
January 10, 2007

TALKING POINTS

The Good News (Really) About Voting Machines

By ADAM COHEN

In the summer of 2004, I attended a national meeting of state election directors, and one of the biggest laugh lines was how activists were demanding that electronic voting machines produce a paper record of every vote cast.

An election official stood in front of the group, produced a roll of paper and started to unroll it while saying, to the delight of many in the audience, that the paper record would have to be mighty long to record all of the votes on a California ballot. Ha! Ha! Ridiculous!

The tinfoil-hat-wearing conspiracy nuts who hate electronic voting could complain all they wanted, the consensus in the room seemed to be, but paper records for electronic voting were impractical and unnecessary, and they were not going to happen.

What a difference two years makes.

Today, 27 states — including such large ones as California, New York, Illinois and Ohio — require electronic voting machines to produce a voter-verified paper trail. There is paper-trail legislation pending in a dozen more states.

And with the [Democrats](#) now in control, Congress appears poised to pass a strong federal law requiring electronic voting machines to produce paper records.

It is, of course, far too soon to celebrate the reform of our election system. Every election brings a flurry of disturbing stories about things going wrong at the polls, many of them involving electronic voting. In this year's midterm elections, the big news was the widespread reports of "vote flipping."

There are also a growing number of reports, including recent ones from a [Princeton University](#) computer scientist and the government of Cuyahoga County, Ohio, pointing out serious flaws in the election system.

But all of the bad news about voting systems is obscuring a very real piece of good news. Voting machines are one of the few areas recently in which a reform movement, in this case a truly grass-roots one made up largely of ordinary Americans, has not only made a huge difference — it is also well on its way to winning.

I. The Problem With Electronic Voting Machines

Critics of paperless electronic voting have long warned that the results cannot be trusted because it is impossible to know what goes on in the “black box,” their word for the internal workings of a computerized voting machine.

The totals that the machine reports when the polls close may not reflect the choices that the voters actually made.

In the darkest scenario, the machine’s manufacturer could build a computer code into it that was written to add votes to one party’s candidates and take them away from another. In the summer of 2003, these fears were underscored when it was reported that the chief executive of Diebold, one of the biggest voting machine makers, had written a fund-raising letter for President Bush’s campaign in which he said he was committed to delivering Ohio’s electoral votes for the president — while his machines counted many of the votes in Ohio.

But the machines’ manufacturers are hardly the only ones who could put malicious code on a voting machine. A single renegade employee could write vote-stealing code, or put a “patch” on the software that accomplished the same thing. Many electronic voting machines also have wireless capacity, so the results on them are vulnerable to being changed by remote technology.

There have been a number of alarming reports about how easy it would be to hack an electronic voting machine.

[Prof. Edward Felton](#), a computer science professor at Princeton, conducted a [study](#) recently that found that it would not be at all difficult to hack into a Diebold machine that is the most commonly used electronic voting machine in the country.

Professor Felton's two main findings were:

(1) Malicious software on a voting machine can “steal votes with little if any risk of detection.” It can also “modify all of the records, audit logs and counters kept by the voting machine, so that even careful forensic examination of these records will find nothing amiss.”

(2) “Anyone who has physical access to a voting machine, or to a memory card that will later be inserted into a machine, can install” malicious software in as little as one minute.

[Prof. Aviel D. Rubin](#) of [Johns Hopkins University](#) reached much the same conclusion. In a [classroom exercise in 2004](#), he created a malicious code that was able to change the outcome of an election and then disappear without a trace.

These scenarios of intentional vote theft are the most alarming, but there is a lot that can go wrong simply by accident or with poor handling of the machines.

Voters using electronic machines have often reported that when they tried to cast a ballot, the machine “flipped” their votes from the candidate they selected to an opponent. In last November's elections, [reports of “vote flipping” were widespread](#), and in some cases they were confirmed by election officials. In Broward County, Fla., a spokeswoman for the Board of Elections told The Miami Herald that it is not uncommon for their electronic machines to get out of sync when they are used heavily, and to register votes incorrectly. When voters call the glitches to poll workers' attention, she said, the machines can be recalibrated on the spot.

November's election brought reports of other problems with electronic voting last November, ranging from software glitches that caused votes to be counted

twice to a faulty memory cartridge that caused votes to be added to races in which they were not cast. VotersUnite.org kept a [log of problems reported in the media](#).

II. The Solution

There is a clear answer to the problems with electronic voting: a voter-verified paper trail. That is, every time a voter casts a ballot electronically, he or she should receive a paper record that can be reviewed for accuracy. Those records should remain with the voting machine and become the official record of the vote - so if there is a conflict between the tally on the machine and the totals obtained by adding up the paper ballots, the paper-ballot tallies are the ones that are used to decide the election.

The reason is clear: as Professors Felton and Rubin and many others have shown, the results produced by electronic voting machines themselves cannot be trusted.

The [National Institute for Standards and Technology](#), a federal agency that promotes the use of appropriate technological standards, issued a [draft report \(PDF\)](#) last month that explained in technical terms why paperless electronic voting systems cannot be trusted. To be credible, NIST found, a voting system must be “software independent” — that is, there must be a check on the accuracy of the system that is independent of the software in the system. The most obvious way to do that, according to NIST, is with a voter-verified paper trail.

For touch-screen voting machines, this means having a paper printout that reflects the choices made by the voter.

Touch screens that produce paper trails are far better than ones that do not. But there are still problems. The biggest is that the technology for producing paper trails, and the humans who feed in the paper and keep the printers running, are prone to error. Cuyahoga County, Ohio, which includes Cleveland, recently commissioned a [study of the performance of their electronic voting machines \(PDF\)](#). The study, conducted by Election Science

Institute, found that nearly 10 percent of the paper records reviewed were either blank or otherwise unreadable.

A better method uses “optical scan” technology: the voter darkens ovals on, or otherwise marks up, a sheet of paper that is then fed into an optical scan device that reads the voter’s choices. Optical scans combine the integrity of a paper-based system — the sheets of paper voters fill out remain the official ballots — with the efficiency of vote counting by computer.

To ensure that the vote totals are correct, after every election there should be a mandatory audit of a fixed percentage of randomly chosen machines. The paper ballots should be tabulated and compared with the votes recorded by computer, to ensure that there is no discrepancy. In New York, [the law requires a manual audit of 3 percent of the paper trails](#) from randomly chosen machines.

III. The Electronic Voting Reform Movement

The movement to reform electronic voting has been an impressive combination of leading experts and ordinary citizens.

[David L. Dill](#), a professor of computer science at [Stanford University](#), has been a pioneer. Professor Dill began publicly questioning electronic voting in January 2003, and in June of that year he launched the Web site [VerifiedVoting.org](#). VerifiedVoting.org has since become an important voice demanding that electronic voting machines produce paper trails.

Other computer scientists like Professor Rubin and the tireless [Rebecca Mercuri](#) have, like Professor Dill, used their deep knowledge of voting technology to explain the machines’ security vulnerabilities to the general public.

Major national organizations, ranging from [Common Cause](#) and the [American Civil Liberties Union](#) to [MoveOn.org](#), have played an important role in mobilizing their members and attracting attention to the issue. The national [League of Women Voters](#), which was regrettably slow to recognize the

importance of voter-verified paper trails, has recently become a strong supporter.

The most remarkable part of the movement, though, has been the grass-roots organizations that have sprung up around the country to demand better voting technology. One of the most effective of these has been [New Yorkers for Verified Voting](#). The verified voting cause has also benefited from the energetic efforts of a few extremely dedicated activists who have made it a personal mission, people like Bev Harris of [BlackBoxVoting.org](#), whose hard-driving style has won her both fans and critics, and Teresa Hommel of [wheresthepaper.org](#).

These groups organize rallies in Washington, and at the state level put pressure on elected officials. In the summer of 2004, [activists held simultaneous “The Computer Ate My Vote” rallies in 24 cities](#), and collected more than 300,000 signatures on petitions demanding paper trails.

They also conduct independent research and influential studies that have helped shape the debate. New Yorkers for Verified Voting recently released [an important report](#) explaining how if New York chooses the wrong machines, the state may end up with such intolerably long lines at the polls that many voters will be disenfranchised.

For the 2004 election, VerifiedVoting.org launched TechWatch, a program that brings volunteers with technology backgrounds to the polls on Election Day to observe the functioning of voting machine technologies and investigate incidents when the machines fail to work properly.

There are some powerful forces lined up on the other side. The leading opponents of paper trails have been, interestingly enough, state and local election officials and voting machine manufacturers. It is no great mystery why. Paper trails are a serious form of accountability in an area where there has been little of it. If the tallies on the paper trails do not match the totals on the machines, election officials and machine companies have to answer a lot of hard questions. Both groups would prefer to be able to certify whatever numbers show up on the machines without fear of contradiction.

Election officials in states like Georgia and Maryland, which spent millions of dollars on electronic voting machines that do not produce paper trails, also have a vested interest in defending their own choices. If it is generally agreed that paper trails are necessary for a voting system to be acceptable, it means that election officials in those states made a multimillion-dollar mistake with the taxpayers' money.

Wherever paper trails have been proposed — in state legislatures, in administrative bodies — election officials have been one of the most outspoken groups to oppose them. As long as election officials controlled the process with little input from the public, they could make decisions like these.

But since the meltdown in the 2000 presidential election, the American public has become much more aware of and concerned about the election system. Increasingly, the public's views on voting machines are prevailing, even over the opposition of election officials.

IV. Successes at the State Level

When Congress passed the Help America Vote Act in 2002, it gave the states hundreds of millions of dollars to upgrade their voting systems. But it did not impose a voter-verified paper trail requirement. As a result, some states, like Maryland and Georgia, rushed out to buy electronic voting machines that do not produce a paper trail.

After the Help America Vote Act was passed, the Republican majority in the Senate and House blocked paper trail bills — including one introduced by Representative Rush Holt, Democrat of New Jersey, with roughly 200 co-sponsors.

This federal inaction has pushed reform efforts to the state level. The remarkable thing is just how successful those efforts have been. State after state have adopted legislation requiring electronic voting machines to produce paper trails. In July 2005 alone, a particularly successful month, the governors of New York, New Jersey and Connecticut [signed laws](#) imposing a paper trail requirement.

California's law was passed over the opposition of the secretary of state and the California Association of Clerks and Election Officials. The clerks and election officials opposed the law even though they conceded that without a paper trail, electronic voting results could be manipulated.

The bill's sponsor, State Senator Debra Bowen, was elected California's secretary of state in November, putting her in charge of the nation's largest election system.

Today, 27 states have paper trail laws, including 6 of the 10 largest states (California, New York, Illinois, Ohio, Michigan and New Jersey). Eight more states use paper trails statewide, though they are not legally required to.

Another sign of the success of the reform movement: jurisdictions that adopted paperless touch-screen voting are beginning to abandon it.

New Mexico, where some voters used to use paperless touch-screens, has adopted [a statewide system in which all votes are recorded on paper.](#)

In last November's elections, voters in Sarasota County, Fla., [voted for a measure](#) to require their county to have voting machines with a paper trail by January 2008.

The commissioners in Cuyahoga County, Ohio, have begun talking about replacing their county's voting machines — which produce paper records that have not worked very well — with an optical scan system, in which voters fill out their ballots by hand, and those ballots are then counted by computers.

Many voting experts now agree that optical scan systems are the best technology, because the voters themselves produce the paper record that can later be recounted. That is better than a system in which the voting machine produces a paper record, which the voter may or may not check for accuracy. Optical scans are also better than touch-screens because many voters can fill out their ballots at once. The ballots are then quickly run through an optical scan reader. Waiting time to vote is far shorter using optical scans than touch-screens.

This state action has revolutionized the voting machine industry. Not long ago, many voting machine manufacturers insisted that it was impractical to provide voters with a voter-verified paper trail. But now that it is a legal requirement in most states, the companies are of necessity making machines that comply. New York is in the process of choosing new voting machines, and Diebold, ES&S, Sequoia and Avante are all competing with machines that produce voter-verifiable paper records.

V. Poised for Victory at the National Level

Having electronic voting machines that can be trusted should not be a partisan issue, but for some reason it has been.

Democratic members of Congress have introduced most of the bills to require paper trails for electronic voting. (One exception: Senator John Ensign, Republican of Nevada, has a paper trail bill. In 1998, Senator Ensign lost a Senate race to [Harry Reid](#), now the new Senate majority leader, by fewer than 500 votes.) The Republican leadership prevented those bills from coming to the floor.

With the Democrats now in charge, there is an excellent chance that a federal law requiring a paper trail will pass.

[Senator Dianne Feinstein](#), Democrat of California, is the new chairwoman of the Senate Rules and Administration Committee, which has jurisdiction over election law. Last October, Senator Feinstein [announced that she intends to introduce legislation requiring paper trails and mandatory, random audits](#) early in the new session.

Representative Rush Holt, Democrat of New Jersey, [plans to push a paper trail bill in the House](#). Mr. Holt's bill, [called the Voter Confidence and Increased Accessibility Act](#), has more than 220 bipartisan sponsors.

If paper trail legislation is passed, there is certainly a chance that President Bush will veto it. But it is unclear whether a president who was put in office by the Supreme Court after an electoral system meltdown — and who has vetoed so few bills — would want to end his presidency by vetoing a popular bill to

ensure the integrity of American democracy. In any case, given the growing bipartisan support for paper trails, it is not out of the question that a veto could be overridden.

The last few years have been hard ones for reformers. Washington's lobbying industry and its pay-to-play culture have thrived, despite the best efforts of good-government groups to get rules adopted to rein it in. Well-heeled contributors and cash-hungry politicians have proved adept at finding holes in the limited campaign finance regulations that are in place.

Fixing voting machines is arguably the only major reform effort that has met with undeniable success.

There are still, unquestionably, hurdles standing in the way.

Federal legislation could still be blocked, by a presidential veto or [a Republican](#) filibuster, or simply by cold feet in the ranks of the Democratic Party.

Even when there is good paper trail legislation, there is still a lot of work to be done.

The Cuyahoga County study showed that paper trails on touch-screens are still a highly imperfect technology. Election jurisdictions that have touch-screen machines may have to dump them — as Cuyahoga County is reportedly considering doing — in favor of optical scans, even though the cost of switching could be considerable. Or, working with the voting machine companies, they may need to find a way to make paper trails more reliable.

More work also needs to be done on the auditing process, to determine the optimal percentage of ballots to audit and the best procedures for doing so.

There is also a lot of work to be done beyond paper trails to make voting machines acceptable.

Ballot design remains a major area of deficiency, six years after the “butterfly ballot” in Florida showed how easily a bad ballot can frustrate voters’ intent. Many people now believe that the Congressional election in Florida’s 13th District that is now in court — where the Republican, Vern Buchanan, beat the Democrat, Christine Jennings, by fewer than 400 votes, and as many as 18,000 votes may not have been registered on the paperless electronic voting machines — may have been tainted in Ms. Jennings’s strongest county in part by a bad ballot design that confused voters into not casting a ballot in that race.

The overall quality of voting machines remains poor, and the reputations of the leading voting machine manufacturers are not good. In New York, some voting rights activists — and this editorial writer — have [urged the boards of elections to put off adopting new machines](#) until the machines offered by the companies get better.

Still, it’s amazing how far we have come in a little more than two years. This is one reform movement that is leaving its mark.