September 9, 2004

Ms. Judy Grady
Director of Election Reform
State of Ohio

Dear Ms. Grady,

The following comments regarding Voter Verified Paper Audit Trail (VVPAT) systems are submitted on behalf of the Verified Voting Foundation, a national and strictly nonpartisan organization that champions reliable and publicly verifiable elections in the United States.

We would first like to commend the State of Ohio for adopting legislation (Substitute House Bill 262) to require direct recording electronic (DRE) voting systems to provide a voter-verified paper audit trail (Sec. 3506.10(P)), for requiring that such VVPAT systems be accessible to voters with disabilities (Sec. 3506.01(H)), for specifying that the VVPAT shall serve as the official ballot in any recounts (Sec. 3506.18(A)), and for requiring the Ohio Secretary of State to establish VVPAT standards as a condition for certification of new DREs and continued certification of existing DREs (Sec. 3506.05(H)(3)(a)). The development of those standards is the subject of the public hearings scheduled today and tomorrow and for which these comments are being submitted.

With regard to specific standards governing the functionality and accessibility of VVPAT systems, we encourage your Election Reform division to examine the AVVPAT standards recently adopted by the State of California and which are available at: http://www.ss.ca.gov/elections/ks_dre_papers/avvpat_standards_6_15_04.pdf

We would also encourage Ohio to take a broader view of what constitutes a Voter Verified Paper Audit Trail. While VVPATs are typically discussed in the context of DRE voting systems, DREs are not the only voting systems which can and do provide a VVPAT. Sec. 3506.05(H)(3)(a)(i) directs the Ohio Secretary of State to develop VVPAT standards that shall include:

"A definition of a voter verified paper audit trail as a paper record of the voter's choices that is verified by the voter prior to the casting of the voter's ballot and that is securely retained by the board of elections",

while division (H)(3)(a)(v) of that section specifies inclusion of:

"A requirement that the voter verified paper audit trail shall be capable of being optically scanned for the purpose of conducting a recount or other audit of the voting machine and shall be readable in a manner that makes the voter's ballot choices obvious to the voter without the use of computer or electronic codes."

We submit that the above VVPAT requirements (as well as the other requirements specified in Sec. 3506.05(H)(3)(a)) are already met by optical scan voting systems, and at substantially lower cost than a DRE plus VVPAT-printer solution. In addition, the other voting system requirements established elsewhere in Sub. House Bill 262 and those specified in HAVA (especially those requirements pertaining to prevention of over-votes, warnings of under-votes, and accessibility of voting systems for voters with disabilities) can be met via precinct-based optical scan voting systems augmented by existing ballot marking devices (an example of an accessible ballot marking device is the Vogue/ES&S AutoMark; see http://www.essvote.com/HTML/docs/AutoMark.pdf) that provide touch-screen and audio-based interfaces to a standard optical scan ballot. Furthermore, multiple studies (including a recent Florida study) indicate that precinct-based optical scan voting systems provide a lower rate of under-votes than do DREs.

Adding to DREs an accessible VVPAT printer (i.e., one that includes an audio feedback capability as required to make the VVPATs accessible to blind voters and one which also produces a VVPAT that can be optically-scanned) significantly increases both the cost and complexity of what is already an expensive and complicated technology. This concern is reflected in division (H)(3)(b) of Sec. 3506.05, which permits the Ohio Secretary of State to waive the requirement (division (H)(3)(a)(v)) "that the voter verified paper audit trail shall be capable of being optically scanned" if the Secretary determines that that requirement is "cost prohibitive". Yet this optical-scanning requirement can easily be met in a cost-effective manner by existing precinct-based optical scan voting systems.

The cost of adding VVPAT printers to DREs is also addressed in Sub. House Bill 262 Sec. 3(E)(4)through 3(E)(6). If a vendor's bid for delivering a DRE plus VVPAT-printer solution is more than 120% of that vendor's prior bid for a DRE-only system, division 3(E)(6) states that:

"...the Secretary of State shall not accept the cost, and any contract negotiated with the vendor shall be deemed null and void with respect to any direct recording electronic voting machines not yet purchased."

Once again, a precinct-based optical scan solution augmented with ballot marking devices may provide a comparable (and in some respects, superior) VVPAT solution at a significantly lower cost. Division 3(F)(1) of this section provides that if a given vendor fails to gain certification for its DRE+VVPAT solution or if its previous contract is declared null and void under division 3(E)(6), then that vendor may submit a bid:

"...to provide voting machines, marking devices, or automatic tabulating equipment..."

We believe this language may enable counties to consider precinct-based optical scan systems and ballot marking devices as a cost-effective alternative to implementing a DRE + VVPAT solution.

In addition, a precinct-based optical scan voting system enables the voter to provide another critical verification: verification that the voter has been given the correct type of ballot. A recurrent and serious problem with DREs (which has been documented in states where they are used, including California, Maryland, and Georgia) is of voters receiving the wrong ballot type or an incomplete ballot. In some of these cases, voters have been partially disenfranchised, as they have been denied the opportunity to vote on races for which they were entitled to vote.

With a DRE-based system, when a voter signs into the poll book and is handed a ballot by the poll worker, they are given either a 'smart card' (on which the ballot is electronically encoded) or a 4-digit code number (e.g., Hart InterCivic eSlate system). In both cases, what the voter receives is opaque and inscrutable; the voter has no way to verify, prior to entering the voting booth, that he or she has received the correct type of ballot.

It is only after the voter has started voting (and often not until they finish voting) that a voter may realize that the ballot he or she received was the incorrect type or that it is missing one or more races or questions. In many cases, this realization comes too late, as many voters have inadvertently cast their DRE ballots while searching for the missing races or questions. And even when voters detect this mistake in mid-ballot, they typically have to compromise the secrecy of their electronic vote when showing poll workers that their partially-voted electronic ballot is of the wrong type.

Contrast this with an optical scan ballot system, where voters can inspect the complete ballot at the time they receive it from the poll worker and can exchange any incorrect ballots for the correct ballot type before they begin to vote. Such exchanges can be done without compromising ballot secrecy.

The problem of poll workers mistakenly giving voters an incorrect ballot type is clearly a human problem that can occur regardless of whatever voting technology is used; it can partially be addressed by better training of poll workers. However, it is a problem that will never be completely eliminated, and one which any voting system must adequately address. To date, DREs have not adequately addressed this problem, nor will it be addressed by adding VVPAT printers to DREs.

There is also a critical difference between the VVPAT functionality provided by a DRE-plus-VVPAT-printer solution versus that provided by an optical scan voting system. Most optical scan ballots are inherently voter-verified because they are marked directly by the voter. But a VVPAT that is produced by a printer attached to a DRE may or may not be verified by the voter, because there is no requirement that the voter actually inspect the VVPAT.

Optical scan voting systems also provide a more transparent and publicly verifiable means for conducting pre- and post-election logic and accuracy tests. A test deck of optical scan ballots can be publicly counted by hand (and by multiple parties) and compared against an optical scanner's count of that same test deck; multiple scanners can be quickly and efficiently tested using this same deck. This is considerably more cost-effective and transparent than comparable logic and accuracy tests on DREs.

In addition, a precinct-based optical scan solution provides capabilities that are comparable to DREs in terms of providing the same opportunities for voters to detect and correct errors such as over-votes and under-votes and, when augmented by ballot marking devices, for accessibility by voters with disabilities. Such a solution is fully compliant with the provisions of HAVA. It also ensures that most ballots will in fact be voter-verified, and it reduces the likelihood of voters voting on ballots of the incorrect type.

It also ensures that all of the voters (absentee, non-absentee, disabled and non-disabled) in any county deploying such a solution receive an identical ballot and that all such ballots are counted the same way, thus simplifying election administration. In those counties currently using punch-card based systems, the deployment of an optical scan system means using a voting system closer to what voters are familiar with and more similar in implementation for election officials. Because it is simpler than the more complex DRE system, it will likely reduce the human error factor and make training easier, as well as requiring fewer poll workers to staff the polls on election day. And for the reasons described earlier, it provides a voter verified paper audit trail superior to that provided by DREs.

For all these reasons, we encourage Ohio to develop accessible VVPAT standards that are sufficiently broad so as to include precinct-based optical scan voting systems (coupled with at least one electronic ballot marking device per polling place to meet accessibility requirements) as a viable and cost-effective option for providing an accessible VVPAT voting system for Ohio's voters. Such a solution can be implemented rapidly using existing technology (i.e., its does not require jurisdictions to wait for the major voting systems vendors to develop accessible VVPAT capabilities) and with significantly lower capital outlay than a DRE-plus-VVPAT-printer solution, because only one optical scanner and one ballot marking device is needed per polling place.

However, Ohio's VVPAT standards obviously must also address the requirements for VVPAT printers attached to DREs. Accordingly, those standards should encompass both types of technology (optical scan and DRE), as a two-pronged approach is needed to best address the varying needs of Ohio's counties:

1. For those Ohio counties that have already deployed DREs without accessible VVPAT-printers, adding such printers may well be a viable solution for meeting the requirements of Sub. H. B. 262. The California AVVPAT standards should provide a solid foundation on which to base Ohio's standards.

2. For those Ohio counties that have not yet deployed DREs (or other HAVA-compliant accessible voting systems), the approach we have described here (precinct-based optical scanners plus ballot marking devices) will likely provide a more cost-effective, less complex, and easier to administer system.

Please do not hesitate to contact us if you have any questions regarding the issues raised by these comments.

Respectfully,

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Attachments:

1. References to studies (including the recent Florida study) showing lower under-vote rates for optical scan systems compared to DREs

2. References to articles describing voters receiving and voting on electronic ballots that were either of the wrong type or missing races

3. Economic analysis showing cost-savings for a precinct-based optical scan/ballot marking device solution compared to a DRE+VVPAT-printer solution

Attachment 1:
References to studies (including the recent Florida study) showing lower under-vote rates for optical scan systems compared to DREs

1. The MIT/Caltech Voting Study
http://www.vote.caltech.edu/Reports/2001report.html
Table 1, on page 21 of this report, contains the following data:

RESIDUAL VOTES AS A PERCENT OF ALL BALLOTS CAST,1988-2000

| Machine Type | President | Governor & Senator |
|---|---|---|
| Paper Ballot | 1.8% | 3.3% |
| Punch Card | 2.5 | 4.7 |
| Optical Scan | 1.5 | 3.5 |
| Lever Machine | 1.5 | 7.6 |
| Electronic (DRE) | 2.3 | 5.9 |

Residual votes is the sum of unmarked ballots (a.k.a. under-votes), over-votes, and any other ballots that are cast by voters but uncounted for any other reason. Additional commentary can be found on report page 21.

A more recent (2004) study conducted in Florida compared the number of under-votes reported by DRE and optical scan systems in elections where there was only a single race or question on the ballot. It is assumed that in such single-contest elections, voters are unlikely to make a trip to the polling place to cast a blank ballot, so that under-votes that occur in such elections reflect a failure of the voting technology in use to record those votes. This study found that in such single-contest elections, DRE voting systems registered roughly 8 times as many under-votes optical scan systems. While the optical scan systems incurred an over-vote rate of 0.01%, those presumably occurred on central-count optical scan systems. Both DREs and precinct-based optical scan systems prevent over-votes.

For details, see: “Analysis reveals flaws in voting by touch-screen” by Jeremy Milarsky and Buddy Nevins, in the July 11, 2004 issue of the Sun-Sentinel. An archived version of this article is available at:
http://www.verifiedvoting.org/article.asp?id=2473

Attachment 2:
References to articles describing voters receiving and voting on electronic ballots that were either of the wrong type or missing races

"The Vexations of Voting Machines" by Viveca Novak in the May 3, 2004 edition of TIME Magazine,
http://www.time.com/time/archive/preview/from_redirect/0,10987,1101040503-629410,00.html

"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...

Liss is still awaiting satisfaction. He was finally allowed to cast a provisional ballot for the Mikulski race. Then the state refused to count it. Liss filed a petition with the county board of elections and awaits a decision."

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"New Voting Glitch Had Old Cause", by Stuart Pfeifer, in the March 6, 2004 edition of the Los Angeles Times. An archived version of this article is available at:
http://www.verifiedvoting.org/article.asp?id=1444

"Confusion in Orange County that led to some voters receiving the wrong ballots on Tuesday highlights a problem election officials have been

struggling with for years: recruiting and training temporary poll workers.

With the advent of high-tech voting, the problem is only going to get worse, some analysts say.

In Orange County, poll workers — including some who said they received inadequate training — gave some voters incorrect access numbers that led some of them to vote for candidates in the wrong political party or in the wrong election district.

Officials are investigating the problem, but say they may never know how many votes may have gone astray..."

Also see:
"7,000 Orange County Voters Were Given Bad Ballots", in the March 9, 2004 edition of the Los Angeles Times. An archived version of this article is available at:
http://www.votersunite.org/article.asp?id=1476

"7,000 Orange County Voters Were Given Bad Ballots
By Ray F. Herndon and Stuart Pfeifer, Times Staff Writers

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.

Wide margins in most races seem likely to spare the county the need for a costly revote. But the problems, which county officials have blamed on insufficient training for poll workers, are a strong indication of the pitfalls facing officials as they try to bring new election technology online statewide.

'The principal of democracy is every vote should count. That's why we need a better election system,' said Henry Brady, a political science professor at UC Berkeley and an expert on voting systems.

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.

Problems occurred in races throughout the county — including five out of six congressional races, four of five state Senate contests, and five of the nine Assembly races that are decided in whole, or in part, by Orange County voters.

Election officials acknowledged that poll workers provided some voters incorrect access codes that caused them to vote in the wrong legislative districts but said there was no evidence yet that any result was in jeopardy...

The Times arrived at its estimate of 7,000 improper ballots by comparing precincts with unusually high voter turnout to the average turnout at polling places.

Orange County election officials have traced the problem to poll workers who were responsible for giving each voter a four-digit code to enter into the voting machines.

After signing in, each voter received a ticket bearing his or her precinct number and party affiliation from a poll worker. The voter would take the ticket to a second worker, who was supposed to scroll through a computer screen and use the voter's precinct and political party to an access code that would identify the appropriate ballot. Several workers who handled this stage of the process — including some who said they didn't know more than one precinct had been assigned to their polling place — gave voters codes for the wrong precincts, causing the wrong ballots to appear on their screens.

Some voters noticed the problem and were able to get workers to give them access codes for the proper ballots. But many voters did not..."

Attachment 3:
Economic analysis showing cost-savings for a precinct-based optical scan/ballot marking device solution compared to a DRE+VVPAT-printer solution

BACKGROUND:
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1. Unlike a central-count optical scan voting system, a precinct-based system scans the ballots at the polling place, as they are cast. After marking their ballots, voters insert them into the scanner. If they have over-voted, the scanner will reject their ballot and inform them to contact a poll worker in order to exchange their spoiled ballot for a replacement. In such cases, the spoiled ballot is placed in a privacy envelope to ensure ballot privacy, then marked as spoiled and deposited into a secure box for storing spoiled ballots. If voters have under-voted, the scanner will warn them of that condition, and give them the option of retrieving their ballot and marking additional contests. However, if the under-vote is intentional, voters can instruct the scanner to accept the under-voted ballot. Once a ballot has been cast and counted by the scanner, the scanner deposits the ballot into a secure ballot box.

2. A ballot marking device provides a touch screen interface that can be used by visually-impaired voters (i.e., to display the ballot in very large fonts) and an audio interface for blind or language-impaired voters. In many ways, it looks like a DRE but it is not one. The big difference is that instead of storing the voter's choices electronically, it fills in the ovals on a standard optical scan ballot. You can think of such a device as a computerized marking pen.

One example of a ballot marking device is the ES&S/Vogue AutoMark. For details, see: http://www.essvote.com/HTML/docs/AutoMark.pdf
(This device is listed here for illustrative purposes only; the Verified Voting Foundation does not endorse any specific brand or vendor of voting systems nor does it have any financial ties to any such vendors.)

3. There are several advantages to using a ballot marking system to provide voting access for the blind and disabled at the polling place. Under such a model, each polling place would have at least one ballot marking device and one precinct-based optical scanner. A significant advantage of this approach (coupled with the use of precinct-based

optical scanners) is that all voters use an identical, paper, optical scan ballot, which means that the ballots for all types of voters (including both absentee and non-absentee voters) can be handled and counted using the same type of equipment.

A. Absentee voters fill out their optical scan ballots by hand. When these are received at the registrar of voters, they can be scanned using the same type of optical scan ballot scanners that are used at the polling places.

B. Blind or disabled voters at the polling place can use a ballot marking device to complete their optical scan ballots. Blind voters would use the audio interface on the ballot marking device to complete their ballots, and would use a similar audio interface either on the ballot marking device or on the precinct-based optical scanner to verify their ballots.

C. Able-bodied voters at the polling place can always fill out their optical scan ballots by hand, or, if they so choose, they can use the ballot marking device, if it is not busy or if they are willing to wait in line for it. However, any blind or disabled voters would always have priority (over able-bodied voters) in using the ballot marking device. NOTE: having at least some able-bodied voters use the ballot marking device is a good thing, because it helps to preserve ballot secrecy, since at many polling places there may be only one (or even zero) blind or disabled voters. Besides, if the device is just sitting there idle, voters may as well use it. Having at least some able-bodied voters using it provides a further check that it is operating as intended.

COST COMPARISON:

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Capital costs for each polling place will be significantly lower, because you only need one ballot marking device and one precinct-count optical scanner, as opposed to several DRE voting machines. For most voters, all you need to provide is a fold-up voting booth and some felt tip pens. Counties which previously employed punch-card-based voting systems most likely already possess the needed voting booths.

1. Cost estimate to equip a polling place with ballot marking device + precinct-based optical scanner

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The current estimate for the cost of a ballot marking device is $4,500. A similar, estimate for a precinct count optical scanner is $5,000, and a similar estimate for a fold-up voting booth is $250. For a polling place with 8 voting stations, the total capital cost would be:

| | |
|---|---|
| (1) Ballot marking device | $4,500 |
| (1) Precinct count optical scanner | $5,000 |
| (8) Fold-up voting booths | $2,000 |
| Total | $11,500 |

Note that if the jurisdiction already had an optical scan ballot system in place (and a large number of jurisdictions do), then they would already have the fold-up voting booths and the precinct-count optical scanner, so the capital outlay would be only $4,500 for the ballot marking device.

2. Cost estimate to equip a polling place with DRE voting machines + VVPAT printers

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The average cost of a typical DRE voting machine is about $3,500 (which includes its own fold-up voting booth) and the cost of a disabled-accessible (i.e., audio-equipped) voter-verified paper audit trail printer could add as much as $1,000, for a maximum combined cost of approximately $4,500 per voting station. However, we will assume a lower average cost of $500 per accessible VVPAT printer, which brings the average cost per voting station to $4,000.

For a polling place with 8 voting stations, the total capital cost would be:

| | |
|---|---|
| (8) DRE voting machines | $28,000 |
| (8) Disabled-access VVPAT printers (with audio feedback) | $ 4,000 |
| Total cost | $32,000 |

The DRE solution is therefore almost 3 times more expensive than a solution using ballot marking devices and precinct-based optical scanners, just in terms of initial capital outlay. When you factor in the increased maintenance costs (because there are physically more units to maintain) and the increased costs for logic and accuracy tests, security audits, the larger number of poll workers needed to operate DRE polling places, etc., the DRE solution will likely prove even more expensive in operating costs.

3. Other advantages
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The ballot marking devices do nothing more than assist voters in completing their optical scan paper ballots. (They essentially replace a human assistant, who compromises ballot secrecy, with an automated assistant, which does not compromise that secrecy.) Unlike DRE voting machines, the ballot marking devices do not store any electronic ballots nor count any votes. Accordingly, they avoid most of the authentication, security, and auditability issues associated with DRE voting machines:

A. Unlike many DRE voting machines whose "SmartCards" might be compromised to enable multiple votes, a ballot marking device only allows each voter to vote once, because that voter is given only a single optical scan paper ballot when they sign in. All of the security, anti-counterfitting, and audit features of existing optical scan paper ballots (e.g., tear-off ballot stubs with serial numbers [to prevent chain-voting], watermarks, etc.) are retained. Accordingly, at the end of the day, the total number of optical scan paper ballots that have been cast, spoiled, or which remain unused can be tracked and counted and reconciled against the sign-in logs.

B. Because no votes are stored electronically in the ballot marking device, one eliminates the potential conflicts between electronic ballots and paper ballots that one faces with a DRE voting machine + VVPAT printer solution. For each voter, there is one (and only one) ballot of record: the optical scan paper ballot that the voter completes (either with or without the assistance from the ballot marking device). Since the optical scan paper ballot is its own "voter-verified paper ballot", there is no need for additional printers and the added cost and complexity they impose.

C. Since the ballots are scanned at the polling place using the precinct-count optical scanners, incorrectly-completed ballots (e.g., over-voted ballots, smudged ballots, etc.) should be rejected by the scanner. The voter can then exchange the spoiled ballot for a new blank ballot so that the voter can correct his or her mistake. Also, since the ballots are counted in the precinct, there is less opportunity for ballots or ballot boxes to be lost in transit, as sometimes occurs in central-count tabulation systems.

D. Like DREs, precinct-based optical scan systems produce initial tallies at each polling places immediately at the close of voting.

E. Because most incorrectly-completed or unreadable ballots will be rejected by the precinct-count optical scanner, if a manual recount is called for, most ballots (except possibly absentee ballots) should not present significant problems when trying to infer voter intent, and this should facilitate efficient recounts, either by machine or by hand. While some absentee ballots may be filled out in a noncompliant manner and thus may require careful (and time consuming) adjudication of voter intent, that would also be the case for any solution which employed DREs at the polling places. Either way, the absentee ballots present the same problems.

Finally, note that this analysis does not include the cost of printing the optical scan ballots that are used in the "precinct-based optical scan + ballot marking device solution". However, neither does it include the costs of printing the VVPATs produced in the "DRE+VVPAT-printer" solution. To first order, these are considered to be roughly comparable because both consume paper and ink (or toner). In fact, one can argue that the per-ballot printing costs for mass-produced optical scan paper ballots may be lower than the per-VVPAT printing costs for individually-printed VVPATs.

Also keep in mind that any jurisdiction that deploys DREs must still continue to print paper ballots (e.g., optical scan ballots) to meet the needs of their absentee voters. So it is false to argue that a jurisdiction will avoid having to print any paper (e.g., optical scan) ballots if they

deploy DREs+VVPAT printers in their polling places. Regardless of what they do, jurisdictions will need to continue printing mass produced [optical scan] paper ballots for their absentee voters.

While deploying DREs+VVPAT printers may reduce the number of such mass-produced paper ballots that need to be printed in advance of the election, its does not eliminate the need to print any. Thus, jurisdictions will still be faced with all of the costs of contracting for the printing of such paper ballots. Certain fixed costs are involved regardless of the number of ballots printed: the labor cost of designing and laying out the ballot, and the one-time printer setup charges.

Thus, while deployment of DRES + VVPAT printers may reduce the total cost of printing mass produced [optical scan] paper ballots, the cost per ballot for printing those ballots used by absentee voters will actually go up. If the printers who print these ballots give price breaks at various levels for large orders, the loss of such discounts for smaller orders will also add to the cost per ballot for the printing of absentee voter ballots.

For example, if the deployment of DREs + VVPAT printers reduces by a factor of 4 the total number of mass-produced paper ballots printed, the corresponding reduction in those ballot printing costs will be significantly less than a factor of 4. Furthermore, any reduction in the number of mass-produced paper ballots that are printed will be offset by the costs incurred in printing a corresponding number of VVPATs.