# The case for preserving voter-marked paper ballots

Voting machines are computers and, like any computers, can produce incorrect output. Despite the best possible efforts of even the most diligent elections clerk, electronic miscounts are occasionally produced by:

- Accidental human error when setting the machine up for the election, compounded by pre-election testing that does not detect the miscounts in the number of votes for individual candidates;
- Machine malfunction, such as overheating or miscalibration;
- Deliberate hacking, such as when the voting machine vendor's system is compromised by an unauthorized programmer or by a corrupt authorized programmer. Any hacker who knows how to tamper with the source or operating code knows enough to make the hack operable only on Election Day so that it will not be noticed in pre-election testing. No local elections official, no matter how diligent, has control over the security of the machines or the software before they come into his or her possession.


**Therefore, we need voting systems that preserve a paper record that can be reliably recounted or audited.** Voter-marked paper ballots are suited for this purpose; a voter-verifiable paper trail (VVPAT) created by a 'Direct Recording Electronic' machine, also known as a DRE or touch screen machine, is not.

1. Unpredictable malfunction can prevent VVPAT ballots from being created, leaving no record for a recount or audit. Studies and experience show that very few voters actually do look at the printed paper trail, and only a portion of those say anything to the elections inspectors if they notice a problem. Therefore, if the paper fails to advance, prints illegibly or not at all, or has some other problem that prevents the creation of a usable paper trail, dozens of voters may cast their ballots before the problem is noticed and corrected.
2. In the event of a recount or audit, VVPAT ballots are flimsy, hard to read, and hard to handle. Paper ballots are easier to handle and both the votes and the ballots are easy to count.
3. Elections inspectors and clerks must perform more hand counts when using VVPATs than when using optical scanners. DREs do not eliminate paper ballots, which will always be used by a portion of voters, including absentees, provisional ballots, voters who refuse to use touch-screens, and by all voters during periods when the VVPAT is temporarily out of

service on Election Day. When optical scanners are used, none of these problems require elections officials to hand-count ballots.

4. When hackers do succeed in compromising voting-machine software, voter-marked paper ballots remain safely beyond their grasp and thus allow elections officials to detect and correct fraud by comparing the votes on the ballots against the vote totals reported by the machine. However, with DREs, no record of the votes will exist other than that created by the hacked machines. Even if the hacker allows the paper trail to match the altered vote-count, he or she will likely escape detection. The arithmetic is dramatic:

   > A hacker needs to switch only five out of every 100 votes to give a fraudulent ten-percent advantage to one candidate--or only 500 votes in a 10,000-vote contest. When voting on a DRE with a voter-verifiable paper trail, studies have shown that two-thirds of these 500 voters, or about 335, will leave the polling place without looking at the paper trail. Of 165 who do look at the paper trail, as many as 125 can be expected, in the interests of saving time or embarrassment, to allow the incorrect vote to be recorded or to correct the vote without saying anything to the elections inspector. The remaining 40 voters will be scattered over several precincts, so no single polling place will experience more than one or two voters noting anything odd about the machines' operation, a number unlikely to trigger concern in either the municipal or county canvass. The hacker will escape detection, even though the VVPAT displayed the incorrect votes to the voters.
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   > In the unlikely event that anyone did notice and document the vote-flipping, the clerks would be powerless to determine the correct results, because the hacked DRE machines would have left them with no record of the true votes.

With voter-marked paper ballots and optical-scan voting systems there will always be a complete, clear, and reliable record of the voters' choices—a record that remains fully in the control of the voters and local elections officials from its creation through the entire process.