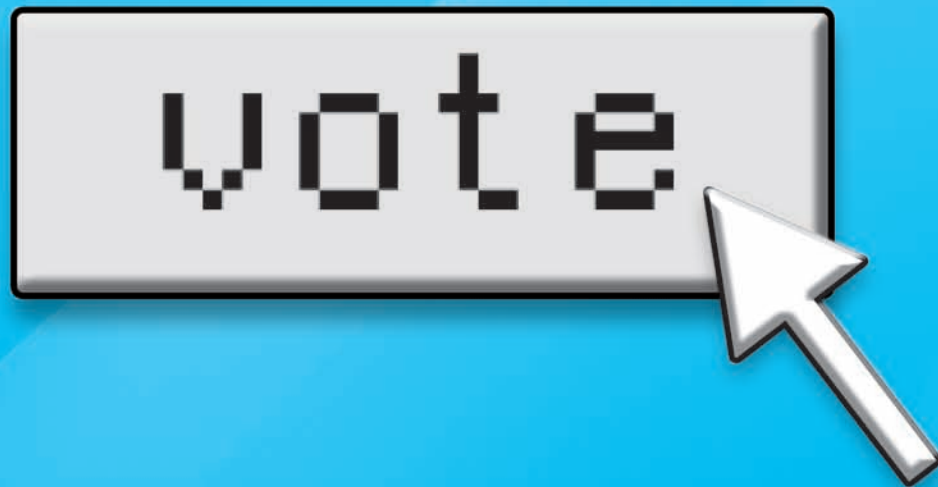


Upgrading America's Ballot Box:

The Rise of E-voting



2nd Edition

by Sonia Arrison and Vince Vasquez
October 2006

Electronic voting has, unfortunately, moved from the realm of science and statistics to conspiracy theory by overheated partisans. Sonia Arrison and Vince Vasquez puncture the myths of the conspiracists in their paper. Even leading Democrats such as Joe Andrew, Bill Clinton's handpicked chairman of the Democratic National Committee, have pointed out that while problems remain that demand vigilance, electronic voting aids the poor, the elderly, minorities, and is more accurate. Last year, Mr. Andrew lamented that "When it comes to electronic voting, most liberals are just plain old-fashioned nuts." Those who want to lay out the facts on electronic voting now have a powerful weapon in this Pacific Research Institute paper.

— John Fund

Author of *Stealing Elections: How Voter Fraud Threatens Our Democracy*

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Executive Summary

In the months following the 2000 Florida vote fiasco, federal lawmakers began work on new legislation to overhaul America's electoral system. The Help America Vote Act (HAVA) was signed into law on October 2002, allocating billions of taxpayer dollars to replace antiquated voting systems that have proven disastrous in post-election recounts. Nearly 700 counties have now procured direct recording electronic (DRE) devices, or "e-voting" machines, a type of cutting-edge technology that has quickly moved the country away from its perilous punch card past.

For millions of Americans, gone are the days of "dimpled" and "pregnant" chads. The use of touch-screen monitors and adaptable software has increased vote integrity and ballot security. With the click of a button, many Election Day errors have been innovated out of existence.

DRE machines promise to take voter enfranchisement to new levels. Elderly voters have found e-voting machines easier to read, a marked improvement from the small print and unpredictability of paper ballots. A majority of African-Americans have expressed a high level of comfort with DREs and thousands of handicapped voters, who sometimes were turned away from the ballot booth, have found new hope in the accommodating use of this electoral innovation. Indeed, e-voting machines proved critical to the success of the 2004 presidential election, which saw the rate of voter-ballot mistakes cut nearly in half from 2000 levels.

Despite the advances made through DRE machines, prominent computer scientists have expressed concerns about the reliability and security of electronic voting. Some partisan advocates have attempted to make political hay from the discrepancy between the 2004 presidential election returns and Election Day exit polls. Further, Internet-fed rumors and conspiracy theories have sought to whittle DRE credibility with whispers of covert fraud and rigged elections.

While the concerns of computer scientists are important, current evidence shows that electronic voting is more secure and effective than traditional ballots, which are more prone to human error and cheap fraud. Conspiracy theories have turned out to be just that. Post-election reviews have not found any indication of fraud or deceit involving the machines, and polling data suggests that the public is embracing the digital ballot box.

Highlights

- A dozen different e-voting firms currently provide counties with various models of DRE machines, each using their own unique proprietary code, security, and access systems.
- On Election Day 2004, voters cast more than 40 million votes, nearly one third of the total,

on approximately 175,000 electronic voting machines. Throughout the 2006 election cycle, over 65 million Americans will be able to use DRE devices at voting centers nationwide. Of the more than 27,000 “incidents” reported by voters to the Election Incident Reporting System (EIRS) on Election Day 2004, little more than 2,000 were related to “machine problems,” which were not exclusive to DRE devices.

- A 2004 Winston Group survey found that voters using e-voting machines are just as likely to trust their voting technology as voters using lever machines and optical scanners. The survey further revealed that seven out of 10 voters were not concerned with the security of e-voting equipment, and that an overwhelming majority of voters who have used e-voting systems agreed that DRE devices are helpful in reducing electoral maladies, such as accidental over or under voting.
- A 2005 poll developed by the Pacific Research Institute found that 51 percent of Americans trust automated voting machines, with 25 percent not trusting, and 24 percent unsure. In addition, more than six in 10 respondents believed that new technology would help improve the voting process, and more than half said it would help reduce electoral fraud.
- Poll workers can be “professionalized” to reduce human error, and those with information technology backgrounds could be trained to handle more high-tech issues, such as troubleshooting DREs on Election Day. Partnerships between election officials and DRE device vendors could be forged to establish technical training programs for qualified poll workers.
- With a competitive DRE vendor industry, election officials can open a bidding process to meet any and all voter concerns for future purchases. Election officials and activists can track the outcomes of different vendor machines over time, compare their performance, and select those that best fit their county’s needs.

I. Introduction

The digital revolution has left an imprint on virtually every aspect of society, including the process by which Americans choose their leaders. On Election Day 2004, voters cast more than 40 million votes, nearly one third of the total, on approximately 175,000 electronic voting machines. Relatively few complaints about e-voting systems were received, and those that were could be attributed to user error. For the first time, thousands of handicapped and special-needs

voters, who in the past have been turned away from their precincts, were allowed to vote at a polling booth.

A 2004 Winston Group opinion poll indicates high voter confidence in the reliability of e-voting machines, and a strong understanding of their benefits. Despite the overwhelming success of e-voting systems, the technology continues to be hounded by Internet-fed rumors and conspiracy theories of massive fraud and rigged elections. Perhaps surprisingly, prominent computer scientists and academics have come out against e-voting, and many have questioned the potential drawbacks of using machines at the polling booth.

Has America shifted too quickly from “hanging chads” to “touch-screen” voting, and is e-voting here to stay? This policy briefing examines the rise of e-voting, what its critics say, how to answer them, and what the future might hold.

II. Laying the Foundation for E-voting

Florida 2000

The widespread adoption of e-voting technology can be partly attributed to the problems surrounding the 2000 presidential election recount. With early reporting precincts handing George W. Bush a razor-thin Florida victory on Election Day, pundits called into question the notorious fallibility of punch-card ballots.

Within days, scores of lawyers and “chad teams” descended upon the Sunshine State, scrutinizing voter intent and wrangling the courts for control of the White House. For more than a month, accusations of minority disenfranchisement and voter fraud mired the state, leaving the country without a presidential successor. Having struck a major blow to the legitimacy of American elections, and voter confidence nationwide, congressional lawmakers jumped into action.

HAVA

In October 2002, President George W. Bush signed the Help America Vote Act (HAVA), a \$3.75-billion effort by Congress to overhaul voting systems and bolster voter outreach across the country. HAVA allows federal grants to be awarded to counties to replace outdated punch card ballots with high-tech voting solutions such as optical scanners and direct recording electronic (DRE) voting machines. Responding to complaints from voters who were wrongfully turned away from precincts on Election Day 2000, HAVA requires local election officials to create a statewide voter registration list, distribute “provisional” ballots, and increase polling access to disabled voters.

Republicans and Democrats alike have praised HAVA as a significant step towards fairer elections and more accurate vote counts. Representative Robert Ney of Ohio, the lead Republican HAVA sponsor, proclaimed that with the signing of HAVA, “no more will voters have to wonder if their vote was properly recorded or not.”

Representative Steny Hoyer of Maryland, the leading Democratic sponsor, called the elections bill “the most important civil rights legislation since the Voting Rights Act of 1965.” It is perhaps a bit of a stretch to place the legislation in that category, but nevertheless it makes it easier for counties all over the country to join the digital age.

III. The Voting Landscape Today

Most states have used their HAVA funds to replace punch-card ballots with Direct Recording Electronic (DRE) machines and optical scanning technology. However, not all of the voting systems of yesterday have been discarded in every county, so it’s important to understand how they differ from the electronic voting experience.

Lever machines

Lever machines were a hallmark of early American voting, particularly along the East Coast, where they are still being phased out of existence. Under this system, voters pull levers on large machines to indicate their selections, which are then recorded by a mechanical counter.

Punch-card machines

Punch-card voting systems use either a stylus or a hole-punching mechanism to allow voters to indicate their ballot selections on a paper ballot. These ballots are then fed through reading machines to tabulate votes.

Optical scan ballots

With optical scan systems, voters fill in “bubble sheets,” broken lines, or other types of paper ballots to mark their selections, which are then fed through an electronic device to tabulate the votes. Physical ballots are usually kept as an audit trail, in case errors, misfeeds, or miscounts are later discovered.

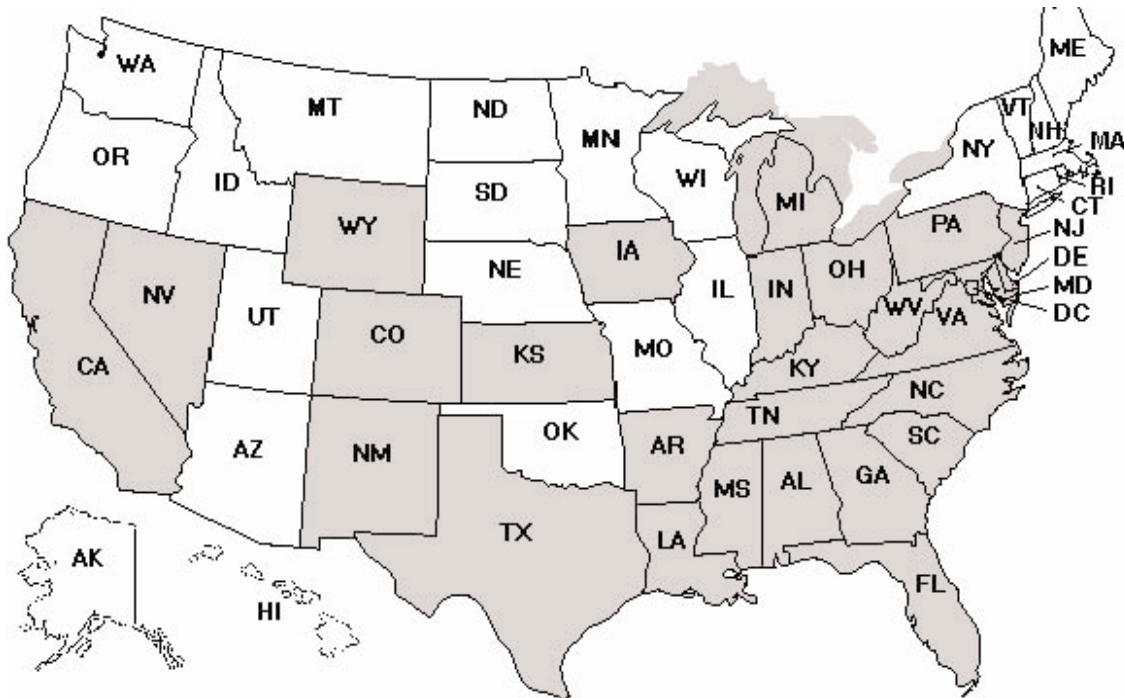
Direct Recording Electronic (DRE) machines

There are many types of DRE systems made by a number of different vendors such as AccuPoll, Avante, Diebold, Sequoia, ES&S, and Hart InterCivic. The specifics of each system vary, but one common method is to give voters personal identification numbers (PIN) or a “voter card,” a credit-card-sized plastic memory card that they bring with them to access touch-screen or keypad-operated terminals.

After completing their selections, the machines present a summary of all votes cast. Voters are then allowed to submit their selections onto the official vote record, which is stored in the machine. After the election period has ended, each individual terminal is accessed with an administrator card and PIN, and the final count tabulated.

Nearly 700 counties in more than half the nation’s states used DRE machines in the 2004 general election. States with e-voting counties are shaded gray in the map below.

Figure 1: States with E-voting Counties (as of November 2004)



■ States with E-voting Counties

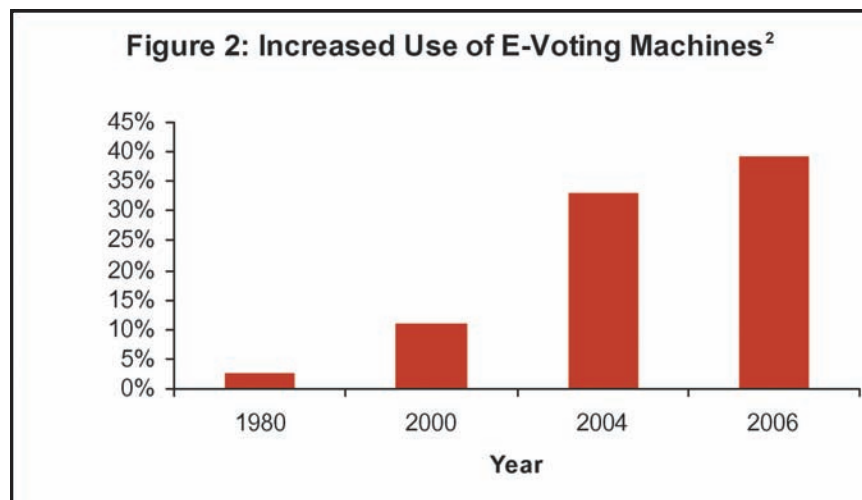
Source: *The Industry Standard*¹

In 2004, one out of every three voters used DREs to vote. That is, on Election Day 2004, 40 million out of nearly 120 million votes were cast on 175,000 to 180,000 DRE machines.

One of the key reasons election voting systems have taken off so quickly is that HAVA requires recipient states to improve the accessibility and quantity of polling places in order to maintain eligibility for HAVA funds. This order includes providing polling booth access for individuals with physical disabilities, the visually impaired, and individuals with limited English proficiency.

Activists and leaders from the disabled community, including the American Association of People with Disabilities, are major proponents of

DRE technology, as these devices are found to be more accessible to the handicapped than other voting methods. Special DRE features, such as Braille-embedded keyboards and headphones, enable the illiterate, the blind, and the physically challenged to vote at a polling location. In addition, DREs can be readily customized or retrofitted to accommodate the needs of a diverse electorate, without the cost of reprinting paper ballots.



Sources: The Caltech/MIT Voting Project, Election Data Services

Over the last 25 years, e-voting has been steadily increasing. In 1980, one out of 40 voters used DRE machines. By 2000, one out of nine voters used DREs. In 2004, one out of every three voters used DREs to vote. That is, on Election Day 2004, 40 million out of nearly 120 million votes were cast on 175,000 to 180,000 DRE machines.³ This growing use continues to build trust with the public. According to a study by Election Data Services, 39% of American voters – over 65 million – will have the opportunity to use DREs throughout the 2006 elections.⁴

Poll numbers also validate the e-voting phenomenon in the country. A 2004 Winston Group survey found that voters using e-voting machines were just as likely to trust their voting technology as voters using lever machines and optical scanners.⁵ The survey further revealed that seven out of 10 voters were not concerned with the security of e-voting equipment, and that an overwhelming majority of voters who have used e-voting systems agreed that DRE devices are helpful in reducing electoral maladies, such as accidental over or under voting. Another survey taken later that year also found that the majority of African-Americans have a high degree of comfort in using DREs, more so than Caucasian-Americans.⁶

IV. A Closer Look at E-voting

The Benefits

DRE devices provide two innovations to public elections: a visual verification of votes cast, and remote vote storage. First, voters using e-voting machines are led to a screen where they are allowed to verify their selections; if the votes received by the terminal are incorrect, then the voter has the option to return to the contest in question and change his or her selection. Although HAVA requires all voting systems to allow voters to verify their selections, optical scanners and other methods merely offer verification brochures and printed reminders to double-check votes cast.

Second, votes are stored in each voting terminal, which can only be accessed with an administrative data card and password. Historically, paper ballots were overly manhandled, being placed into boxes, moved around, and passed through the hands of low-level poll workers to precinct supervisors and county officials. Fraud was less detectable, and more prevalent, as pre-scored ballots could be easily corrupted or votes altered with a simple punch through a hole, or mark of a pen.

The pre-DRE vote era was marked with a high level of trust and responsibility upon election officials, which due to innocent mistakes and malicious behavior, failed to completely secure paper ballot integrity. DRE devices have one of the lowest “residual vote rates” of any voting system because they help to reduce voter error. The residual vote rate is the total sum of “under votes” (no votes cast in a contest) and “over votes” (more than one vote cast in a contest) with a particular voting system. If a voter under votes on a DRE device, a user prompt pops up asking him or her to confirm that they are declining to vote. A similar prompt is used to prevent multiple votes, or over voting in a single race. Efficiency of e-voting machines is also an added benefit.

Electoral results with touch-screen voting machines are tabulated faster than hand feeding paper ballots through a punch-card reader or optical scanner, which may take hours, or even days to complete. Hand counts of paper ballots are prone to problems, as the repetitive nature of the activity and human fatigue draw less accurate counts than electronic or machine counts.

DRE technology is constantly improving, and vendors continue to work to meet the needs of election officials. And with all the extra scrutiny being applied by computer scientists combined with experiments going on all over the country, Americans may wind up with a better-run election system.

Most voter experiences with DRE machines have been positive, but others have not.

Real Problems with Electronic Voting

Some voters have complained about their selections appearing in the wrong box, leading some technology critics to suggest evidence of fraud. However, this phenomenon, where a screen is not optimally angled to the user as a result of thick touch-screen glass or an air gap, causing inadvertent selections, is known as “parallax.” It is prevalent with many other types of touch screen devices.

The good news is that this problem is easy to fix. Screen displays can be modified to reduce parallax problems, and cutting-edge touch-screen technology can significantly cut down screen thickness. Another potential problem is that buggy software could, theoretically, alter the results of an election. Indeed, there already have been some examples where problems of this nature have occurred.

In 2003, for example, DRE machines recorded an amazing 144,000 votes in Indiana’s Boone County, which has fewer than 19,000 voters. County Clerk Lisa Garofolo said “I about had a heart attack” watching the impossible numbers roll out on her computer screen. She traced the problem to software programming errors, not deliberate fraud.⁷ DRE hardware reliability is also an issue, as poll workers are often not trained to handle malfunctions or errors. They are typically given instructions only on how to activate the machines, not troubleshoot. E-voting company technicians are usually not stationed at every precinct, increasing the potential for machine malfunctions and extended voter delays.

Arguments against Electronic Voting Systems

E-voting has brought new benefits, as well as new challenges to election management. Technology critics have been quick to point out a host of hypothetical doomsday scenarios – everything from massive fraud to precinct meltdowns. Some opponents have criticized the eagerness of election officials to purchase DRE devices with little consideration for potential problems.

For instance, Barbara Simons, former president of the Association for Computing Machinery (ACM), and lecturer at Stanford University, said there’s been little oversight and testing of the computer voting systems. She blames this on a “gold rush mentality” among manufacturers eager to capitalize on \$4 billion in federal spending to upgrade polling sites after the 2002 election debacle.

Opponents also declare that DRE machines place too much of the public responsibility for conducting elections in the hands of the private sector. Indeed, it is the DRE technicians who monitor machine problems and tabulate the final voter cast. Paper trails, for count for election officials. Further, vendors use their own secret or proprietary software code in their machines which, some claim, cannot be forcefully inspected, scrutinized, or released to outside experts, even in the face of a recount. However, it is the case that the code and other e-voting software must be submitted for a series of local, state, and federal qualifications, and meet set standards for approval.

Proponents of open source software have raised their voice in the e-voting debate, claiming that forcing DRE code to be open for public scrutiny will make elections safer. However, this presumes that a legion of tech-savvy citizens will be actively reviewing software throughout the country, making recommendations for changes which would be swiftly made by local bureaucrats and vendor technicians before Election Day. Such a scenario is unlikely, and for good reason. As the California Secretary of State's office noted to the state legislature in January 2006, "the business of technical innovation and the effectiveness of information security may both depend upon some measures of confidentiality, which open source, by its very nature, precludes."⁸ Opening e-voting code will in fact give malicious attackers the advantage if there is not enough "competent scrutiny" to find flaws beforehand. Furthermore, the complexity of DRE devices requires numerous hardware components from various manufacturers who provide their own proprietary software. An open source e-voting mandate would then not only be burdensome for vendors, but for all of their business partners in the technology industry who provide critical components to their finished products. With so many unknown policy outcomes with open source mandates, the Secretary noted that "the potential risks of open source are impossible to quantify or to constrain."⁹

Others suggest that though older voting systems were more prone to error, they at least have a paper trail that could be audited and reviewed for recounts and problems. Without a voter verified paper trail, there is no way to conduct a meaningful recount with DRE devices, and machines can malfunction and miscount votes without bringing such problems to the attention of technicians. Since most counties that use touch-screen machines lack a voter-verified paper trail, opponents declare that no one even knows for sure if the tabulated votes from the touchscreens were accurate. Despite the loud assertions of the anti-DRE movement, nothing could be further from the truth.

Each DRE machine has an auditable record (paper or electronic) of votes that can be retrieved, if required by law, to show the individual selections that each voter cast. Paper trails, for their part, are meaningless if manual counts are still prone to fraud and human error. The ultimate nightmare scenario suggested by opponents is the possibility that company insiders or hackers could

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be bought off, or simply be malicious, and alter the vote count without anyone knowing. Indeed, hackers across the country have brainstormed ways to tamper with election results.

In a report by computer experts Tadayoshi Kohno, Adam Stubblefield, Aviel Rubin, and Dan Wallach, the group showed alarming success in hacking the source code of one Diebold model of touch-screen machines.¹⁰ However, low-skill, low-level fraud, which is prevalent in paper ballot election systems, is not an issue with e-voting. As the Florida State Association of Supervisors of Elections noted, "...not a single case of election fraud due to tampering of a system's hardware or software has occurred. Comparably, in the last 40 years, hundreds of cases of election fraud involving paper have occurred and been successfully prosecuted."

It's important to remember that e-voting vendors continue to have a strong economic incentive to protect their products from hacking, as a market for corrupted voting equipment is non-existent. Potential hackers would need to know not only critical information about the e-voting software, but also information about the elections themselves, such as the number and order of candidate names on the ballot, which is subject to factors out of their control. Routine testing of DREs before and on Election Day can include countermeasures which could detect hidden hacker programs in the software.

V. E-voting in 2004 and Conspiracy Theories

Still, rumors of fraud persist throughout the virtual world, impressing online visitors with tall tales and far-fetched schemes. One of the most common is that the 2004 presidential election was stolen because there was a difference between exit polls and actual results in states that use optical scanning versus states that use electronic touch screens. However, a report released by the polling firms who conducted polls on behalf of the National Election Pool (AP, ABC, CBS, CNN, FOX and NBC)

Of the more than 27,000 "incidents" reported by voters to the Election Incident Reporting System (EIRS) this past Election Day, little more than 2,000 were related to "machine problems," which were not exclusive to DRE devices.

found that Kerry support was overstated nationally and in 26 states on Election Day, due in part to an over-sampling of Kerry supporters by poll workers.¹¹

Others point to questionable connections between Diebold Election Systems, one of the largest manufacturers of DRE devices in America, and a financial contributor to the Republican Party. In what was a public relations gaffe worthy of the Darwin Awards, Walden O'Dell, chief executive officer of Diebold, wrote that he was "committed to helping Ohio deliver its electoral votes to the president next year."¹²

O'Dell, an ardent supporter of President Bush, was active in the re-election effort, prompting Democrats to question the propriety of allowing O'Dell's company to calculate votes in the 2004 presidential

election. O'Dell also attended a strategy "pow-wow" with wealthy Bush benefactors – known as Rangers and Pioneers – at the president's Crawford, Texas ranch. The following week, O'Dell penned invitations to a \$1,000-a-plate fundraiser to support the Ohio Republican Party's federal campaign fund, partially benefiting Bush, at his mansion in the Columbus suburb of Upper Arlington.

Though some partisan pundits tried to make political hay out of these tenuous connections early in 2004, there is no serious research that shows e-voting rigged the results of the last election. Claims by groups such as blackboxvoting.org gloss over the complexities in elections – that different jurisdictions are using different machines from different manufacturers and have different procedures. They also ignore the reality that complaints with e-voting machines were negligible. A dozen different e-voting firms currently provide counties with various models of DRE machines, each using their own unique proprietary code, security, and access systems. Many counties opted instead to purchase optical scan systems with their state's HAVA funds, and still others continue to use improved versions of punch card ballots and other rudimentary voting systems.

Of the more than 27,000 "incidents" reported by voters to the Election Incident Reporting System (EIRS) this past Election Day, little more than 2,000 were related to "machine problems," which were not exclusive to DRE devices.¹³ Most voter problems surrounded registration issues, comprising one third of the EIRS incident list. Moreover, all cumulative incidents occurred in a national pattern that largely reflected each state's respective population, rather than the preferred type of voting system. However, doubts regarding the results from November 2nd persist.

Shortly after Election Day, some partisan commentators balked at the official returns from three heavily Democratic counties, which showed a majority of votes going to President Bush by a wide margin. A ballot review by local news reporters later found that the votes were accurately reported on Election Day, exposing an inexperienced understanding of voter behavior. Similar results were found in a 2000 media investigation of four Democratic counties, confirming their majority votes for Bush.

President Bush won the 2004 general election with a popular vote edge of nearly three percent (three million votes) over Senator John Kerry, picking up the support of more than 11.5 million new voters from the 2000 election, and winning with 50.7 percent of the popular vote overall. In addition, the two most heavily scrutinized states, Ohio and Florida, both produced sizeable leads in votes for the President, who won with a popular vote edge of two percent (more than 110,000 votes) over Kerry in Ohio, and by five percent (nearly 400,000 votes) in Florida.

His re-election was underscored by electoral pick-ups in Iowa and New Mexico, as well as historical gains from fellow Republican nominees in the House and Senate. Furthermore, Democratic nominee John Kerry conceded that no recount could surmount either lead in Ohio or Florida, even with doubts over the results tabulated from paperless DRE devices. The day

after the election, Kerry noted in his concession speech that “it’s now clear that even when all the provisional ballots are counted, which they will be, there won’t be enough outstanding votes for us to be able to win Ohio. And therefore we cannot win this election.”¹⁴

Despite the partisan drubbing of DREs from the 2004 election, public approval for electronic voting has held relatively firm. According to a 2005 opinion poll developed by the Pacific Research Institute, 51 percent of Americans (voters and non-voters alike) trust automated voting machines, with 25 percent not trusting, and 24 percent unsure. In addition, more than six in 10 respondents believed that new technology would help improve the voting process, and more than half said it would help reduce electoral fraud.¹⁵

With an amalgam of voting systems and technologies used by county officials, the likelihood of across-the-board massive fraud becomes unlikely. Claims persist that billions of dollars in equipment, thousands of individual contracts, and government officials of every stripe were behind an attempt to hand George W. Bush the 2004 election. Such theories are reminiscent of claims that Neil Armstrong never landed on the moon.

With persisting doubts dogging an otherwise effective technology, what will it take before electronic voting becomes the standard?

VI. Innovative Solutions

One way to analyze the issue is to refer back to the early 20th century insurance industry, which was slow to dump its punch-card record system for a new high-tech system of storing and calculating data on magnetic tape.¹⁶ Magnetic tape technology was eventually adopted as the industry standard for three reasons.

Industry and innovators worked closely to shape future technology. Market forces reacted to the demands of business. Third, the culture changed, allowing companies to discard their easily corruptible punch cards.

As the national population topped more than 100 million after World War I, life insurance companies found written paper records difficult to maintain, and switched to a punch-card based system that rapidly increased automation.

Critically, pioneers didn't favor one data machine firm over another, fostering a healthy competition that quickly brought innovation to the marketplace.

By mid-century, the insurance industry became heavily dependent on punch cards to maintain records, process premium billings, statements, receipts, and other accounting systems. However, moisture and heavy handling often contaminated punch cards, leaving some in the industry to look for an acceptable alternative.

Insurance companies were loath to completely abandon their punch cards, as newer technologies

like magnetic tape did not allow for a visible verification of records. In addition, concerns were raised about the acknowledgment of tape-based records in a court of law, or by other public and private institutions. Influential groups pointed out that no matter how effective magnetic tape machines were, they would never be purchased without a cultural acceptance of the technology.

Seizing an opportunity to revolutionize the industry with cutting-edge technology, key pioneers in the insurance field worked closely with data machine firms to improve magnetic tape reliability and accuracy, and meet exact specifications. They initially weaned the industry on magnetic tape by requesting that the first tape machines allow owners the option to transfer records to punch cards. Critically, pioneers didn't favor one data machine firm over another, fostering a healthy competition that quickly brought innovation to the marketplace. At first, data firms sold magnetic drum machines mostly to public institutions, in a calculated attempt to win over the hearts and minds of the private sector. Their efforts proved to be a resounding success. Over time, the industry use of magnetic tape machines moved from routine processes to more sensitive ones, allowing for punch cards to be discarded.

The leading magnetic tape firm, IBM, later built upon its experience with insurance companies to create the personal computer. The insurance industry's experience with shifting to new technology is not much different from the nation's experience with moving from punch cards to e-voting machines.

For years, DRE vendors have worked with hundreds of different election offices to meet varying specifications, and obtain compliance with a multitude of local laws. More than a dozen prominent vendors provide e-voting solutions to counties throughout the nation, and most states work with at least two different DRE providers. Many states are taking a go-slow approach to DRE technology, only encouraging a limited number of counties to purchase the machines and experimenting with newer systems.

With touch-screen machines processing everything from stadium tickets to boarding passes at airports, the American body politic has grown accustomed to touch-screen user interfaces. E-voting may appear to have handed punch cards a full rout, but developments in the Golden State may soon return America to paper-based problems on Election Day.

California's Push for Paper

California lawmakers have already announced a series of landmark DRE requirements that could potentially make the state a national leader in e-voting paper trail mandates. In late 2003, then Secretary of State Kevin Shelley decreed that beginning on July 2005, no county or city may purchase touch screen voting systems that do not have an "accessible voter verified paper audit trail" (AVVPAT) – a printout that voters can use to independently verify that their votes were cast the way they intended.

This law was followed up Governor Arnold Schwarzenegger's 2004 proclamation that required all DRE devices used in California, regardless of when they were purchased, to produce a paper receipt for every ballot cast beginning January 2006. Both of these decrees surpass HAVA's general requirement of an auditable paper trail available for every voting system by 2006, regardless of technology. But California's move towards paper may be a mistake, as recent experiences with voter verified paper trails prove they are not the panacea advocates claim.

Neighboring Nevada, which already requires a voter-verified paper audit trail, scored a perfect record in post-election accuracy audits in 2004. However, county election officials ran into a multitude of hardware problems, including paper jams, malfunctions, and ink depletion. The additional costs and maintenance requirements of printers arguably negate the cost savings of paperless DRE devices, and undercut the arguments from the departure of paper ballots and punch cards.

It's important to note that these additional costs can run into the millions, and may not be covered under HAVA funds. Passing sweeping laws on the state or national level to require voter verified paper trails for touch screen machines, though well intentioned, could bankrupt cash-strapped counties, and may erode the efficiency of electronic voting management. But some California politicians persist in dragging the state into the voting wilderness by tacking on new demands for beleaguered local officials.

SB 370, Sponsored by State Senator Debra Bowen, and signed into law by Governor Schwarzenegger on October 2005, discarded the benefits of DRE electronic vote tabulation by enlisting voter paper trails in mandatory manual recounts, making election management in California exceedingly difficult. Opposed by the California Association of Clerks and Election Officials (CACEO), the bill demands the expense and time of voting officials that may effectively negate the original virtues of DRE devices: timeliness, cost savings, and efficiency. With rising voter registration, and a burgeoning population, Bowen's bill is a legislative lemon that will do little to strengthen voter confidence in California elections. As CACEO has noted, "elections in California are at risk of collapsing under the weight of their own complexity."¹⁷

Despite the rhetoric from statewide politicians championing the supposed virtues of paper trails, the increased use and demands on AVVPATs can bring severe headaches for the countless grassroots volunteers and managers who conduct Election Day duties. As the Brennan Center Task Force on Voting System Security reported in June 2006, voter paper trails can still fail to prevent attacks and abuse. The group identified over 40 potential attacks on paper trail systems.¹⁸ Not only are AVVPATs in some cases useless, but in others they can actually be harmful. For example, in the event of a discrepancy between the electronic results and the paper results, fifteen states, including California, give preference to the electoral results printed on paper.¹⁹ As such, it would not be necessary for a malicious Election Day attacker to sneak viruses and disruptive software into e-voting machines – they would only need to tamper with the paper trail.

VII. The Future of E-voting

Over the last 100 years, the American people have increasingly organized grassroots movements to broaden voting rights and democratic power through constitutional amendments and statewide initiatives. E-voting has advanced voter access, and continues the march towards the growing political empowerment of voters. With the dawn of a new century, our nation may have even more opportunities to expand the frontiers of technology and democracy.

Eliminating Geographic Restrictions

Currently, federal elections are held through a geographically based division of power known as the "Great Compromise," an 18th-century scheme to balance national control between smaller and larger colonies. Presidential votes have traditionally been devised and awarded based on population and geography, with states casting ballots in a "winner-take-all" system.

If the Internet trend holds, and Americans continue to live and interact in the borderless, data-rich domain, voting standards may soon follow, allowing the electorate to vote online and for candidates based on their knowledge, rather than where they come from. An ever-growing electorate and recent budget cuts have made managing "brick-and-mortar" elections difficult, encouraging some states to provide early voting days and promote absentee ballot programs.

Online Voting

The high turnout for the 2004 general election left many voters waiting hours in long lines at their precincts and put heightened demands on beleaguered election officials with limited resources. Voting via the Internet could change all of that. With a familiar user interface, and easy access to additional voter information online, the electorate could vote with ease from the comfort of their homes or offices. Internet voting could provide a unique opportunity for better voting decisions.

With many voters taking "voter cues" from a wide range of candidate-endorsing interest groups, such as the

Dozens of states have opened up their bureaucracy to scrutiny and are allowing voters to cast their selections for political leaders who set vital state policy, such as in law enforcement, education, and finance. Only the federal executive branch continues a rigid-approach of insulating cabinet-level appointments from voter scrutiny.

League of Conservation Voters (LCV) and the National Rifle Association (NRA), datasets could be distributed by various causes to help their members and supporters easily endorse their recommendations.

Some opponents of Internet-based voting systems decry independent voting, and suggest that true voter “independence” from intimidation or pressure cannot be guaranteed in the home as well as it can in the ballot booth. However, current absentee ballot programs, where voters receive ballots by mail and make their selections at home, suffer the same limitations but are widely popular. Voter fraud with Internet voting could be prevented by new personal identification technologies, such as biometrics.

Changing the Shape of Democracy in America

Taken even farther, this Internet-based approach could bring about dramatic shifts in political parties and the nature of our democratic system.

For instance, independent and decline-to-state voters are the fastest growing segment of the electorate, and they even comprise pluralities in some states. Fewer members of the electorate identify with a single party or set of beliefs, and many now choose to vote for candidates based on experience and ideas, rather than making strict straight-ticket selections. The rise of non-geographic Internet voting could also fuel a move away from partisanship.

The Internet is also promoting greater political accountability and even more direct representation. Dozens of states have opened up their bureaucracy to scrutiny and are allowing voters to cast their selections for political leaders who set vital state policy, such as in law enforcement, education, and finance. Only the federal executive branch continues a rigid-approach of insulating cabinet-level appointments from voter scrutiny.

Given a growing frustration with ideological political agendas, and more voters calling for an end to partisanship in the Beltway, Americans could eventually find themselves choosing the next Secretary of Defense or Director of the Central Intelligence Agency. Whether Congress would endorse such changes remains to be seen. In the last century, however, federal lawmakers have at times been quite radical in their response to public demands for constitutional change.

The Seventeenth Amendment, giving voters the right to elect senators, was passed into law in 1913; women were given the right to vote in 1920; and the voting age was lowered to 18 in 1971. With recent legislative steps toward addressing the needs of the electorate, such as the Voting Rights Act of 1965 and HAVA in 2002, government continues to evolve.

A reshaping of the nation’s democratic process may be on the horizon. Consider, for instance, how many institutions of higher learning are proving to be hotbeds of political innovation.

In the interests of cutting costs, more colleges and universities are adopting Internet voting systems for student elections, introducing new e-voting technologies to millions of new

and future voters. Firms that provide Internet voting solutions for academia continuously refine their products to improve security and accuracy, and to further reflect the needs and input of collegiate voters. It's also worthwhile to note that many major campuses offer students the option to vote directly for student government positions for a broad range of issues important to students, such as finance, diversity, athletics, and community service.

Whether or not a groundswell for Internet-voting and direct democracy nationwide will emerge is unknown, but it's clear that the next generation of American voters is better prepared for the opportunities that may lie ahead.

VIII. Policy Recommendations

DRE technology introduced a host of concerns for voters and election officials, but its benefits persist in the face of criticism. In the interest of bolstering voter confidence and targeting effective uses of government resources, the following is a list of recommendations to raise the standards and expectations of e-voting in America.

Raise e-voting transparency at the state and national level

Without compromising important intellectual property protections, state and national election officials should require DRE vendors to routinely allow their proprietary software code to be examined for flaws and potential weaknesses. A host of DRE vendors have already submitted their code for analysis, and should continue to do so on a regular basis. In addition, "parallel monitoring," or randomized election-day testing of e-voting machines, should be made by state election officials to maintain system reliability, and bolster voter confidence.

Monitor e-ballot integrity at the local level

As the saying goes, change begins at home. It is incumbent upon county and state election officials to negotiate contracts with DRE vendors that reflect the concerns of their electorate. Volunteer "electorate councils" could be established by local residents to survey fellow voters and give public input before future equipment purchases are made, or contracts are drafted.

Encourage a competitive bidding process among e-voting vendors

Currently, most county voter offices have strong relationships with a single DRE vendor, which they solely rely on for e-voting machines. With a competitive DRE vendor industry, election officials can open a bidding process to meet any and all voter concerns for future purchases. Election officials and activists can track the outcomes of different vendor machines over time, compare their performance, and select those that best fit their county's needs.

Explore new designs of auditable vote verifications

HAVA's requirement for an auditable paper trail is a step in the right direction, but voter access is often restricted, and e-voting printers have already proven to be messy and prone to hardware malfunction. More economical methods, such as an electronic verification system that voters could readily access, should be explored by elections officials.

Better train poll workers

Typically, adolescents, retirees, and enthusiastic volunteers handle the bulk of election management, operating polling booths and managing other electoral duties with less than a weekend's worth of training. Poll workers can be "professionalized" to reduce human error, and those with information technology backgrounds could be trained to handle more high-tech issues, such as troubleshooting DREs on Election Day.

Partnerships between election officials and DRE device vendors could be forged to establish technical training programs for qualified poll workers.

IX. The Future Is Electronic

As the famous American psychologist B.F. Skinner once said, "the real problem is not whether machines think, but whether men do." For years, conspiracy theorists and distrustful academics have warned of massive and malicious fraud with "black box" voting, but partisan pundits have yet to cite a single example of such activity. And it's not for lack of a paper trail.

A review of the voter-verified paper trail from an early 2004 election in Nevada found a complete and accurate record of the votes cast. Electronic voting technology made a major milestone in the last general election, as an unprecedented number of Americans used DRE devices to cast their votes. User error and poll worker mishaps with e-voting machines have been few and far between, and they are predicted to decline further with future use and familiarity.

At the end of the day, the future of e-voting lies in the hands of the American people. DRE devices will only become a mainstay in national politics if voters allow them to become so, and all indications lead one to believe that such is the case. E-voting machines appear to have earned the confidence of the electorate, proving to be more reliable and easier to use than other voting systems.

The benefits appear to outweigh any risks that may arise with using electronic voting systems. DRE vendors have shown a strong willingness to work with election officials to quickly meet changing needs and requirements. The real question is how DRE devices and – later – Internet voting, will continue to shape the way elections are managed in America.

Endnotes

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