BACK TO BASICS:

New York should not replace our lever voting machines.

New Yorkers for Verified Voting ("NYVV") recently published "Leverage Against Levers: Why New York Should Not Keep The Lever Voting Machines."[1]

NYVV argues that our lever machines should be replaced by voter-marked paper ballots and precinct-based optical scanners as soon as the scanners pass their certification tests.

However, some of NYVV's arguments against lever machines are circular. Other arguments are more applicable to scanners than lever machines, and still others reveal misunderstandings or omission of facts.

1. NYVV's Circular Argument: Paper ballot systems are superior, thus lever machines are inferior.

NYVV begins by stating principles they believe are required for voting equipment to best serve our democratic society. Their first principle is that a voting system should be based on voter-marked paper ballots. Using this principle, NYVV easily concludes that voter-marked paper ballots and scanners are superior to lever machines because lever machines don't use voter-marked paper ballots.

NYVV says that "transparency," something we all want in our elections, is indicated by "making a visible paper ballot the official record." Using this indication, NYVV easily concludes that lever machines are not transparent.

2. NYVV's Arguments that lever machines aren't transparent actually apply more severely to scanners.

When NYVV tries to explain in detail why lever machines are not transparent, the flaws they describe actually apply equally or more severely to scanners.

2.A. In response to lever advocates' assertion that "patent documents show the precise construction of the machines," NYVV says "The voter cannot see and judge the patent."

NYVV fails to say that technicians can easily see and judge lever machine construction, and the correct placement of the rods and gears that constitute ballot definitions in lever machines.

In contrast, with scanners, not only are voters unable to see and judge the software that counts the votes, but neither can election personnel who create ballot definitions, nor technicians who install the ballot definitions via tiny memory cards or sticks, nor staff who perform pre-election testing.

2.B. NYVV says "The voter cannot see the counters turning inside the [lever] machine."

This is true for both lever machines and scanners. The problem is more severe with scanners, however, because voters cannot see whether the scanner has scanned, stored, or tabulated the votes correctly.

2.C. NYVV says "Many voters will have heard of occasions when a machine failed, even after pre-election testing; so they do not find the machines 'transparent.' "

If transparency means a machine failure is immediately noticeable, then scanners suffer a greater lack of transparency than lever machines. With scanners both the hardware and software can fail. No one can notice when, due to software failure, a scanner switches votes or entire tallies between candidates, or shaves a few votes off some candidates. Scanners have produced severe miscounts. With New York's 3% audit requirement, 97% of scanner software failures can remain unnoticed.

2.D. NYVV says that programming errors discovered during pre-election testing show lack of transparency:

> "The custodian then adjusts the machine. Apparently the problem was not 'transparent' to the custodian upon looking at the back of the machines."

Human mistakes do not indicate lack of transparency. In fact, it is the transparency of lever machines that enables observers to catch the mistakes and custodians to correct them.

Scanners have more severe transparency problems because pre-election testing cannot find all errors in ballot definitions. This is detailed below in Section 5.

2.E. NYVV says lever machines are not transparent to poll workers:

> "Neither is the [lever] machine "transparent" to election inspectors. They can observe the external counters for the total number of voters, but they do not see the inner counting of individual votes."

It is difficult to understand why NYVV would point out this characteristic, since seeing the inner counting of individual votes is not possible with any election equipment, and obtaining vote counts prior to close of polls is typically associated with fraud.

2.F. NYVV says that with lever machines, at the end of the election day:

> "[poll workers cannot] see individual votes, since there simply are no records of these."

Votes stored inside the scanner memory are also invisible to poll workers, who simply press a button to print the tallies that are calculated by an invisible, proprietary software program. Nor do poll worker see individual voted ballots, since at the end of the day the voted ballots will be in a locked ballot box. No one should see them unless, some days later, that particular scanner is selected as part of the 3% audit (hand-count).

3. NYVV's argument that lever machines are "mutable" reveals a misunderstanding of the issue.

NYVV states that "every machine is mutable," referring to the possibility that a lever machine may be broken. That is possible, and scanners can be broken also. But vulnerability to damage is not the same as mutability of software.

"Mutability" refers to software's capability of modifying itself—both its own programming and the data it works on in computer memory. The software characteristic called "mutability" introduces a new danger into elections. We don't want scanner software to improperly modify itself, its ballot definitions, or its counters and tallies, and then erase the evidence of improper modification.

In contrast, the programming in lever machines consists of hardware—metal rods and gears. Hardware is not mutable, that is, it is not capable of self-modification.

If citizens and officials do not understand the mutability of software, they may undervalue security procedures for scanners and be tempted to skip procedures that are designed to protect against errors caused by software mutability. Indeed our state law and regulations still have not established proper procedures for software security.[2, 3]

4. NYVV omits pertinent information about the vulnerabilities of paper ballots and scanners.

Regarding security, NYVV says:

> "Lever advocates worry more about fraudulent or accidental mistakes in programming of scanner software than about voter-verifiability and true auditability as ways toward accuracy and security. They downplay the fact that lever machines also can be wrongly programmed."

Both scanners and lever machines can be wrongly programmed. However, NYVV omits important, relevant information: lever machines are programmed individually, and each lever is connected to only one individual counter. An error cannot infect other lever machines or even other lever-counter mechanisms in the same machine.

In contrast, all scanners in a county will be programmed by the same Election Management System ("EMS") so that one error can infect many scanners. In the software of each scanner, the counters can affect each other, enabling simple errors to cause all or some votes to be switched or uncounted.

NYVV omits mention of many serious security vulnerabilities that apply to scanners but not to lever machines.

- Paper ballots can be replaced or altered (swipe a pencil across to create stray marks, add another vote in a given contest to create an invalidating over-vote, and remove the voter's marks with solvent and mark the ballot with different votes).
- Whole ballot boxes can be lost.
- Scanner sensitivity can be miscalibrated, or lose calibration after being set properly.

- The scanners submitted for certification in New York store their ballot programming on memory cards the size of a postage stamp or flash memory sticks the size of a cigarette lighter. Such cards or sticks are standard items sold in office supply stores. They can be dropped unnoticed into someone's pocket and replaced with cards or sticks containing different ballot programming, so ballot programming can be switched (replaced) in a few seconds.

- By using ballot definition software known as a "bridge tool" that has been distributed by one vendor to private New York businesses, such as ballot printing shops, a rogue individual can bypass a county's state-certified Election Management System ("EMS") software and create corrupt ballot definitions that credit votes to the wrong candidate.

- The use of "bridge tool" software exposes the EMS and scanners to computer viruses.

- Vote data on the memory cards or sticks can be easily modified, or replaced by alternate records.

- The "tamper-evident seal" that holds a small cover closed over the memory cards or sticks may remain unsealed after card or stick installation. The seal may be cut and replaced.

NYVV says that the values for a democratic voting system will be secured when "[t]he state and counties mandate the strongest possible regulations to protect the security of all equipment, including ballots." Yet they advocate using paper ballots and scanners upon certification, regardless of whether our laws and regulations are in place to secure them. This is like opening a bank before we have a safe for the money.

Will our state mandate proper security requirements? Due to the high vulnerability of both paper ballots and scanners, procedures to secure them will be complex and cumbersome; they will also seem unfamiliar and perhaps unnecessary to legislators and other New Yorkers who do not work professionally with paper and computer security.

5. NYVV's reliance on certification and pre-election testing to provide security for elections shows a misunderstanding of both types of testing.

It appears that NYVV has failed to consider significant information about both types of testing.

Certification testing is important because it shows that a particular make and model of scanner is *capable of working under tested conditions*. But certification, like inspection of your car, does not guarantee that the same machine will run properly tomorrow, nor that other machines of the same make and model will work.

It is wrong to assume that after New York certifies our scanners, we will have no lemons, no errors in human handling, no ballot definition errors, and no mysterious computer glitches. Long after problem-ridden elections, some jurisdictions have discovered that uncertified software was operating in their scanners. Whether use of incorrect software is innocent or malicious, it easily escapes notice because no one can visually inspect software, in contrast to the easily-visible mechanical programming in lever machines.
Equally important, certification does not test ballot definition programming, which is created uniquely for each election and determines whether the scanner tabulates correctly in that one live election. Ballot programming errors have been responsible for many incorrect results tabulated

by scanners in the past.[4] We know this because of the errors that have been detected and corrected, but there is no way of knowing how many errors were not detected.

Pre-election logic and accuracy testing is important because it shows that a scanner's ballot definition software programming is *correct at the time of the test for the tested ballots*. But these pre-election tests cannot find all innocent and malicious errors because problems can be triggered during the election by:

- Specific combinations of votes that were not tested. Testing every combination of votes could require many thousands of test ballots.

- Errors that take effect only after hundreds or thousands of votes have been entered, which would happen only on election day.

- The election date and time (scanner software is affected by the computer's clock).

6. NYVV's emphasis on the voter-verifiability and auditability of paper ballots is irrelevant unless paper ballots are secured by continuous observation and unless auditing occurs.

Audits need to be appropriate for the needs and vulnerabilities of the system being audited.

- Lever machines use hardware components to increment hardware counters. Lever machines need visual inspection, mechanical tests, and visual comparison of the Return of Canvass to the mechanical counters.

- Scanners use invisible, mutable software to increment invisible software counters. Scanners need software-independent verification via hand-counting individual votes on continuously-observed paper ballots.

NYVV defines the term "audit" by simply describing the type of verification needed by scanners:

"In normal usage, an 'audit' looks again at the individual items that accumulated to arrive at that total as a way of checking the machine's accuracy."

NYVV fails to say that New York law does not require *meaningful* audits of scanner tallies.

- The "individual items that accumulated" are voted ballots. However, the voter-verifiability of paper ballots does not guarantee verifiability of an election. The voted ballots must be continuously observed by representatives of all parties from the close of polls until completion of the audit. The history of tampering with paper ballots[5] tells us that this is the only way to prevent tampering, opportunity for it, or suspicion of it. The scanners themselves and other election-day material must also remain under observation so that the cause of discrepancies between scanner and hand-count tallies might be determined.

- Audits must be done for 100% of scanners or election districts, or at least for a statistically-significant number of them, to show that all or nearly all scanners worked accurately and that all or nearly all votes have been counted accurately.

Current New York law requires only a 3% audit that escalates if errors are found. New York law does not require continuous public observation of the voted ballots, scanners, or other election-day materials.

In contrast, computer work in the professional world is 100% verified during every processing step. New York's 3% audit requirement drastically lowers this standard for scanners because Boards of Elections don't have the resources to verify in the way that is standard in the professional world.

NYVV claims that a "paper ballot-ballot marker-optical scanner voting system" provides auditability. But these systems, as planned to be implemented in New York, will not be meaningfully or professionally audited. Auditability without auditing is useless.

Computers are not inherently accurate; they are merely inherently fast and capable of following the instructions in their software programming. However, computers are programmed and used by people, and people make mistakes. Hence software is always error-prone.[6] For this reason the accuracy of computer results is not a theoretical concern. In a 2006 paper recommending software independence in voting systems, the National Institute of Standards and Technology (NIST) said:

> "[E]xperience in testing software and systems has shown that testing to high degrees of security and reliability is from a practical perspective not possible."[7]

The need for meaningful audits after scanner elections is not a theoretical concern. Scanner systems nationwide have caused problems by inaccurate interpretation of the marks on paper ballots, crediting votes to the wrong candidates, and counting inaccurately. Without meaningful audits most errors of this type would escape notice.

The invisibility and mutability of scanner software, in contrast to the visibility and immutability of lever machine hardware, provide another way to explain the need for meaningful audits when scanners are used.

- If observers see a lever machine programmed and working properly before and after an election, we know that the lever machine has not modified itself, used different hardware programming during the election, and then modified itself back to its pre-election state after the election.

- If observers see successful pre- and post-election tests of scanners, we still don't know whether innocent or malicious errors have caused the scanner to operate differently during the election. This is why examination of software inputs and results (meaningful audits of voted ballots and tallies) are the only way to know whether software worked properly.

7. NYVV does not address many significant cost issues.

7.A. Running scanner elections that are as trustworthy as lever machine elections will require additional time, effort, and cost.

- Software ballot programming for scanners is more expensive and difficult to perform than mechanical ballot programming for lever machines.

- On-going county licensing fees for Election Management System software for scanners can exceed $100,000 per year.

- Pre-election verification of ballot definition software programming is more expensive and difficult because it requires designing many test ballots, even when it does not test all combinations of votes. Combinations of votes need not be tested with lever machines because the separate lever-counter mechanisms cannot interact with each other.

- Securing paper ballots is more expensive and difficult than securing lever machines.

- Securing computerized hardware (scanners and their memory cards or sticks) is more expensive and difficult than securing lever machines, and may require inventory control systems such as bar code stickers and bar code scanners.

- Scanners and their batteries require storage space with climate-control and electrical service beyond what lever machines need.

- Year-round maintenance as well as election-day technical support will cost more for scanners than for lever machines.

- Hand-counting votes on paper ballots after each election is a new time and cost factor.

7.B. No one has fully assessed our future costs.

No governmental body has fully assessed the costs we will incur by replacing our lever machines. Our state comptroller, state legislature, and State Board of Elections have not looked ahead at cost, nor assessed how much each federal dollar we accepted for replacement of lever machines will cost us in the long run.

However, we have experience with the cost of accessible Ballot Marking Devices ("BMDs") that we purchased and fielded in 2008. Given that experience, it appears certain that New York State and our counties would save money if we return the $50 million HAVA funds that New York State accepted for replacement of lever machines. Our state would still be able to keep the remaining $170 million that we accepted for other uses.

We need a credible 10-year projection showing costs of

- transition,
- setup, maintenance, and operation while scanners are under their 5-year warrantee,
- setup, maintenance, and operation after warrantees expire, and
- costs of ballot printing and hand-counts.

7.C. The additional federal relief NYVV recommends is unlikely to be available.

NYVV says New York State should "seek additional federal relief" if we need it. However this has not worked for other jurisdictions that are already facing reduced budgets and the high costs of computerized elections.[8]

When our county Boards of Elections are faced with higher costs and lower budgets, the expensive security needs of paper ballot-scanner systems will be vulnerable to budget cuts. Computer security procedures that election administrators don't fully understand would be likely to be skipped. This will create opportunities for tampering by individuals with access to the

computers who more fully understand the implications of the skipped procedures. An example is the check of software hash numbers, which even some computer-literate people do not understand.

Meanwhile, our lever machines have at least another 100 years in them. They are fully paid for and cost comparatively little to maintain and use. They require no annual licensing fees for software, no election staff and poll worker retraining, no costly assistance by computer technicians, no redesign of county procedures, no public education campaigns, no need to hire higher-paid computer technicians to replace our lower-paid lever machine technicians, etc.

8. NYVV Does Not Address the Conflict of Interest Inherent in Depending on Private Voting System Vendors.

New York is one of two states that are not dependent on private, for-profit vendors in order to hold elections. We have experienced the problems of depending on them for accessible BMD equipment, and we can observe how severely elections are undermined by vendor dependence in other states.[9]

Administering elections on equipment running proprietary software forces election administrators to rely on the vendors who own the software. This dependence is a reality in all the states that use vendor-owned software. In many jurisdictions voting system vendors perform critical election administration functions, even tallying results; elections could not be conducted if the vendors were unable to, or refused to, provide support.

ES&S and Sequoia have shown themselves to be more motivated by profit than by service. Entrusting our elections to their care is sure to be more costly than we can anticipate, even if we have made responsible cost projections.

9. In claiming that lever machines do not comply with the federal Help America Vote Act of 2002 ("HAVA"), NYVV omits information that challenges their claim.

9.A. HAVA requires voting systems to have a "manual audit capacity." NYVV says that lever advocates have re-defined "audit" in order to claim that lever machines are auditable.

Direct Recording Electronic voting systems ("DREs" or "touchscreens") are used across the country, and are regarded as providing a manual audit capacity because of the end-of-election-day printout they produce. This printout summarizes the total votes cast in each race for each candidate— precisely the same content that lever machines or poll workers record on New York's Return of Canvass form. If DREs comply with HAVA's requirement for a manual audit capacity, it is difficult to understand why NYVV says that lever machines do not.

9.B. NYVV incorrectly states that lever advocates claim "Lever systems comply with HAVA by providing Accessibility."

To our knowledge, no one has claimed that lever machines are accessible to all voters with disabilities. Clearly they are not, and this is why New York counties have purchased and fielded accessible Ballot Marking Devices ("BMDs"). The use of voter-marked paper ballots and scanners, like the use of lever machines, will require the use of accessible BMDs. In either case, with the BMDs, all voters have an equal opportunity to cast a private and independent vote at the poll site as required by HAVA.

10. NYVV's vision of "one integrated system" still requires three types of equipment and would also require new training for poll workers.

NYVV argues for "one integrated system" in order to reduce poll worker training. But BMDs and our possible future scanners are not one system regardless of whether they are housed in one physical unit or two. Scanners and BMDs require separate operational procedures and will require separate poll worker training that will be more complex than training for lever machines and BMDs.

Poll worker training to handle lever machines and hand count BMD ballots at the close of polls will remain simpler than comparable training for poll workers and counters to handle BMDs and scanners and to conduct hand-count audits after an election.

NYVV expresses concern that keeping lever machines would require counties to prepare three systems consisting of lever machines, BMDs, and paper ballots for provisional, military, and absentee use. This is what our counties are doing now, and it appears to be quite manageable.

11. Conclusion.

Despite NYVV's arguments, it remains unclear why they advocate implementing paper ballot and scanner elections *before* New York has legal requirements and feasible procedures ready to do it securely, or budgetary resources to pay for it without skimping on other essential needs.

NYVV's list of democratic values doesn't include simplicity, understandability, manageability, affordability, opportunity for citizen oversight, learning from others' experience or the past, or acknowledging valid concerns so they can be dealt with.

Most of our state election laws and procedures are written to protect the security of lever machine elections, paper ballots hand-counted at the poll site on election night, and our provisional, absentee and military ballots. Our laws and regulations are inadequate to secure elections conducted entirely with paper ballots and scanners.

The two vendors seeking New York State certification for their scanners currently face a deadline in April 30, 2009, to submit their software and hardware. Their original deadline was September, 2005, and, despite three and a half years of testing, the machines still don't work. At the most recent series of public demonstrations conducted by the Board of Elections in the City of New York in February, 2009, one vendor's equipment crashed during use.

In Erie County in March, 2009, the other vendor withdrew at the last minute from a pilot scanner election. The county election commissioner who had chosen this vendor said, "Unfortunately, the fact that the manufacturer pulled out of the pilot project at the last minute indicates to me a lack of confidence in its own system."[10]

New York is the first state in our nation to stringently test computerized voting equipment prior buying and using it. The reason we have not moved forward is that the equipment has not passed its tests. Our State Board of Elections is to be commended for resisting all pressures to buy and use equipment that does not work.

Meanwhile our lever machines are working dependably. They can work dependably for another hundred years if they receive routine maintenance.

It is worthwhile now for our counties to:

- Urge our state legislature to rescind ERMA, the state law that requires replacement of our lever machines. Alternatively, the requirement for replacement of lever machines can be rescinded, and our standards for computerized systems can be left in place but explicitly required to apply to computerized systems only.

- Urge our congressional delegation to clarify that HAVA, the federal law that funded America's rush to electronic voting equipment, has always allowed lever machines if supplemented by accessible ballot marking devices.

- Urge our state to return the $50 million HAVA funds we accepted to replace our lever machines, while keeping the more than $170 million we accepted for other purposes.

# # #

[1] http://www.nyvv.org/newdoc/2009/LeverageAgainstLeversWWB.pdf, March 12, 2009, by Wanda Warren Berry, Director. A previous similar NYVV position paper was rebutted by http://www.wheresthepaper.org/rebut_NYVV_LWVNYS_Feb12_09.htm

[2] http://www.wheresthepaper.org/ny.html#CCreso228 provides information about New York City Council Resolution 228-2006. Paragraph 6 recommends security measures not yet implemented.

[3] http://www.cs.berkeley.edu/%7Edaw/papers/stopgap-evt08.pdf suggests additional security measures not yet being contemplated by New York. "You Go to Elections with the Voting System You Have: Stop-Gap Mitigations for Deployed Voting Systems" by J. A. Halderman, E. Rescorla, H. Shacham and D. Wagner, Proceedings of EVT 2008, Usenix/ACCURATE, 2008.

[4] http://www.votersunite.org/info/BallotProgramming.pdf "Ballot Definition Files: No Review Is Provided for a Key Component of Voting System Software." June, 2006, by Ellen Theisen.

[5] Deliver the Vote, 2005, by Tracy Campbell, Carroll and Graf Publishers. Election Administration in the United States, 1934, by Joseph P. Harris, Ph.D., available at http://vote.nist.gov/election_admin.htm

[6] http://www.pbs.org/cringely/pulpit/2003/pulpit_20031204_000794.html explains why 72% of computer software projects fail. "Why the Current Touch Screen Voting Fiasco Was Pretty Much Inevitable," December 4, 2003, by Robert X. Cringely.

[7] http://vote.nist.gov/DraftWhitePaperOnSIinVVSG2007-20061120.pdf "Requiring Software Independence in VVSG 2007: STS Recommendations for the TGDC." National Institute of Standards and Technology, November 2006. Page 10.

[8] http://www.wheresthepaper.org/Electionline090220StateCtyElecOfficesEconomicCrisis.htm "State and County Elections Offices Struggle with Economic Crisis, Electionline.org, February 20, 2009

[9] http://www.votersunite.org/info/ReclaimElections.pdf "Vendors are Undermining the Structure of U.S. Elections" by Ellen Theisen, VotersUnite.Org, August 18, 2008.

[10] http://www.wheresthepaper.org/ErieCommissionerMohrPR090311.pdf Press Release by Erie County Election Commissioner Ralph M. Mohr. March 11, 2009.