburg County, North Carolina tallied the votes incorrectly, and the county officials have no explanation for it.[91]
- The Sequoia Veri-Vote system (DRE with a voter-verified paper trail) failed to print the correct ballot during a demo in Sacramento in the fall of 2004.[92]

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[86] **Election Commission Bails Out Voting Machine Maker In Time for May Primary.** March 11, 2004; http://www.wishtv.com/Global/story.asp?S=1706282&nav=0Ra7LTW3

[87] **Count Crisis? Elections official warns of glitches that may scramble vote auditing.** Miami Daily Business Review. May 13, 2004. By Matthew Haggman. http://www.law.com/jsp/article.jsp?id=1084316008117

[88] **Voting machines to receive digital fix.** Miami-Herald. July 10, 2004. By By Mary Ellen Klas. http://www.miami.com/mld/miamiherald/9120544.htm

[89] **County clerk say phantom votes won't be a problem.** KRQE Albuquerque. October 26, 2004. Reproduced at: http://www.votersunite.org/article.asp?id=3421

[90] **Unilect vote device causes uproar.** Oakland Tribune. November 24, 2004. By David Morrill. Reproduced at: http://www.votersunite.org/article.asp?id=3977

[91] **Board of Elections Audits Early Voting Results; Revises Unofficial Results**. Released by the Mecklenburg Board of Elections. November 4, 2004. http://www.votersunite.org/info/mecklenburgnewsrelease.pdf

[92] **Wrong Time for an E-Vote Glitch.** Wired News. August 12, 2004. By Kim Zetter. http://www.wired.com/news/evote/0,2645,64569,00.html?tw=wn_tophead_2

Illegal Use of Uncertified Software

Even though the testing and certification process may be "virtually non-existent," the laws in most states require electronic voting equipment to be certified before it can be used in an election. These laws attempt to give election officials control over the software used in their elections.

But software is not easy to control. Once a floppy disk has been inserted into the computer briefly or a unit has been sent to the vendor for repair, there's no way of knowing what software is installed on the system. Indeed, it's not unusual for state and local officials to find out about — or even participate in — the installation of illegal election software. Often the officials have so little technical experience that they do not understand the need for, or the reasons for, software version control (refer back to page 26).

Without question, the officials have no way of knowing if the software actually installed is the version the vendor says is installed. Dr. Shamos says:

> In this whole discussion we have ignored the matter of where the software used in the machine comes from. It may have worked when delivered by the vendor but may have been modified or substituted, either deliberately or innocently, by persons known or unknown.

In violation of state laws, and with or without the knowledge of election officials, vendors have installed uncertified software on systems in several states. For example:

California – Diebold

> An audit of Diebold Election Systems voting machines in California has revealed that the company installed uncertified software in all 17 counties that use its electronic voting equipment. ... three counties, including Los Angeles, used software that had never been certified by the state or qualified by federal authorities for use in any election. ... **The extent of the changes that Diebold made to upgrades of its software is still unknown.**[93]

Washington — Sequoia AVC Edge

An email dated January 15, 2004 from Corene Henage at Sequoia Voting Systems to Joseph Smith at the elections office in Snohomish County, Washington, demonstrates the cavalier attitude of some vendors and election officials regarding software version control:

> I have attached Florida certification for Edge firmware version 4.0D. As you know, **this version was never certified in Washington,** but decision was made by Scott to go ahead and use it.[94]

In a later email dated October 8, 2004, sent to Snohomish County officials along with a report of machines repaired by Sequoia, John Homewood, Engineering Manager at Sequoia said:

> There were also 11 Edges that were downgraded to 4.0D.[95]

Indiana – ES&S iVotronic

> Election Systems & Software provided illegal software for last year's election, lied to the board about a temporary fix and fired a helpful project manager, said Clerk of the Courts Jill Jackson.[96]

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[93] **E-Voting Undermined by Sloppiness.** Wired News; Dec. 17, 2003 ; by Kim Zetter http://www.wired.com/news/evote/0,2645,61637,00.html?tw=wn_tophead_2

[94] http://www.votersunite.org/info/Uncertified4.0d.pdf

[95] http://www.votersunite.org/info/Downgradedto40.d.pdf

[96] **Election vendor under fire: Repeated mixups raise issues of trust, reliability.** Indy Star; March 4, 2004; By Andy Gammill. Reproduced at: http://www.votersunite.org/article.asp?id=1412

Maryland – Diebold

> Black Box Voting reported that Diebold has used uncertified software in Maryland. According to Diebold employee emails, in the run up to the 2002 election, certified software was installed, but then overridden by uncertified software - before the election – making the vote count illegal.[97]

Software is Uncontrollable

The "National Association of State Election Directors General Overview for Getting a Voting System Qualified," a handbook for election equipment vendors, specifically states:

> In order to maintain its status as a NASED Qualified system, the hardware and software must be identical to the hardware and software tested by the ITAs. **Should it differ even slightly, it would not meet the definition of NASED Qualified and may render the system in noncompliance with state's certification process,** so it is incumbent upon the manufacturer to keep their systems current through the ITA process.

Vendors know that in most states it's illegal to install unauthorized software. Yet they do it — sometimes quite casually. For example, testifying before the California Voting Systems and Procedures Panel regarding the widespread failure of precinct control modules in the March 2004 primary, James Dunn, a Diebold technician, explained that the batteries were refusing to remain charged during the testing before the election.

When they discovered discharged batteries, they worked frantically to get them to hold a charge, even to the extent of installing whatever software they thought might work. Mr. Dunn said:

> We did the software settings with a smart card insert. And they brought out new versions, took the old ones from us, gave us the new ones, and said start using this software. **What versions, I'm not sure of.**[98]

Election officials also know that it's illegal to install unauthorized software, but their lack of technical knowledge causes them to rely heavily on the vendors for technical advice, and some of them clearly don't understand the serious potential consequences when software versions "differ even slightly" from one another.

As explained on page 25, a software program is created by writing lines of instructions and then running the instructions through a compiler, which converts it into a program that can be executed on a computer. As the iVotronic audit bug illustrates, even one small change to one line of the code can impact the operation of the software, often in unexpected ways.

However, many election officials do not understand the integrated nature of software and yet they have the authority to make decisions. For example, in a letter from Washington State Election Director Nick Handy to all Washington State Legislators, he explained why six counties in Washington would be using unqualified software in the 2004 general election:

> In addition, the software modification only occurred to the "pick a party" feature in the primary. This feature will not be activated in the general election.[99]

Had he been a software programmer, he would have known that a compiled software program is a single, integrated system component, not separate elements working independently.

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[97] From Campaign for Verifiable Voting in Maryland to Karl S. Aro, Department of Legislative Services, Annapolis, MD; http://www.truevotemd.org/2003-12-22_Karl_Aro_Letter.pdf

[98] **Meeting: State Of California Secretary Of State Voting Systems And Procedures Panel.** Wednesday, April 21, 2004. Transcript:, page 80. http://www.ss.ca.gov/elections/vsptranscript0421.pdf

[99] http://wwwvotersunite.org/info/ToWALegFromNickHandy.pdf

Even if election officials attempted to adhere strictly to their state laws regarding election software, they would have no way of knowing whether the software versions they are using are the ones approved by NASED and their state certification boards.

Only by running a cryptographic checksum or hash against systems files is it possible to tell if a software program is identical to the version it is purported to be. [100]

Electronic Data Has No Substance That Could Resist Alteration

Technology advances daily. Electronic data can be stored on microscopic chips, but that's yesterday's news. Electronic data can be transferred over internet cables, telephone wires, and through empty air via wireless connections, and that's yesterday's news, too. Data on one computer can be changed from another via cable, modem, or wireless — again yesterday's news.

Advances in communications technology are so complex and widespread that even computer professionals struggle to keep abreast of the latest developments.

Fortunately most, if not all, election directors are now aware that it is a serious breach of security to have their central tabulator (the computer that accumulates all the county totals) connected to the Internet. But still, many central tabulators are available to remote connection via modems. And without opening up their computers and examining the hardware inside, they can't know if their system is equipped for wireless communications.[101]

Electronic data is not safe data. One of the primary advantages of electronic data is that it is stored in a form that has no more physical size or substance than electricity running through power cords. Unfortunately, this lack of substance is the very characteristic that allows it to be changed undetectably.

Bev Harris, author of *Black Box Voting*, has demonstrated this fact in Diebold's tabulator, called GEMS (Global Election Management Software). Electronic election totals can be changed without any indication that they were altered. Alterations are even possible by running a script that by-passes GEMS, so election officials would be oblivious that anything had occurred.

> Harris said the problem lies in the fact that GEMS creates two tables of data that don't always match. One table consists of rows showing votes for each candidate that were recorded on voting machine memory cards at each precinct. The other table consists of summaries of that precinct data. Officials use the raw precinct data to spot-check accuracy.
>
> Harris said it's possible to alter the vote summaries while leaving the raw data alone. ... the election results that go to state officials would be manipulated, while the canvas spot check performed on the raw data would show that the GEMS results were accurate.
>
> ... Harris said it's possible to change the voting summaries without using GEMS by writing a script in Visual Basic -- a simple, common programming language for Windows-based machines -- that tricks the system into thinking the votes haven't been changed.[102]

Alterations are even possible remotely, as the RABA Technologies team proved in Maryland.

> The team was able to remotely upload, download, and execute files with full system administrator privileges. Results could be modified at will, including changing votes from precincts. [103]

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[100] http://www.chuckherrin.com/evotingquestions.htm

[101] Photo of the wireless port on the Diebold DRE: http://www.truevotetc.org/Photo+Gallery/63.aspx

[102] **Activists Find More E-Vote Flaws.** Wired News. September 22, 2004. By Kim Zetter http://www.wired.com/news/evote/0,2645,65031,00.html

[103] **Even a Remote Chance?** January 10, 2005. By Pokey Anderson. http://www.votersunite.org/info/evenaremotechance.htm

Administration Complexities

Chain of Custody Complexities Increase Exponentially with Electronic Data

Election Equipment

When votes are cast on paper ballots, they are placed into a ballot box. Carefully developed custody procedures have been in place for decades to ensure the security of the paper ballots – before they are counted and afterward in case a recount is needed.

Custody procedures become significantly more complex when electronic equipment is used in elections. All election equipment must remain secure before and after the election – DREs, optical scanners, control modules, ballot cards (see page 36), and all other software and hardware used in the election process. Procedures for protecting electronic voting equipment are just now being developed. There has not been time to refine them. The current procedures are complex and, even if they were adequate, they are often not used in accordance with the law.

- Each DRE and precinct optical scanner is a ballot box that must be empty before the election begins and safeguarded to make sure it remains empty. Each one, after being tested and zeroed out, must remain secure until election day.[104]
- Each DRE, precinct optical scanner, and control module also contains a portion of the electronic counting process — the software. Once officials are certain that certified software is installed, every single DRE and precinct optical scanner must be secured to ensure that the software contained on it is not illegally altered between elections.
- Each DRE also contains the software that selects and builds each voter's ballot from the information contained on the access card. That software, too, must be safeguarded from tampering before the election.
- When machines break down during an election and are removed from service, the chain of custody must be maintained.

Election equipment is particularly vulnerable to tampering after it has been tested but before it is used. For example, San Diego county allowed precinct workers to take the electronic machines home with them after the training program (up to a week before the election) so they would not have to pick them up the morning of the election. [105]

As Pam Smith of VerifiedVoting.org pointed out:[106]

> In spite of the vulnerability of Diebold's electronic voting system, the registrar sent computerized voting machines, cards, keys and card encoders to be stored in poll workers' homes before the election, secured only by easily removed stickers and flimsy plastic zip-ties.
>
> In one precinct observed by SAVE-Democracy's poll watchers, these security stickers had never even been placed over the memory card ports ---- where votes are stored ---- as they should have been.
>
> Poll workers were given extra zip-ties to hold the machines and key-card pouches closed. These were not inventoried and apparently were not even inspected, so no one knows if machines were tampered with.

---

[104] Officials cannot **directly** ensure that the memory cards have no ballots cast on them. They can only trust the report from the software, which could contain errors or malicious code. (See page 27.)

[105] **County ordered to offer voters paper ballots.** North County Times; February 12, 2004; By Gig Conaughton. http://www.nctimes.com/articles/2004/02/13/news/top_stories/2_12_0422_53_18.txt

[106] **Electronic voting was a fiasco.** North County Times; February 12, 2004; By: Pamela Smith - Commentary http://www.nctimes.com/articles/2004/03/16/opinion/3_15_0422_26_59.txt

The Electronic Ballot Box

Using electronic voting machines does not eliminate the need to track and preserve the physical records of votes. When DREs are used, the physical records are in the form of ballot memory cards rather than paper ballots. Unlike paper, the ballot cards are not a permanent form of storage since the data can be erased or overwritten; thus, the level of security required is even higher. This means that new procedures for electronic elections must be strictly followed, in addition to procedures similar to the old ones when paper ballots were used.

Note also that the loss, damage, or tampering of a ballot card is comparable to the loss, damage, or tampering of a ballot box, since each card contains hundreds or even thousands of votes. Since each memory card is about the size of a stack of five credit cards, they are much more challenging to track and protect than a ballot box. It would be very easy for cards to be lost or removed without detection, as they were in San Joaquin County, California:

> Hundreds of electronic ballot cards were lost Tuesday in San Joaquin County, left at a warehouse where elections' officials later discovered them, the registrar of voters acknowledged.
>
> Election workers found eight metal cases containing ballots from eight precincts at the Stockton warehouse after precinct officials boxed the ballots instead of handing them to elections officials, Registrar of Voters Deborah Hench said.
>
> ... Precinct officials reported a "mile of cars" waiting to turn in ballots at the warehouse, one of four buildings to which ballots could be brought. **At least one official said he took ballots home and returned later to deliver them.**[107]

Many election officials — though wise in the ways of paper — do not understand the software concepts behind the procedures established for electronic equipment, and they may not be prepared to make impromptu decisions about safeguarding electronic equipment if an unusual circumstance occurs. In Collin County, Texas, for example, when an electronic ballot box refused to give up its data, election officials sent it to Canada to have the data retrieved (see page 12.)

Increased Problems from Human Error in Electronic Elections

While many have advocated computerized elections as a way of reducing human error, the fact is that human error may be increasing because of the new and complex problems they present to voters and poll workers, as well as election directors.

It is important to realize that experienced software designers expect users to make errors. Therefore, well-designed programs include lots of error-handling instructions for the sole purpose of ensuring that user errors will not waste the users' time or destroy the users' data — thus the "undo" command that is available in nearly every program marketed today. **If a user's error can cause a disaster, then the fault lies in the program design, not with the user**.

Hundreds of voters have been disenfranchised or voted on the wrong ballots because trained poll workers had difficulty with the computerized systems. Freddie Oakley, Clerk/Recorder in Yolo County, California, suggests one source of the problem:

> I'm not persuaded that the pollworker's job is ever to administer an information technology system. The poll worker's job is to be a witness to fair elections, and a witness to accurate elections.[108]

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[107] **Electronic S.J. ballot cards lost.** The Stockton Record (San Joaquin County); March 4, 2004; By David Siders. Excerpt reproduced on http://www.calvoter.org/news/blog/2004_03_01_blogarchive.html

[108] Interview with Freddie Oakley, Yolo County (CA) Clerk-Recorder. May 2004. By Pokey Anderson for Pacifica.

Neither should voters be disenfranchised by their inability to use an information technology system. However, they have been. For example:

Palm Beach County, Florida. October 2004. Sequoia Edge DRE.[109] After a woman finished voting, she realized the touch-screen hadn't given her the option to vote on the two referendums for Boca Raton or for state House District 87. She was given the wrong ballot because the computer was programmed for the wrong ballot, but she can't re-vote.

Orange County, California. March 2004 [110]
Poll workers, responsible for giving each voter a four-digit code to enter into the voting machines, gave thousands of voters the wrong ballots.

Adams County, Colorado. October 2004.[111] Many Denver voters left in frustration when poll site officials were unable to connect their laptops to the central voter registration database to verify the voters.

Roanoke, Virginia. November 2004. WinVote. [112] Some ballots were voided because voters left machines before pushing a flashing red button to record their votes.

Even election directors continue to encounter new and unexpected problems as they learn to use their electronic election equipment.

Elko County, Nevada. December, 2004. Sequoia Edge DRE.[113] A month after the election, it was discovered that 271 votes had not been retrieved from the memory cartridges and were never counted.

I spoke with Elko County Clerk Win Smith and discovered that the voting machines had been left in test mode on election day, so the upload process had disregarded the votes. Problems had occurred with those machines and cartridges on election day, but Ms. Smith and her staff didn't understand their significance, since they had received no training on using the machines before the election.

Bernalillo County, New Mexico. October 2004. Sequoia Edge DRE.[114] County Clerk Mary Herrera acknowledged that "phantom votes" (more votes than voters) had appeared in the last three elections, ever since she "upgraded" to the new version of WinEDS (Sequoia's election management system). She claimed her staff has always managed to remove the bogus votes before the final tally. Refer to page 6 for an overview of the 8,656 phantom votes reported by Bernalillo County in November 2004.

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[109] **Balloting Blunders.** Boca Raton News. October 30, 2004. By Dale M. King. http://www.bocaratonnews.com/index.php?src=news&category=Local%20News&prid=9999

[110] **7,000 Orange County Voters Were Given Bad Ballots.** Los Angeles Times; March 9, 2004; By Ray F. Herndon and Stuart Pfeifer, Staff Writers. Reproduced at: http://www.votersunite.org/article.asp?id=2389

[111] **Early Voting Begins In Colorado.** October 18, 2004. By Steven K. Paulson, Associated Press Writer. http://news4colorado.com/campaign2004/local_story_292161858.html

[112] **Back up! We need back up!** Roanoke.com. November 11, 2004. By Brian Gottstein. http://www.roanoke.com/columnists/gottstein/13719.html

[113] **Missing votes found in machines.** Elko Daily Free Press. December 8, 2004. By Dave Woodson, Staff Writer. Reproduced at: http://www.votersunite.org/article.asp?id=4147

[114] **County clerk say phantom votes won't be a problem.** KRQE Albuquerque. October 26, 2004. Reproduced at: http://www.votersunite.org/article.asp?id=3421

Violation of Ballot Secrecy with the Use of DREs

Voters in many states have complained that DRE voting systems do not provide adequate ballot secrecy. There are no voting booth curtains, DRE voting displays are nearly vertical, and in many cases, voters voting on adjacent DREs or other voters waiting in line could view their selections.

In other cases, when voters encounter a problem in mid-ballot and called for the assistance of a poll worker, they often have to give up the secrecy of their ballot in order to page back and forth through their electronic ballot to demonstrate the problem to the poll worker.

> Michael Cadigan, president of the Albuquerque City Council, had a similar experience when he voted at City Hall. "I cast my vote for president. I voted for Kerry and a check mark for Bush appeared," he said. He reported the problem immediately and **was shown how to alter the ballot.**[115]

> Voter David Solomon at the Good Hope Community Center in Montgomery County [Maryland] tried twice to vote for his preferred candidate, but each time the "X" appeared next to another candidate's name. **After getting the assistance of an election judge**, he tried a third time and believes he was successful—but is not certain. [116]

Running an Electronic Election - a Ballot Judge's Summary

Because the systems are complex and confusing, one of the challenges of using electronic voting equipment is recruiting and training poll workers. Here is part of an edited description of one ballot judge's training experience in Montgomery County, Maryland. As his parenthetical remarks so clearly point out, the challenge is increased by the fact that the systems are new and the inexperienced trainers are teaching new procedures.[117]

> Before the use of electronic "machines", voting volunteers arrived at 6:00 at the polling sites to set up the mechanical ones. Now, volunteers are asked to meet the day before elections (**new**) for some additional set up duties. On the actual voting day, volunteers will do much of the same as they previously did except for those new functions that result from using the new electronic equipment.
>
> The new "machines" now have a plastic seal which needs to be broken (**new**) to assure the absence of tampering. Previously, no seal was used or necessary. Seal numbers now must be recorded (**new**) on a control sheet (**new**), put into a plastic zipper bag (**new**), and returned (**new**) to the Board of Elections, presumably for validation and cross checking. A tally sheet (**new**) also needs to be stuck to the side of each "machine" (**new**) for use as voters are escorted (**new**) to the "machines". That has implications to be explained later.
>
> The "machine" is plugged in and turned on - it has a battery pack should there be a power failure. The Chief Judges come with a key (**new**) open the gates to the hard drives (**new**) and record the data from each (**new**), presumably the number of the drive, perhaps the count on the "odometer" and the count on the "counter" for the day's tallies. They will do the same at the end of the day (**new**), all this for "security." Note that all functions described are done "in tandem", that is by two people, each representing one of the major parties, again for "security".
>
> ... Any way you look at it, the introduction of the "machines" has complicated the voting process and increased the workload of the volunteer staff.

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[115] **Some Early Voters Say Machines Mark Incorrect Choices.** ABQJournal. October 22, 2004. By Jim Ludwick, Journal Staff Writer. http://abqjournal.com/elex/246845elex10-22-04.htm

[116] **When the Right to Vote Goes Wrong.** TrueVoteMD. November, 2004. http://www.truevotemd.org/Election_Report.pdf

[117] Jaime Manzano, Bethesda, Maryland

Running an Electronic Election – an Election Official's Report

The official report on San Diego's use of touch screens (DREs) on Super Tuesday (March 2004) shows increased need for poll workers, poll worker training, machine testing, pre-election education, and poll-worker support on election day.

The following excerpts are taken from the official San Diego County polling report released after the California primary on March 2, 2004. They show that the effort involved in running an election is significantly increased by the use of touch screen voting machines. (Bold highlighting has been added to notable comments.) [118]

Recruitment of Poll Workers

Because of the move to the new voting system, the Registrar of Voters recruited **600 more poll workers than in past elections.** A new County employee poll worker program was implemented, and approximately **900 County staff served in key poll worker positions** throughout the day.

Training of Poll Workers

In prior elections, two poll workers – a Precinct Inspector and Assistant Precinct Inspector – were trained on the voting equipment, election processes and the legal aspects of operating the polls. Because of new procedures and requirements for the touch screen machines, two more positions were added – the Systems Inspector and the Systems Assistant – who were responsible for the set up and operation of the machines.

Each of the more than 3,200 Systems Inspector and Assistant Systems Inspector received 2-1/2 hours of hands-on training specifically on setting the equipment up, creating voter access cards, logging into the card-encoding devices, use of the touch screens, and closing down the equipment at the end of election day.

The Precinct Inspector and Assistant Precinct Inspector [3,200 of them] received two hours of training on the election processes and the legal aspects of operating the polls...

Testing of Equipment

All 10,200 touch screens and 1,700 Precinct Control Modules underwent acceptance testing at the Registrar of Voters.

Troubleshooter Hotline and Other Phone Support

The Registrar of Voters had the following phone support available to answer questions from the polling places:

- 11 troubleshooter hotline phones. All poll workers were provided with this phone number.
- 12 direct lines to recruitment staff that had been working with the poll workers during the weeks and months prior to the election.
- 38 Registrar of Voters phone bank lines that supplemented the other lines during the peak incident period.
- 10 dispatch phones for communicating with Supervising Troubleshooters.
- 26 Supervising Troubleshooters. Diebold also had 12 staff at the Registrar's office to assist with technical support and to address systems questions.

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[118] **Correspondence, written report regarding Touchscreen voting system used for the first time March 2, 2004 by the County of San Diego.** From: Walter F. Ekard; Chief Administrative Officer http://www.signonsandiego.com/news/politics/county/20040310-1315-report.html

Field Support

> The Registrar of Voters recruited 26 Supervising Troubleshooters, who were available in the field from 5:30 a.m. until the polls closed on Election Day. These Supervisors were coordinating and working with approximately **200 Rovers who were supplied by Diebold,** each assigned to monitor a set of polling places in their designated area. Rovers began making their rounds at 5:30 a.m. as well.[119]

Outreach/Public Education

> The Registrar of Voters made a significant effort to educate the public on the use of the new system. A public education campaign was developed with the help of the contractor. This included a web site, educational brochures and other written materials, and an instructional video. Additionally, teams from the Registrar of Voters demonstrated the equipment at shopping malls and at community meetings throughout the county during the months preceding the election. More than 60 demonstrations were conducted, reaching more than 5,000 voters.

Election Day

> Each polling location received four to eight Diebold TSx touch screen voting machines, based on the number of registered voters, and a Precinct Control Module (PCM). The system used in this election uses an encoded card to give voters access to their appropriate ballot on the touch screen machines. These access cards are encoded by the PCM. The encoded card is then inserted into one of the voting machines to activate the appropriate ballot for each individual voter.
>
> Early on election morning poll workers at each polling site removed the PCM from its sealed case and set it up. **At approximately 40% of the sites, poll workers found that the machine did not display the expected login screen.** Some of the more computer-savvy poll workers were able to maneuver through a series of screens until they found the specific login screen upon which they had been trained. Other poll workers did not, as they had only been trained with the expected screen. Therefore, they were not able to perform the card-encoding function. **Without the ability to encode the electronic ballot cards at those polls, voters could not vote.** There were no back-up paper ballots at the polling locations. Provisional ballots were also electronic. Therefore, many poll workers could not open the polls for voting at 7 a.m.
>
> ... At 7 a.m. 64% (1,038 of 1,611) of polling sites were operational. By 8:00 a.m., 88% (1,419) were open and by 9:00 a.m., 98% (1,580) were open. Before 10:00 a.m., 21 more polls were open. Nine additional polls were open after 10 a.m. and the one final poll opened at 11:05 a.m.

Rovers were available to help starting at 5:30, and some estimates indicate that the problem may have occurred at as many as 80% of the precincts.

Preliminary Findings

> Most aspects of the March 2 election went very well. ... However, there were problems that must be addressed. Most importantly, there was a significant and unexpected problem, which resulted in the delayed opening of 573 out of 1,611 polling places. This inconvenienced many voters, some of whom returned later or went to another polling site, and some who were unable to return at all to vote. **There is no method to accurately measure how many voters were unable to vote.**

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[119] All vendor technicians are paid by the county for their services and their travel, adding significantly to the cost of the election.

Technical

> **Approximately 40% of the PCM devices failed to "boot-up" to the correct screen** when turned on by the poll workers. Diebold Election Systems, manufacturer of the voting machines has made a preliminary determination that the problem experienced with the PCM devices was **caused by an unexpected discharge of the internal battery.** This loss of power caused an unfamiliar screen to come up for poll workers upon start up ...
>
> **The possibility of this large-scale hardware problem was not anticipated by the manufacturer**.[120] However, it was determined to be a possibility on a smaller scale and 26 supervising troubleshooters were armed with the remedy, as they were for other potential issues that might arise.
>
> Technical support in the field was not consistent in that some precincts received support, and others never received a visit from their roving support person.

Management Complexities

Saving Money by Combining Precincts May Decrease Voter Turnout

Some counties are combining precincts to reduce the number of polling places. The reason for combining is two-fold. When county officials first consider the cost of the new electronic voting machines, they realize how much it is going to cost and try to save money by buying fewer machines. One way is to combine precincts, increasing wait times as well as voter confusion.

After the first election with the new machines, they realize that they now need twice the number of poll workers they did before they used the complicated new systems. So they consider combining more precincts to cut down on the cost of poll workers and training.

Every time a polling place is closed, voters must go somewhere else to vote. This causes some confusion and, in many cases, forces voters to travel further to vote. Comfort levels go down, and some citizens don't bother to vote.

Potential DRE Problems Inherent in Electronic Devices[121]

Touch Screen Misalignment

The sensors in touch screen devices can be knocked out of alignment by shock and vibration that may occur during transport. Unless these sensors are realigned at the polling place prior to the start of voting, touch screen machines can misinterpret a voter's intent. For example, a voter might touch the part of the screen identified with candidate Jones, but candidate Smith's box would light up instead.

Such vote-jumping problems have occurred on touch screens for years. The problem was reported in a dozen counties across the country during the 2004 general election. See page 8 for examples.

Diebold, ES&S, and Sequoia products all use resistive touch screens. The longest warranty provided for a resistive touch screen is five years.[122]

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[120] The manufacturer's official claim is contradicted by the testimony of James Dunn, a Diebold technician, who told the California VSSP that battery problems plagued the pre-election testing. **Meeting: State Of California Secretary Of State Voting Systems And Procedures Panel.** Wednesday, April 21, 2004. Transcript:, page 77-80. http://www.ss.ca.gov/elections/vsptranscript0421.pdf

[121] Much of this section is based on information compiled by Robert Kibrick, research astronomer for the University of California Observatories/Lick Observatory; see http://voting.idlecircuits.com/

Power Surges or Static Electricity Discharges

Like any computer or electronic system, touch screen voting machines could be disturbed by power surges or static electricity discharges, such as those that sometimes occur during lightning storms. Such interference could cause votes already cast to be lost or a voting station to become inoperative. Although touch screen machines are required to meet certain specifications regarding immunity to electrostatic discharges, during conditions of severe weather such discharges might exceed the specified limits.

Electrical Outages and Inadequate Battery Charges

Most touch screen voting machines have backup electrical power that is provided by means of an internal, rechargeable battery similar to those in a small Uninterruptible Power Supply (UPS). These batteries, if fully-charged, are intended to provide several hours of backup power, so that power outages of moderate length should not impact the operation of the voting machine.

Unfortunately, on the morning of an election, the batteries in these voting machines might be either partially or fully discharged. In some cases, voting machines may have batteries that are no longer able to take a charge if the machines have been stored for long in an unpowered state.

Many of these machines use sealed lead acid batteries, which will discharge over time. The longer they remain uncharged, the less able they are to be fully recharged. The lifetime of such batteries is significantly degraded if they are not recharged on a regular basis. Anyone who leaves a car undriven for months at a time is likely to find that car with a dead battery that may refuse to hold a charge. The same concept applies to touch screen voting machines that employ lead acid battery technology and which are left for months at a time disconnected from electrical power.

> Arapahoe County will spend an extra $100,000 on Tracy Baker's recall election, because nobody bothered to charge the batteries in county voting machines.
>
> County commissioners blame Baker, the clerk and recorder, who oversaw the machines as they sat unplugged and their power seeped away. Baker blames commissioners, saying they took away his ability to charge the machines by placing an elections worker on administrative leave.
>
> Ed Bosier, the county assessor put in charge of the recall, won't blame anyone. But he said Wednesday that the cost of replacing 800 batteries - which can't be recharged once they've died - will probably push the price of the election over $400,000.
>
> ... Bosier, who discovered the dead batteries in October and ordered them replaced in time for the recall, said new batteries will cost about $80,000. Installing them, county officials say, will cost around $15,000 more.[123]

To ensure that the batteries of touch screen voting machines will be fully charged on the morning of an election, in the days or hours before the polls open election officials need to test every touch screen voting machine in their inventory to:

- Verify that the battery in each unit is still able to take a charge, and if not, replace it with a new battery,
- Verify that the battery-recharging electronics in each voting machine are operating correctly and are able to charge the battery, and
- Verify that the battery in each voting machine is fully-charged before the polls open.

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[122] http://www.elotouch.com/products/accutec/accben.asp

[123] **Getting zapped for vote. Clerk's recall election $100,000 pricier after batteries for voting machines lose juice.** Rocky Mountain News; February 5, 2004; By Jim Tankersley, http://www.rockymountainnews.com/drmn/election/article/0,1299,DRMN_36_2631038,00.html

If such precautions are not taken (and it is likely that they will not, given the level of manpower required to carry them out), the batteries in these voting machines will not provide the number of hours of backup power advertised in the vendors' specifications. Thus, should a power outage occur during an election, it is likely that many of these voting machines may become unusable because their batteries will not have sufficient charge to keep them operating during the outage.

For example, in Solano County, California, on March 2, 2004, Diebold TSx voting machines were daisy-chained together and plugged into a single outlet. While this is handy for charging batteries during storage and keeping cables to a minimum during elections, it places a high load on the circuit. The overloaded circuit breaker shut off, and the machines kept running on batteries. Since it affected only the single circuit, poll workers didn't notice the problem. After three hours, the batteries ran down and all the machines shut off. The poll workers called the Fairfield headquarters and were told to hand out provisional ballots until the circuit was reset and the machines were re-started.[124]

In those cases where a battery has been fully discharged and is unable to take a charge, if the power goes out, the voting machine may shut down without any warning. If this occurs while voters are in the midst of casting their votes, they will be left in limbo, not knowing whether or not their vote has been cast. They will have no way of finding out until power is restored, and it is unlikely that they will be able to remain at the polling place waiting for that to happen. The votes of such voters will thus likely be lost.

Maintenance Challenges

As touch screen voting machines age, like all electronic equipment, they will inevitably develop maintenance and reliability problems. This will require more technically savvy election workers at each polling place, that is, workers who have the skills needed to troubleshoot and respond to such problems. Already, many localities are having difficulty finding adequate numbers of temporary workers to operate their polling places.

While some elections officials may argue that touch screen machines will be easier for poll workers to deal with than optical scan paper ballots, it is simply not true that a malfunctioning touch screen machine will be simpler to deal with than a marking pen that has run out of ink.

Rapid Obsolescence and Toxic Waste Disposal

Given the rapid pace at which computer technology advances, touch screen voting machines will become obsolete and potentially unmaintainable within a few years. When that occurs, they will be expensive to replace, and funds may not exist at that time to help counties bear the cost.

When touch screen machines are retired from service, like any other computer, they represent a toxic waste disposal problem. Unlike optical scan ballots, they can't be readily recycled. While the volume of toxic waste generated by the disposal of touch screen machines represents a small fraction of the total, nevertheless it is an issue to consider when selecting a voting system, especially since there are less toxic alternatives.

Rechargeable batteries in these touch screen voting machines will wear out and require replacement. This adds to the long term operating and maintenance costs for these voting machines. These expended batteries will also present a toxic waste disposal issue. While small in magnitude when compared to the number of car batteries that are disposed of every year, the problem of voting machine battery disposal is not incurred by alternative voting technologies such as optical scan ballot cards.

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[124] **Registrar says electronic vote went smoothly.** Times-Herald; March 4, 2004; By Matthias Gafni, Times-Herald staff writer. http://www.verifiedvoting.org/article.asp?id=1428

5 HAVA-Compliant Alternatives to Paperless Voting

Voter-Verified Paper Audit Trail (VVPAT)

While some states, such as Maryland and Georgia, now have election systems that are fully paperless DREs, there is a great deal of resistance to paperless voting on many fronts. Many officials and citizen groups are strong advocates of using only paper records of the vote that voters have reviewed and approved (voter-verified paper audit trail, or VVPAT) to provide evidence of the voters' intentions and allow for a meaningful recount.

Legislation and executive orders requiring VVPAT also require the availability of ballots on which disabled individuals can vote without assistance.

As Susan Nielsen, Associate Editor of The Oregonian says, "It's not because they distrust technology. It's because everything in democracy needs checks and balances. And every vote, whether for local sewer commissioner or national president, needs to be counted openly. Not tallied and zapped."[125]

- **Federal legislators:** There is growing support nationwide for federal legislation that would require all voting systems to provide a voter-verified paper record of all votes. As of October 8, 2004, 192 members of the U.S. House of Representatives (over 44% of its members) and 20 members of the U.S. Senate, including Democrats, Republicans, and Independents, have cosponsored a requirement that all voting systems provide a VVPAT by 2006 or sooner.
- **State legislators:** In the last two years, bills aimed at ensuring a VVPAT on election equipment have been introduced into 22 states and passed in six states.[126] In April of 2004, Vermont banned paperless voting altogether by passing a bill that includes this sentence. "No voting shall occur in any general election which does not use printed ballots."[127]
- **Chief election officials:** Officials in at least eight states[128] have declared that they will insist on a voter-verified paper audit trail for elections in their states. Some say that since there is time before the HAVA deadlines, they are waiting for the development of a technology that gives them and their constituents confidence in the election outcomes.
- **Citizen organizations:** Coalitions of concerned citizens have formed in at least 30 states for the sole purpose of working for verifiable elections in their states.[129] Several national organizations are dedicated wholly to this same goal, and others are forming departments to work in various ways toward verifiable elections across the country.

However, even a VVPAT cannot prevent voters from receiving and accidentally casting an incorrect or incomplete ballot — a problem that has occurred in many recent elections (see pages 9 and 14 for examples). Nor can VVPAT avoid the ballot secrecy violations that occur when a voter must call a poll worker to help with a malfunctioning DRE (see page 38).

Many Americans, discouraged by the multitude of problems that have come to light as election equipment has come under recent scrutiny, are advocating the exclusive use of optical scan equipment or even a return to the simplicity and verifiability of paper ballots, hand counted.

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[125] **An America where votes disappear.** April 4, 2004. http://www.oregonlive.com/news/oregonian/susan_nielsen/index.ssf?/base/editorial/1080997122176372.xml

[126] http://verifiedvoting.org/article.php?list=type&type=13

[127] S.202 — http://www.leg.state.vt.us/docs/legdoc.cfm?URL=/docs/2004/acts/ACT094.HTM

[128] California, Missouri, Montana, New Hampshire, Nevada, Oregon, Vermont, West Virginia

[129] http://www.votersunite.org/info/groups.asp

Precinct-Count Optical Scan Systems [130]

Optical scan ballots are printed on card stock. Ballots can be available in different languages as needed. Voters cast their votes by filling in the "bubbles" or connecting arrows on optical scan ballots. Voters use lightweight, portable voting booths to afford privacy while voting. These are available in heights to accommodate standing voters as well as ADA-compliant wheelchair-height versions. [131]

Once voters complete their ballots, they insert them into the precinct-count optical scanner. Over-voted ballots are rejected, and the voter gets a fresh ballot. Blank ballots produce a warning, and the voter gets the opportunity to correct the ballot. After a ballot is successfully completed and accepted by the optical scanner, the votes on the ballot are counted into the scanner's memory, and the scanner deposits the ballot into a locked ballot box.

At the close of the polls, the optical scanner produces a printout of all of the vote totals, the totals are sent to election central, and the locked ballot box is transported to election central in case the ballots were needed for any subsequent recount or audit.

Examples Of Large States & Cities Using Precinct-Count Optical Scan

Illinois	Precinct-count optical scan systems are used by 41% of the population of Illinois voters (5 million). Will County, Illinois has posted a web page describing their rationale for choosing a precinct-count optical scan solution. [132]
Arizona	100% of the State of Arizona is using precinct-count optical scan or will soon. [133]
Michigan	The Secretary of State of Michigan has recommended that that entire State use precinct-count optical scan. [134]
Seattle	King County also encompasses the cities surrounding Seattle and has more voters than the state of New Mexico.[135]

Adding a single ballot-marking device at each polling place fulfills the HAVA requirements for accessibility to the disabled.

Two major studies of voting systems determined that precinct-count optical scan systems outperformed DRE voting machines in terms of residual voting errors and cost per voter. [136]

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[130] Examples: ES&S Model 100 precinct-count optical ballot scanner; http://www.essvote.com/HTML/products/m100.html

Diebold Election Systems AccuVote-OS; http://www2.diebold.com/dieboldes/accuvote_os.htm

Vogue Election Systems AutoScan; http://www.vogueelection.com/products_autoscan.html

[131] Example: Vogue Election Systems Vogue-I voting booth. http://www.vogueelection.com/products_votingbooth.html

[132] http://www.willclrk.com/votingsystem.htm#Why%20was%20the%20optical%20scan%20system%20selected?

[133] http://www.azsos.gov/releases/2003/pressrelease46.htm

[134] http://www.michigan.gov/sos/0,1607,7-127-1640_9150-43906--M_2001_5,00.html

[135] http://www.metrokc.gov/exec/news/1998/vote421d.htm

[136] **Report on Election Systems Reform.** July, 2001. George Washington University, Institute For Communitarian Policy Studies. http://www.gwu.edu/~icps/ExecutiveSummary.pdf
"In conclusion, our analysis points to paper ballot, fill-in-the-dot, precinct-count optical mark reader systems as the clear technological option of choice on cost-benefit grounds."

Caltech-MIT Voting Technology Project: Voting - What Is, What Could Be. July 2001. http://www.vote.caltech.edu/Reports/2001report.html

Optical scan technology is a cost-effective and accountable system that meets the needs of both absentee and polling-place voters. Increasing capacity simply means adding more low-cost booths, and booths can easily be redistributed on election to decrease lines at the polls. Many believe the limited funds available under HAVA would be better spent on optical scan technology, known to be one of the most reliable voting technologies currently in use.

> After years of wrangling and protests, Secretary of State Ken Blackwell announced Wednesday that he will limit Ohio's uncompleted voting-machine conversion to a single device: the precinct-count optical-scan machine.[137]

Computerized Ballot-Marking Devices

Computerized ballot marking devices[138], which allow persons with disabilities to vote independently, can be used in conjunction with precinct-count optical scan machines. In addition to the standard touch screen interface (non-DRE), they provide an audio interface for blind, visually-impaired, or reading-impaired voters and print each voter's choices on the standard optical scan ballot inserted by the voter.

They provide over-vote and under-vote protection, thus ensuring that the optical scan ballot completed by any voter is correctly filled in. Thus, any optical scan ballot completed by the ballot-marking device will be readily accepted by the precinct-count optical scanner.

Individuals with visual impairments can use the ballot-marking device to verify their ballots. When a completed ballot is inserted, the machine reads the ballot and either displays it on the screen or provides an audio description of the votes through the headphones.

Non-Computerized Ballot-Marking Assistive Device - The Vote-PAD

The Voting-on-Paper Assistive Device (Vote-PAD) is an inexpensive, non-electronic, voter-assist alternative that helps most people with visual or dexterity impairments to vote independently. The Vote-PAD can be used in any jurisdiction. It is customized to provide access to each precinct's hand-counted or optically-scanned paper ballot.[139]

The heart of the Vote-PAD is the transparent "ballot sleeve," which encloses the ballot on both sides and reveals the content of the ballot that slips into it. The Vote-PAD is composed of one custom ballot sleeve for each sheet of a ballot. The sleeves are bound together between front and back opaque covers for privacy. A page-turning aid is attached to the outside of each page cover to assist voters with dexterity impairments in turning the pages.

Holes are cut out of the sleeve at locations where a voter can mark choices. The sleeve protects the ballot from stray marks. Raised dots attached to the sleeve beside each cutout provide tactile indications for blind voters. An audio tape interprets the raised dots so listeners know which hole corresponds to which candidate — just like the tactile ballot templates used in Rhode Island since 2000.

Unlike voter-assist methods that only offer audio for blind voters, the Vote-PAD can be accompanied by Braille instructions, thus allowing voters who are both blind and deaf to vote unassisted – an advantage neither DREs nor ballot-marking devices have. A light-sensing wand

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[137] **Ohio pulls plug on electronic voting. Blackwell opts for people filling out ballots by hand.** Cleveland Plain Dealer Bureau. January 13, 2005. By Julie Carr Smyth. http://www.cleveland.com/news/plaindealer/index.ssf?/base/news/1105612399208372.xml

[138] Examples: ES&S — http://www.AutomarkTS.com; IVS — http://www.ivsllc.com/ Avante — http://www.aitechnology.com/votetrakker2/accessible_optical_voting.html

[139] http://www.vote-pad.us/

allows voters with visual impairments to review their selections. As they replay the audio tape, or re-read the Braille instructions, they point the wand at each candidate location to receive audible feedback indicating whether or not the location is marked.

An opaque, sliding "privacy shield" sits in a pocket inside the front cover and slides part-way out to conceal the ballot as it is being deposited in a ballot box or precinct scanner.

Open Voting Consortium Software

A group of computer scientists and engineers with the Open Voting Consortium[140] is developing electronic voting software to be run on standard computers, even the older models that have been replaced by leading edge technology. Counties could rent computers for elections or use old computers stored in their basements. The software is open-source — open to public scrutiny.

OVC voting systems will accommodate different languages and scoring methods, as well as voters with special needs. The OVC will distribute the software free of charge. Following is an excerpt from a newspaper article written before a demonstration of the system in San Jose, California.

> Although it's far from a finished product, the system retains what's good about current electronic voting systems. It's voter-friendly, easier than older systems to administer, and accessible to blind voters without assistance.
>
> It also addresses the concerns of today's critics. First, it uses open-source software that's available for public inspection - eliminating the secrecy that outrages critics of today's proprietary "black box" systems.
>
> Second, the software is free and can run on a variety of computer platforms, which makes the system cheaper to acquire and maintain. Third, it creates a paper trail of printed ballots that can be counted by hand or machine in case of disputed elections - without compromising privacy for the blind.
>
> ... In the consortium's system, the voting terminal can be a touch screen like today's electronic touch-screens, with the same type of audio accessories for blind voters. But the terminal's main job, once the voter is finished, is to print a paper ballot that identifies the voter's choices - along with a bar code that records the information in computer-readable form.
>
> Once the voter is satisfied, he puts the ballot into a locked box. To verify their ballots, blind voters can hide their printed choices in a security folder and run the bar code under a verifying scanner, which reads back their votes through headphones - eliminating the paper ballot's privacy concerns.
>
> When the polls close, the ballots are scanned on a separate tabulating system. Election judges can compare the scanned totals with those stored in the voting terminals to see if there are any discrepancies. The original ballots are still available to settle disputes - and unlike scanned paper ballots in older systems, the voter's choices are always clearly marked. [141]

You can download and test the software or simply see a simulation on the Internet.[142]

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[140] "The Open Voting Consortium (OVC) is a non-profit organization dedicated to the development, maintenance, and delivery of open voting systems for use in public elections." http://www.openvotingconsortium.org/

[141] **Open system might plug up holes in the e-voting process.** Baltimore Sun; April 1, 2004; By Mike Himowitz. http://www.baltimoresun.com/technology/custom/pluggedin/bal-pl.himowitz01apr01,0,4595991.column?coll=bal-pe-pluggedin

[142] http://gyaku.pair.com/~vote/ballot.html

DREs with Integrated Printer for Printing Voter-Verified Paper Records

Like a DRE, a touch-screen voting machine with an integrated VVPAT printer[143] prevents over-voting and warns about under-voting as well as providing an audio interface for blind, visually-impaired, or reading-impaired voters. It provides an accessible voter-verified paper audit trail (VVPAT) printer, with an audio read-back capability for those voters.

Some manufacturers of paperless DRE systems are developing add-on printers to provide VVPAT. Sequoia Voting Systems now offers their "Veri-Vote" system, which was used by half the population of Nevada in the 2004 general election. Questions remain about whether the printout matches the electronic record of the vote, since in an August 2004 demonstration of the system to California lawmakers , the printout did not match the vote that was cast.[144]

Ballot Integrity Project Proposal

In their common belief that "Accuracy can only be assured through publicly observed hand counts of all ballots cast," an organization called the Citizens for Election Integrity are advocating a return to paper ballots, hand counted.[145] The group's long term goal is stated below.

> American election history has demonstrated the poor reliability of vote counting machines. More serious than frequent accidental counting errors is the threat of intentional vote fraud. Computer technology now makes possible massive vote fraud that is often undetectable. American democracy will never be secure as long as votes are counted inside black box machines.
>
> It is therefore recommended that all U.S. elections be conducted under the following conditions:
>
> 1. All votes cast on paper ballots having legal vote status.
> 2. Upon close of polling place, immediate hand count of all paper ballots in public view.
> 3. Upon completion of hand count, vote totals recorded immediately in triplicate on official report forms and signed by all election officials present.
> 4. One official report form posted immediately on wall of polling place.
> 5. Two remaining official reports and sealed ballot box delivered immediately to appropriate election authorities.
> 6. All paper ballots retained by election authorities in secure location until statute of limitation expires.
> 7. Publicly funded nonpartisan exit polls conducted and reported on Election Day for all federal, state and other key elections.
> 8. Computerized voting machines producing a voter-verified paper ballot may be used in addition to, but not in lieu of, a manual parallel accounting control system.

This group's proposal underscores the severe concern many Americans now have about electronic vote-recording and tabulation. Since the proposal addresses tabulation only, the paper ballot recommendation could easily allow independent voting for the disabled if the voting systems offered optical scan ballots with a ballot-marking device or the Vote-PAD.

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[143] Examples: Avante, http://www.aitechnology.com/votetrakker2/home.htm and AccuPoll, http://www.accupoll.com/ and TruVote, http://www.truvote.com/

[144] **Wrong Time for an E-Vote Glitch.** Wired News. August 12, 2004. By Kim Zetter. http://www.wired.com/news/evote/0,2645,64569,00.html?tw=wn_tophead_2

[145] **The Ballot Integrity Project: Proposal for the Creation of a National Task Force.** March 29,2004; By Citizens for Election Integrity http://www.wesavedemocracy.org/docs/BIP_TF-proposal_reviewed_032904.doc

6 HAVA-Compliant Voting System Costs

DRE Systems

The capital costs of DREs vary, depending on the contract. The following examples are partial costs, since the primary sources were newspaper reports that didn't mention items such as training, maintenance, additional peripherals, and software.

Best Price in Nation Guaranteed to Ohio by Three Vendors

Ohio has signed contracts with Election Systems and Software, Diebold Election Systems, and Maximus/Hart Intercivic/DFM Associates to provide voting equipment for the state. "[Secretary of State Kenneth] Blackwell estimated that at least three electronic voting devices or one optical scan device would be needed at each of the state's 11,434 precincts."[146]

In the contracts, the vendors agreed to sell their products to Ohio at the lowest prices in the nation and with the best warranty, service, and maintenance terms. If any of the three vendors sell at a lower price to other states, **Ohio receives a discount**. Article excerpt:

> "We have a few things in our contract that benefit the state and taxpayers" that Sequoia did not agree to, LoParo said. "We were able to negotiate for the best pricing in the nation for election systems, and included in that pricing was the best warranty terms, best service and maintenance terms vendors have ever agreed to.
>
> One of the issues Sequoia did state to election officials is they didn't want to be tied to Ohio's low prices.
>
> "We also have the stipulation if they offer another government entity a price that is lower than Ohio, they would have to give Ohio a discount."
>
> Blackwell's office also retained the right to terminate the contract. [147]

The contracts call for the following prices for each machine:

Manufacturer	Model	Price Each	3 DREs each in 11,434 precincts
Diebold	AccuVote-TS	$2,964	$101,671,128
ES&S	iVotronics	$2,896	$99,338,592
Hart Intercivic	eSlate 3000	$2,997	$102,803,094

[Note: Citizen groups like CASE Ohio forced this March 2004 contract to be reconsidered and managed to delay implementation of DREs. In January 2005, Blackwell chose optical scan for Ohio, and limited counties' choices to two vendors, ES&S and Diebold.[148]]

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[146] **Three companies sign contracts to sell machines.**
San Jose Mercury News; Feb. 09, 2004; Associated Press
http://www.mercurynews.com/mld/mercurynews/news/politics/7913465.htm

[147] **County to choose voting system; Three companies selected as eligible vendors**
Newark Ohio Advocate; February 11, 2004; By Lachelle Seymour, Advocate Reporter
http://www.newarkadvocate.com/news/stories/20040211/localnews/394868.html

[148] **Ohio pulls plug on electronic voting. Blackwell opts for people filling out ballots by hand.** Cleveland Plain Dealer Bureau. January 13, 2005. By Julie Carr Smyth.
http://www.cleveland.com/news/plaindealer/index.ssf?/base/news/1105612399208372.xml

Diebold DRE Price for San Diego

San Diego County paid approximately $3,040 per Diebold DRE, to include a printer. The printers are yet to be supplied.

> San Diego County spent about $31 million to buy 10,200 Diebold AccuVote-TSx touch-screen machines.[149] Diebold agreed to upgrade the machines to include a printer that would print a voter-verifiable paper record, at no additional charge.[150]

Additional costs for San Diego included, among other items:

One Precinct Control Module for each of the 1,611 precincts	$2,125 each =	$3,423,375
Thirty early voter vote-card encoders	$495 each =	$14,850
Four central optical scan machines for absentee ballots	$60,000 each =	$240,000

Diebold DRE Price for Maryland

Purchasing 16,000 machines for $55.6 million, Maryland paid approximately $3,475 per Diebold DRE, not including a printer.[151] This figure, presumably, also includes similar additional costs.

Increased Cost Per Ballot when DREs are Used

One of the arguments made in support of paperless touch screen voting machines is that they will save jurisdictions money by reducing the amount spent on printing and distributing paper ballots. But ballots must still be provided for absentee voting and provisional voting, and ballots are typically provided at polling places in case of equipment failure. So, the use of DREs does not eliminate the costs associated with printing ballots; it merely reduces the number of ballots that must be printed.

Regardless of the number of ballots printed, these costs remain the same:

- The labor cost of designing and laying out the ballot.
- The one-time printer setup charges.

Thus, while the use of DREs may reduce the total cost of printing paper ballots, the cost per ballot for printing absentee ballots and extra ballots is actually higher. In addition, cost breaks for large orders are reduced, further increasing the cost per paper ballot.

Hidden Costs of DREs

Because of the many hidden costs of DREs, any anticipated costs savings from their purchase and use are likely to prove illusory. Given that the initial capital outlay to acquire such machines can be two to three times more expensive than a comparable optical scan voting system, the

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[149] **County priming public on new voting machines.**
San Diego Union Tribune; February 29, 2004; By Luis Monteagudo Jr. staff writer
http://www.signonsandiego.com/news/metro/20040229-9999-news_1m29voting.html

[150] **County proceeds on touch-screen voting machines.**
San Diego Union Tribune; November 26, 2003 ; By Helen Gao, staff writer
http://www.signonsandiego.com/news/metro/20031126-9999_7m26vote.html

[151] **Hi-tech voting machines 'threaten' US polls. Scientist warns that electronic votes cannot be safeguarded.** The Guardian; Monday February 16, 2004; Tim Radford and Dan Glaister
http://www.guardian.co.uk/uselections2004/story/0,13918,1149135,00.html

Campaign for Verifiable Voting in Maryland to Karl S. Aro, Department of Legislative Services, Annapolis, MD, Page 2; http://www.truevotemd.org/2003-12-22_Karl_Aro_Letter.pdf

deployment of touch screen voting machines to meet the needs of able-bodied voters appears to be an extravagant use of public funds.

The hidden costs could easily negate (and overwhelm) any savings achieved from printing fewer paper ballots. Among these hidden costs are:

1. Increased costs for secure and environmentally-controlled storage for these machines when they are not in use.
2. Increased energy costs for keeping the backup batteries charged between elections.
3. Increased labor costs for security when these machines are stored overnight at the polling place before an election.
4. Increased costs for hardware maintenance and software upgrades for each of the thousands of such machines for a typical large county.
5. Increased costs for expendable parts, including the backup batteries and smart cards used by these machines.
6. Increased labor costs for verifying that each machine has the correct version of the software and firmware installed immediately before the start of every election and again immediately after each election is concluded.
7. Increased labor costs for individually performing logic and accuracy tests on every one of thousands of machines prior to the start of every election and again immediately following each election.
8. Increased labor costs for hiring additional poll workers (San Diego doubled the number of poll workers when it switched to DREs).
9. Increased costs for poll worker training, both for longer training sessions and larger number of poll workers to train on using a much more complicated system.
10. Massive costs for replacing these machines when they age and the technology they employ is no longer maintainable or supported by the vendor.

Precinct-Count Optical Scan System + Ballot-Marking Device

While some jurisdictions are purchasing DREs for every booth in every polling place, it is only necessary to have one booth with full accessibility to disabled persons. A system with one precinct-count optical scan system and one ballot-marking device is much less expensive and provides the additional value of a voter-verified paper audit trail (for details, see page 45).

The equipment required for a precinct-count optical scan system is readily available from several major manufacturers of voting equipment. The cost for each polling place depends on the number of voting booths needed. The minimum number of booths would be one; the maximum would probably not be more than 10.

OS Equipment needed per polling place	Approx. Cost Each
One precinct-count optical scanner with ballot box [152]	$5,000
As many voting booths as needed [153]	$250

[152] Example: Vogue Election Systems SpaceSaver 2000, http://www.vogueelection.com/products_spacesaver.html

[153] Example: Vogue Election Systems Vogue-I voting booth http://www.vogueelection.com/products_votingbooth.html

Enhancing each polling place's optical scan system to include an accessible voting method for the disabled would only require the addition of one ballot-marking device to accommodate the needs of blind, visually-impaired, and language-impaired voters. The devices print directly onto the same ballots completed manually by other voters and fed into the optical scanner.

The AutoMARK, a ballot-marking device marketed by ES&S, was selling for about $5400 in the second quarter of 2005.[154] So, figuring approximately $5,400 for the addition of the ballot-marking device, the following table shows the cost of three sizes of polling places:

Polling Place Size	Optical Scanner	Voting Booths	Marking Device	Total
1-voting booth	$5,000	$250	$5,400	$10,650
5-voting booths	$5,000	$1,250	$5,400	$11,650
10-voting booths	$5,000	$2,500	$5,400	$12,900

Precinct-count optical scan systems can provide a significant savings over DRE systems, even considering the additional costs of printing ballots, especially when you compare them with DRE systems that have voter-verifiable printers attached.

The CalTech/MIT Voting Project report, published in July 2001, estimates that the cost of purchasing DREs **without** a voter-verifiable printer is over three times the cost of purchasing optical scanners. While the cost of operating DREs is about half the operating cost of optical scanners, it would take about 20 years of operation before the overall costs would be equivalent — and this doesn't account for the other hidden costs of DREs outlined on page 50.

The CalTech/MIT report says:

> "Even though optical scanning systems have much higher operating cost, the difference in the acquisition cost is sufficiently large that the total cost of the optical scanning system is somewhat lower over the fifteen-year operating life of the machinery. If we assume a twenty year lifespan, the costs are identical." [155]

The CalTech/MIT study determined the acquisition and operating costs per voter as follows:

Machine type	Acquisition	Operating
DRE (Touch screen)	$18-25/voter	$0.5-1/voter
Optical Scanning (in Precinct)	$6-8/voter	$1-2/voter

The Vote-PAD

This non-electronic assistive device (see page 46) can be used in conjunction with an optical scan system or hand-counted paper ballots.[156] The cost is a minimal addition to the cost of printing ballots and could provide a reasonable solution, particularly for small paper ballot jurisdictions that do not want to, or cannot afford to, computerize their elections.

The initial package costs approximately $1800 to $2200 for one polling place. This provides all necessary equipment and materials including twenty Vote-PAD booklets for use with twenty different ballots. At one Vote-PAD per polling place this would represent 20 elections or, on average, five years of elections.

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[154] The price of the AutoMARK has increased from $4,500 since the first publication of of "Myth Breakers."

[155] **CalTech/MIT Voting Project,** pages 23, 24. http://www.vote.caltech.edu/Reports/
At the time of this report, ballot-marking devices were not yet available, and voter-verifiable printers were not included in the capital costs of the DREs.

[156] http://www.vote-pad.us

Open Voting Consortium System

OVC[157] will provide free voting software that runs on standard PC hardware. In addition, each precinct needs a printer and a bar code reader. Counties may choose to install and run the software on rented equipment, or they may purchase re-marketed computers and sell them back after the election. Either way, counties avoid the costs of storage, maintenance, and toxic waste disposal of retired systems. Assuming a cost of $1,000 per computer and $200 per printer for each voting booth, and then $500 for a bar code reader, the capital cost for a 5-booth polling place would be $6,500.

DREs with Integrated VVPAT Printer

Certified systems currently available[158] are comparable in cost to paperless DREs with an attached VVPAT printer. They range from about $3,600 to about $4,200 per machine.

Estimated Capital Cost Comparison for Voting Systems

The following table shows the cost for a typical polling place, which has five voting booths. Note that a 5-booth DRE system requires five DREs, while a 5-booth optical scan system requires only one optical scanner plus a method of allowing disabled individuals to vote. With the Vote-PAD, no computerized equipment is required.

System Type	5-Booth Polling Place
DREs with integrated VVPAT Printer	$20,000
Paperless DRE System	$17,500
Optical Scan + Ballot-Marking Device	$11,650
Optical Scan + the Vote-PAD	$8,700
Open Voting Consortium System	$6,500
Paper Ballots + the Vote-PAD	$2,200

[157] http://www.openvotingconsortium.org/

[158] Examples: Avante, http://www.aitechnology.com/votetrakker2/home.htm; AccuPoll, http://www.accupoll.com/; and TruVote, http://www.truvote.com/

7 Distinguishing Truth from Misinformation

For many people today, it is difficult to tell legitimate reports from biased information. However, there is a growing number of credible studies and news reports that cast light on the subject of electronic elections.

Reports by Computer Experts Discredit DRE Systems

Johns Hopkins/Rice Report [159]

In July of 2003, four scientists from Johns Hopkins and Rice Universities had an opportunity to study the source code of the software used for Diebold tabulation equipment. The software was found, by Bev Harris of BlackBoxVoting.org, on an unprotected Diebold web page. The scientists who analyzed the source code wrote a 24-page report. The following excerpts are the first and last paragraphs of the abstract.

> Our analysis shows that this voting system is far below even the most minimal security standards applicable in other contexts.
>
> ... We conclude that this voting system is unsuitable for use in a general election. Any paperless electronic voting system might suffer similar flaws, despite any "certification" it could have otherwise received. We suggest that the best solutions are voting systems having a "voter-verifiable audit trail," where a computerized voting system might print a paper ballot that can be read and verified by the voter.

SAIC Report [160]

Wanting another opinion on the Diebold software, in early August 2003 the state of Maryland hired a third-party consulting firm (SAIC – Science Applications International Corporation) to perform an analysis of Diebold's AccuVote-TS voting system.[161]

On September 24, 2003, Maryland released a version of the report, but about two-thirds of the report was censored and remains secret because of concerns that the information it contains might enable malicious hackers to exploit the security vulnerabilities documented in the secret portions of the report. However, the non-secret portions of the report raise serious concerns about the security vulnerabilities of the Diebold touch screen systems currently in use. The final paragraph of the executive summary begins:

> **The system, as implemented in policy, procedure, and technology, is at high risk of compromise.**

Despite the problems identified in the Johns Hopkins/Rice and SAIC reports, Maryland still proceeded with the $55.6 million dollar purchase of Diebold AccuVote-TS voting systems.

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[159] **Analysis of an Electronic Voting System.** July 23, 2003; By Tadayoshi Kohno, Adam Stubblefield, Aviel D. Rubin, and Dan S. Wallach http://avirubin.com/vote/

[160] http://www.dbm.maryland.gov/dbm_search/technology/toc_voting_system_report/votingsystemreportfinal.pdf

[161] **Risk Assessment Report: Diebold AccuVote-TS Voting System and Processes.** September 2, 2003; by SAIC. http://www.dbm.maryland.gov/dbm_search/technology/toc_voting_system_report/votingsystemreportfinal.pdf

Ohio Compuware [162]

Another study, released in December 2003, was commissioned by the State of Ohio and conducted by Compuware Corporation. The scientists examined security vulnerabilities in four major vendors' touch screen machines: Diebold AccuVote TS, ES&S iVotronic, Sequoia AVC Edge, and Hart InterCivic eSlate. The study showed that all four of the voting machines had serious security problems. These problems are described in great detail in the report, which is over 200 pages long.

Once again, an official report of a state government agency found numerous security vulnerabilities in these electronic voting machines. And yet all four of the machines covered in this report had previously been approved by the Independent Testing Authority, the federal certification authorities, and several state certification authorities. This points up the serious weaknesses in the existing certification procedures (see page 17 for more about testing).

RABA Technologies Report [163]

In what appears to be yet another attempt to get a good report on the Diebold machines it had purchased, the Maryland legislature contracted for a practical test of the systems. It hired computer science experts to work with six machines for a week and attempt to hack the machines. The computer science experts gave the systems a failing grade. In addition, Diebold representatives said the test confirmed the accuracy and security of their systems.

> William Arbaugh, a University of Maryland assistant professor of computer science who participated in the test, graded the system an "F," "with the possibility of raising it to a 'C' with extra credit -- that is, if they follow the recommendations we gave them."
>
> "I was really surprised with the totality of the problems we found. Just about everywhere we looked we found them," Arbaugh said.
>
> Diebold officials could not be reached directly for comment. But in a press release, the company said Thursday that the study "validates" the Diebold election systems for the primary.
>
> Diebold President Bob Urosevich said in the release that the Raba (sic) Technologies report confirmed "the accuracy and security of Maryland's voting procedures and our voting systems as they exist today." [164]

Computer Expert's Analysis of Diebold Source Code

Roxanne Jekot[165] studied the Diebold source code that was discovered on an unprotected website in 2003. In an interview with Pokey Anderson, Ms. Jekot discussed the general quality of the programming: [166]

> Well, you know, there were multiple things that I found. The two things that really -- not astonished, but surprised me -- was the lack of professionalism in the code itself. That was the first thing. **Very unprofessional. Very thrown together, untested,** it was a hodge podge of junk, that I don't think anybody really knew whether it REALLY worked or not.

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[162] http://www.sos.state.oh.us/sos/hava/files/compuware.pdf

[163] http://www.raba.com/press/TA_Report_AccuVote.pdf

[164] **E-Vote Still Flawed, Experts Say.** Wired News; January 29, 2004; by Kim Zetter http://www.wired.com/news/business/0,1367,62109,00.html

[165] Ms. Jekot has been a computer programmer and consultant since 1984. She owns two copyrights on an accounting package. She has taught introductory programming at Lanier Technical Institute in Gainesville, Georgia and is currently working on an medical application, due for release in 2005.

[166] **Interview with Roxanne Jekot of Georgia** (CountTheVote.org). January 2004. By Pokey Anderson. http://www.countthevote.org/av/VernaMP3.mp3

The other thing was the division of a group of people working on a set of problems, and then a second group of only three people who worked on really critical programs, programs that would be required to manipulate the vote. Those were the two things that I think stood out, almost immediately. Again, the unprofessionalism. As an instructor, someone who's taught, I was surprised that the majority of the code looked like my first year college students, you know, doing a project. Very amateurish, very poorly put together. Very badly laid out, very poorly planned.

Some Officials' Claims about Electronic Elections Don't Match the Facts

Georgia Secretary of State Cathy Cox

The claim: "Though Georgia Secretary of State Cathy Cox said the state's 26,000 elections voting machines performed **without any problems** on Super Tuesday earlier this week, some lawmakers Thursday said the machines may nonetheless be vulnerable to fraud and wanted printed receipts to serve as proof of the computer tabulation."[167]

The facts: Walker County, Georgia. March 2004 – Super Tuesday.

Walker County election officials worked until after midnight, following Tuesday's election, to rectify problems tallying results.

Problems became apparent with Walker's first returns about 9 p.m. when neighboring counties were wrapping up their tallies. A Diebold computer technician began providing incorrect numbers to news organizations. The botched returns were fed to the media for more than two hours after the polls closed before the problem was corrected.

The voting machines have been used for six elections, three of which were for the same State House District 1 race. **Problems have cropped up at every election.**[168]

Florida Secretary of State Glenda Hood

The claim: March 8, 2004. "Well, I have a high confidence level. And it's based on the fact that, since 2002, when we put new equipment in place in the state of Florida, that **we have had no problem whatsoever,** according to our 67 supervisors of elections." [169]

The facts: Miami-Dade County, 2002: ES&S iVotronics failed to count 8.2% of the votes.[170]

Broward County, 2002: An ES&S iVotronic error missed counting 22% of the votes.[171]

Palm Beach County, 2002. Sequoia Edge touch screens froze up when the language was selected, sometimes switched votes to the opposite candidate.[172]

Broward County, January 2004: ES&S iVotronics lost 134 votes in a one-race election. The winning margin was 12 votes.[173]

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[167] **Printers Wanted for Voting Machines.** WXIA-TV Atlanta; March 5, 2004; Reported By: Keith Whitney http://www.11alive.com/news/news_article.aspx?storyid=43824

[168] **Ballot card problems delayed election returns (Georgia).** Walker County Messenger; March 4, 2004; Eric Beavers. Reproduced at: http://www.votersunite.org/article.asp?id=1417

[169] **Lou Dobbs Tonight.** CNN; March 8, 2004; http://www.cnn.com/TRANSCRIPTS/0403/08/ldt.00.html

[170] **Buyers' remorse.** Broward Daily Business Review; February 3, 2003; by Matthew Haggman http://verify.stanford.edu/EVOTE/buyers-remorse.html

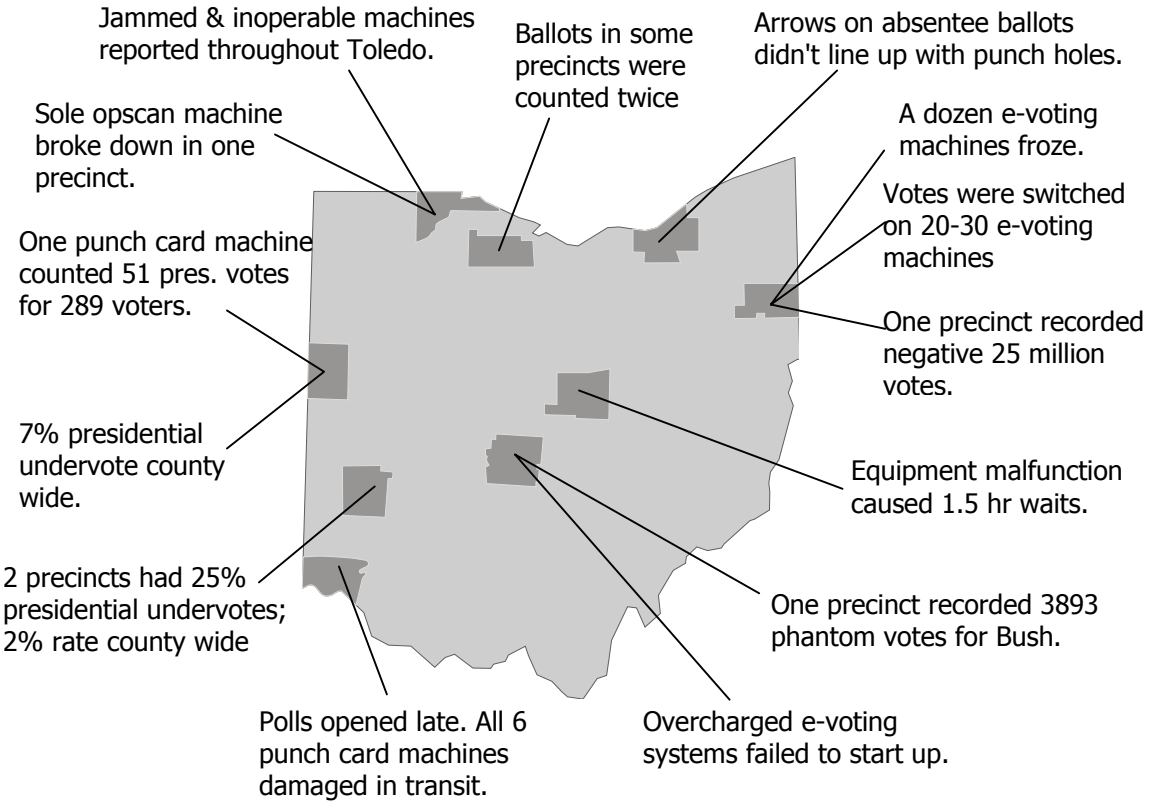
[171] **Election glitch missed 103,000 votes in Florida county.** CNN; November 8, 2002 http://www.cnn.com/2002/ALLPOLITICS/11/07/elec02.florida.votes.missing/

[172] **Human goofs, not machines, drag vote tally into next day.** The Palm Beach Post, 14 March 2002; reported in "Black Box Voting" Chapter 2 by Bev Harris

Ohio Secretary of State Kenneth Blackwell

The claim: "The electoral system in Ohio worked well on Nov. 2. ... Problems and complaints were minimal."[174]

The facts: Problems in the Ohio election led to a Congressional challenge of the Ohio electors, the first such challenge in over 100 years. A few of the problems are indicated on the Ohio map below.



The claim: January, 2005. "Spokesman Carlo LoParo said these [precinct-based optical scan] machines - **long Blackwell's favored technology** - produce the required paper record and are more flexible and affordable than electronic machines."[175]

The facts: March 2004. "Mr. Blackwell hopes to convert 14 counties using punch-card ballots to electronic voting by August special elections and 13 more for the Nov. 2 election." [176]

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[173] **Votes from 134 residents were not counted.** Miami Herald; January 07, 2004; By Erika Bolstad; http://www.miami.com/mld/ miamiherald/7655457.htm

[174] **How Ohio pulled it off.** The Washington Times. November 17, 2004. By J. Kenneth Blackwell. http://washingtontimes.com/op-ed/20041116-085742-1497r.htm

[175] **Ohio pulls plug on electronic voting. Blackwell opts for people filling out ballots by hand.** Cleveland Plain Dealer Bureau. January 13, 2005. By Julie Carr Smyth. http://www.cleveland.com/news/plaindealer/index.ssf?/base/news/1105612399208372.xml

[176] **Expert warns of balloting devices.** Toledo Blade. March 18, 2004. By Jim Provance, Blade Columbus Bureau. Reproduced at http://www.votersunite.org/article.asp?id=1620

New Mexico Secretary of State Rebecca Vigil-Giron

The claim: December, 2004. "So-called phantom votes [more votes than voters] votes are not possible. ... If I would have found some irregularities, believe you me I would have brought them out and questioned them."[177]

The facts: Bernalillo County, November 2004. 8,656 phantom votes were reported in the certified election results.[178]

San Juan County, November 2004. In Precinct 51, 1,843 election-day phantom votes were reported in the County Clerk contest[179]

Statewide, November 2004. 2,087 presidential phantom votes and more than 11,000 in down-ticket races were reported in the official canvass report certified by the Secretary of State.[180]

Missouri Secretary of State Matthew Blunt

The claim: "Secretary Blunt feels both the fax and e-mail voting options enabled many more of our men and women in uniform the opportunity to have their ballots counted in a timely fashion," Blunt spokeswoman Terri Durdaller said Friday.[181]

The facts: "Just 54 ballots were submitted by either fax or e-mail, the data showed."[182]

Some DREs Don't Provide Accessibility to the Disabled

Feedback from 14 blind and visually impaired voters in Santa Clara County, California showed that many of them found the Sequoia voting machines unacceptable and were disappointed that Sequoia didn't listen to their suggestions. They said the machines performed poorly and were anything but user-friendly in the March election.

In a letter to the registrar of voters after the March primary, Dawn Wilcox, a visually-impaired member of Silicon Valley Council of the Blind, wrote "Very few of our members were able to vote privately, independently, despite Santa Clara County's supposed 'accessible' touch screens. I feel this is an unacceptable state of affairs."[183]

> Only two members said the machines had functioned smoothly.
>
> Among the criticism provided by voters was poor sound quality, delayed response time and braille that was positioned so awkwardly it could only be read upside down. Chen, the college professor, also said the audio message required blind voters to press a yellow button. "Yellow means nothing to me," Chen said.

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[177] **Vote Recount Fight 'Is Not Over'.** Albuquerque Journal. December 24, 2004. By Andy Lenderman. http://www.abqjournal.com/elex/278376elex12-24-04.htm

[178] **Brief Summary of Bernalillo County Election Data.** January 5, 2005. By Ellen Theisen. http://www.votersunite.org/info/BernalilloSummary.pdf

[179] http://www.votersunite.org/info/content/mess-up_010905.asp

[180] **Brief Summary of New Mexico State Election Data.** January 5, 2005. By Ellen Theisen and Warren Stewart. http://www.votersunite.org/info/SummaryFlyer.pdf

[181] **Survey: Few troops use new voting options.** News-Leader.com. January 8, 2004. By Kelly Wiese, Associated Press http://springfield.news-leader.com/news/today/0108-SurveyFewt-270021.html

[182] See previous footnote.

[183] **Blind voters rip e-machines: They say defects thwart goal of enfranchising sight-impaired** Mercury News; May 15, 2004; By Elise Ackerman http://www.mercurynews.com/mld/mercurynews/news/breaking_news/8673336.htm

> [Noel Runyan, a blind voter and computer scientist who is an expert in designing accessible systems,] said the voting companies appeared to have ignored feedback they solicited from groups of blind voters as they were developing their systems.
>
> "I personally want them to be decertified for this election," Runyan said. "We need to make a strong statement that all these machines need to be redesigned on the user interface side. We've got a mistake here."

In a conversation with VotersUnite, Noel Runyan said that these criticisms of the machines' accessibility did not constitute a formal position of the Silicon Valley Council of the Blind. He did, however, emphasize that, "many of the visually impaired voters found that it was very frustrating and difficult or impossible to vote with the Sequoia voting systems."

He also pointed out, "One of the most glaring problems with the Sequoia system is the fact that it did not permit simultaneous speech output and large print display, as an option. Many low vision voters need to use both their hearing and whatever eyesight they may have to manage to navigate successfully through an electronic ballot. Forcing these folks to use either only speech or only large print will not permit them to vote independently."

Mr. Runyan also discussed the accessibility features of two other systems he has used: Diebold and Avante. He said that the Diebold systems provide audio and large print simultaneously, but "the Diebold speech quality and response time were so poor that elderly voters and others with hearing problems would have serious difficulties understanding the speech of the systems."

Avante, he pointed out, uses a low-quality "synthetic TTS (Text To Speech) system that is difficult for most older folks to understand. Use of the synthetic voice was the primary reason that the Avante scored at the bottom in the Access World review."

Cleaning up Misconceptions about VVPAT

Many arguments against a voter-verified paper audit trail are based on misconceptions. Here are the facts about a few of the most prevalent misconceptions.

No systems require voters to verify their ballots

Some proponents of paperless voting teach that VVPAT refers to systems that **require** voters to verify their votes.[184] However, none of the supporters of (VVPAT) advocates requiring each voter to verify his or her paper record. The requirements for VVPAT pending in many state legislatures apply to the machines, not the voters. Machines would be required to provide a method by which voters could verify paper records, but voters would not be required to verify them.

No System Provides a VVPAT for the Voter to Remove from the Polls

The term "receipt" has been used by many who advocate a voter-verified paper audit trail. They point out that you get a receipt for deposits made at the ATM, and you should get a receipt for your electronic vote as well. Some proponents of paperless voting claim that VVPAT systems would allow voters to remove the paper records from the polling place, thus allowing for vote-selling and coercing of voters.[185]

However, in a VVPAT system the "receipt" is preserved like the ballot itself, and no system provides a ballot that the voter removes from the polls. All VVPAT systems require the paper to be retained by election officials and securely stored at the polling site.

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[184] **Questions and Answers on Direct Recording Electronic (DRE) Voting Machines,** page 5. The League of Women Voters of the United States. 2003.

[185] **Questions and Answers on Direct Recording Electronic (DRE) Voting Machines,** page 8. The League of Women Voters of the United States. 2003.

No system requires poll workers to assist voters in verifying their ballots

Some advocates for organizations of the disabled misunderstand how paper verification would operate for visually-impaired people. Voters could have their ballots read back to them through earphones by an automated audio facility. No poll workers would be involved. The secrecy of their ballots would not be violated.

VVPAT does not violate the Americans with Disabilities Act

Some people are concerned that providing different verification methods to sighted and blind individuals would be a violation of the law. The United States Department of Justice disagrees. It issued an official opinion, through its Office of Legal Counsel, stating that including a voter-verified paper audit trail as a feature for a Direct Record Electronic (DRE) voting machines would be consistent with both the Help America Vote Act and the Americans with Disabilities Act, so long as the DRE voting system provides a similar opportunity for visually-impaired voters to verify their ballots before those ballots are finally cast. [186]

Financial Ties of DRE Advocates to Vendors Suggests Bias

Influential Advocate of Paperless DREs Received Large Donations from Vendors

The Election Center bills itself as "An international service association of election and voter registration officials." According to its website, the organization, whose Executive Director is R. Doug Lewis, is a primary source of information for election officials. Election officials have told me that Lewis has been **the** primary source for years. The Center website says:

> We research specific questions from our members and provide timely answers to your questions. In more than 12 years of service to elections and voter registration officials, this service alone has been worth the price of membership. No other single location in America has the ability to find the answers to you (sic) elections related topics than The Election Center. [187]

Lewis claims to have organized the National Association of Secretaries of State and the National Association of State Election Directors, and "through them, Lewis told Harris he helps certify the [ITA] certifiers."[188]

R. Doug Lewis is a major source of the arguments supporting paperless DREs and opposing a voter-verified paper trail. Early in 2003, the Election Center widely distributed a letter defending the security and reliability of DREs. His arguments have been refuted by many computer science experts, notably David Jefferson, a member of the California Electronic Voting Task Force, who wrote a point-by-point rebuttal of the letter.[189] Nevertheless, Lewis's arguments are still quoted in the position papers of organizations that advocate paperless electronic voting.

In March of 2004, it was discovered that, for years, the Election Center has been receiving large donations from the three major manufacturers of paperless electronic voting. Excerpts follow.

> The Election Center, which trains election workers and advises Congress and government agencies on election process issues, has taken donations from manufacturers of electronic voting machines even as it has issued strong statements supporting the security of the machines.

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[186] **Memorandum Opinion For The Principal Deputy Assistant Attorney General, Civil Rights Division.** October 10, 2003; http://www.usdoj.gov/olc/drevotingsystems.htm

[187] http://www.electioncenter.org/. Click on Membership Information.

[188] **Electronic Voting Machines Blasted by Scientists, Hacked by Author.** Scoop. July 25, 2003. http://www.scoop.co.nz/mason/stories/HL0307/S00198.htm

[189] http://verify.stanford.edu/EVOTE/ECresponse.html

> ... Its executive director, R. Doug Lewis, confirmed this week that the center had taken donations from makers of electronic voting machines - Sequoia Voting Systems Inc. of Oakland, Calif., and Electronic Systems & Software Inc. of Omaha, Neb. In addition, donations came from "probably Diebold" Inc. of North Canton, Ohio, Lewis said.
>
> ... Lewis issued a report last year saying that "well-intentioned people, some of them even highly educated and respected, scare voters and public officials with claims that the voting equipment and/or its software can be manipulated to change the outcome of elections."
>
> The report went on to say: "Do not be misled into believing that elections are reliant upon technology which can be manipulated..."
>
> **Lewis said he did not think accepting donations from the manufacturers presented any conflict of interest or breach of ethics.** [190]

Activities sponsored by the Election Center have been questioned by election officials as well as concerned citizens. For example, in August 2004 the annual Election Center conference for election officials included a dinner cruise down the Potomac, sponsored by Sequoia Voting Systems. Freddie Oakley, County Clerk/Recorder in Yolo County, California, commented:

> I have been distressed for a long time that the Election Center, which holds itself out as the impartial association for election officials, engages in and appears to encourage this kind of industry subsidy of get-togethers of election officials.[191]

ES&S Paid Commissions to Officials who Endorsed Their Products

The Florida Association of Counties endorsed ES&S machines exclusively, as a result of the lobbying efforts of Sandra Mortham. Both the association and Mortham received commissions from ES&S on the equipment sold.

> A former Florida secretary of state profited by being a lobbyist for both the state's counties and the company that sold some of them touch screen voting machines used in last month's botched primary election.
>
> Sandra Mortham, who served as the state's top elections official from 1995 to 1999, is a lobbyist for both Election Systems & Software and the Florida Association of Counties, which exclusively endorsed the company's touch screen machines in return for a commission. Mortham received a commission from ES&S for every county that bought its touch screen machines. The exact terms have not been disclosed.
>
> ... The association will receive about $300,000 in commissions, according to the agreement.[192]

Fortune's Worst Technology of 2003: Paperless Voting

Fortune magazine's winner of the worst technology of 2003 award was "Paperless Voting." Fortune considers this technology even worse than implanted identification devices, which only won the runner-up award.[193]

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[190] Excerpt from: **Group that called electronic vote secure got makers' aid.** Philadelphia Inquirer; March 15, 2004; By Linda K. Harris. http://www.mercurynews.com/mld/mercurynews/news/world/8273865.htm

[191] **Press Release: Voting Machine Manufacturers Wine and Dine Election Officials.** Institute for Public Accuracy. September 1, 2004. http://www.commondreams.org/news2004/0901-08.htm

[192] Excerpt from: **Lobbyist made money from touch screen sales.** St. Petersburg Times; October 6, 2002. Associated Press. http://www.google.com/search?q=cache:WJT4jZ8WH0AJ:www.sptimes.com/2002/10/06/news_pf/State/Lobbyist_made_money_f.shtml+Florida+%2B+ES%26S+problems&hl=en&ie=UTF-8

[193] **Winners and Losers of 2003: Worst Technology.** Fortune Magazine; December 2003; By Peter Lewis http://www.fortune.com/fortune/technology/articles/0,15114,558787,00.html

Afterword

One of the difficulties that faces a software company is the disconnect between the engineering department and the sales department. In order to please customers and make a sale, salespeople promise features that the engineering department is then obligated to develop.

Sometimes, there is a serious discrepancy between the promises and the deliverables that are even possible — often because the sales people are not tech-savvy enough to know that what they are promising just won't work, sometimes because they are just too excited about the potential sale.

I was discussing this recently with a client who used to be a software developer and is now a software salesman. I pointed out that he had an advantage since he knew what would be possible for his engineering department to develop. He responded by telling me a joke.

> Q. What's the difference between a used car salesman and a software salesman?
>
> A. The used car salesman knows when he's lying.

In an attempt to "bring elections into the 21st century," election system manufacturers promised Congress and the elections community that their computer-based systems provide the following features:

- Records and tallies votes accurately
- Ensures the secrecy of the ballot
- Operates reliably on election day
- Provides security from tampering
- Allows the disabled to vote independently
- Ensures a satisfactory voting experience for voters
- Prevents over-voting and reduces inadvertent under-voting
- Simplifies the administration of elections
- Reduces the cost of elections
- Provides a paper audit trail
- Meets federal standards for voting systems

The facts presented in this document show that no such electronic election system presently exists. Is such a system even possible? My experience in the software development industry gives me grave doubts, but even if it were possible, would it provide the transparency required for democracy? No.

When the founding fathers established a democratic republic in the Constitution, they did not promise that keeping it would be convenient.

Eternal vigilance is the price of freedom.
~ Thomas Jefferson