

Citizens' Election Modernization Advisory Committee

**Recommendations for
Lot 2 Ballot Marking Devices**

February 26, 2008

Prepared for the New York State Board of Elections

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Introduction and Purpose of this Advisory Report

The role of the Citizens' Election Modernization Advisory Committee (CEMAC) is to provide advice to the New York State Board of Elections (SBOE) on the adoption of new voting equipment. With our diverse backgrounds representing a cross section of citizens and election officials, we provide input on many facets of the new voting technologies. One area where CEMAC can provide essential advice is the real world *usability* of voting systems.

A given system may have a required feature present, but whether that feature is actually usable by a voter is an urgent question that must be taken into account. The 2005 VVSG requirements state:

"The importance of usability and accessibility in the design of voting systems has become increasingly apparent. It is not sufficient that the internal operation of these systems be correct; in addition, voters and poll workers must be able to use them effectively."

The testing of BMD submissions performed by New York State's contractor SysTest is called *Functional Testing*. Functional testing is necessary and important, but it does not tell us all that we need to know about a voting system. Functional testing can tell us if a required feature is *present* and if it *functions*. But it does not tell us if it is *usable* - can it be easily used by voters and poll workers during elections, and does it preserve the independence and privacy of the vote during use?

Therefore, for purposes of this advisory report, we have reviewed the six submitted systems based on their real world usability by voters and poll workers, with a view to specific requirements of the federal Help America Vote Act and New York State Election Law. Based on our review, we make specific recommendations to the Board for each of the proposed systems.

Recommendations

Based on our reviews of the available systems, we make the following recommendations to the State Board of Elections regarding authorization of the Ballot Marking Systems submitted for Lot 2 purchases.

We recommend that the following systems be approved:

- ES&S AutoMARK
- Premier AutoMARK
- Sequoia/Dominion ImageCast Precinct Ballot Marker

We recommend that the following systems NOT be approved:

- LibertyVote LibertyMark and LibertyProof Ballot Reading Device
- Avante VOTE-TRAKKER EVC308 SPR-FF-BMD with Ballot Verification Equipment
- Avante VOTE-TRAKKER EVC308 SPR with Ballot Verification Equipment

System Reviews

Committee members reviewed the six proposed systems on several occasions. On 1/18/08, several members reviewed the systems at the SBOE offices. Another evaluation

was carried out on 2/21/08 by committee members who reviewed modifications made to two systems after the initial January review. Also, several day-long tests by voters with disabilities with some of the systems were conducted at the Albany offices of the New York State Independent Living Council and were observed by several committee members. Finally, one of our committee members, a County Election Commissioner, has used one of the systems in county elections since 2006 and shared his experiences with the committee.

Areas of Focus

As noted above, we did our review of the systems with a focus on usability. However, specific criteria were used to guide our review. CEMAC's mandate is to:

"...assist the state board of elections in the examination of the voting machines or systems pursuant to this section by recommending which machines or systems meet the requirements of section 7-202 of this title and the federal Help America Vote Act."

In light of that, we evaluated specific criteria taken from these laws. To guide our evaluation, the committee decided at our 2/21/08 meeting to use a sub-section of the test matrix used by the State Board of Elections and SysTest for Lot 2 testing. See Appendix D for the full table of evaluation criteria we used.

Notes on Recommended Systems

The systems we recommend all have many features which we found to be usable and in compliance with our evaluation matrix. Rather than list each individual feature here we note some of the factors we considered in our recommendation for the ES&S AutoMARK, the Premier AutoMARK, and the Sequoia/Dominion ImageCast systems.

All three of the systems recommended for authorization provide accessible voting interfaces, ease of use, voter privacy, and independent verification of the ballot which we found acceptable. In addition, from the perspective of county election officials, the general ease of set-up for non-technical poll workers, uncomplicated procedures for ballot verification, and the ease with which voters could be assisted by poll workers during the voting process were factors in our approval.

Certainly, there is no perfect system available, and improvements can be made in each of the systems we recommend. However, potential improvements are outside the scope of this report, except to note that we encourage a proactive process for enhancing the accessible voting features of these ballot marking devices as we move forward.

Notes on Systems We Did Not Recommend

Of the three systems we did not recommend for authorization, each had problems which we feel do not satisfy the requirements of specific sections of HAVA or New York State Election law. Specifically, we felt the LibertyVote LibertyMark, the Avante Vote-Trakker EVC308 SPR-FF, and the Avante VOTE-TRAKKER EVC308 SPR BMD systems failed to meet some of the requirements for privacy, vision, dexterity, mobility, and/or independent verification.

Of particular note is that in all three of these systems, the ballot verification features did not meet requirements for privacy and independent use by voters with disabilities. Given the importance of this feature, and the lack of adequate provision for it, we do not recommend these systems for approval.

Details of our findings on these three systems can be found in the Appendices.

Citizens' Election Modernization Advisory Committee Members

At the time of this writing CEMAC has 12 members.
There are currently 2 vacancies on the 14 member committee.

The following Committee members endorse the findings of this report:

James A. Conlon, Esq.
Assistant Director, Career Services, St. John's University School Of Law

Bruce Darling
Director, Center for Disability Rights

William Frucci
Commissioner, Saratoga County Board of Elections

Greg Jones
Senior Attorney, Commission on Quality Care & Advocacy
for Persons with Disabilities

Barbara Lifton
Assemblywoman, 125th Assembly District

Bo Lipari
Representative, League of Women Voters of New York State

Donald Wart
Commissioner, Oswego County Board of Elections

Janet Weinberg
Managing Director of Development, Gay Men's Health Crisis

The following Committee members were unable to review this report prior to publication:

Reginald Lafayette
Commissioner, Westchester County Board of Elections

Peter Quinn
Commissioner, Monroe County Board of Elections

Finally, our 2 remaining members are Stanley Zalen and Todd Valentine, Co-Executive Directors of the State Board of Elections. Due to their official role as representatives of the State Board of Elections in legal matters in progress at the time of this writing, they did not participate in this report.

Appendix A

Notes on the LibertyVote LibertyMark Submission

Our determination after review of the LibertyVote LibertyMark was that this system should not be authorized for use as a ballot marking device. In particular, we agreed that the LibertyMark's mechanism for verifying the printed ballot is unusable for voters with visual disabilities and mobility impairments, and does not preserve the privacy of their ballot.

HAVA Issues From Our Evaluation Matrix

Perceptual Issues and Vision – We found the LibertyMark is not sufficiently accessible for voters with partial vision. The main ballot display is printed and fixed, and cannot perform basic display requirements for these voters. In particular, the main ballot display cannot adjust font size or display white text on a black background, both essential features for voters with partial vision. Although a small LCD screen is provided which displays several lines of text in two user selectable font sizes, it also cannot display white text on a black background and is extremely difficult to read.

We also found that it was confusing to constantly switch one's visual focus from the main display screen and back to the small LCD. This could lead to problems not only for voters with visual impairments but for those with cognitive disabilities as well.

Mobility – We found problems with accessibility for voters who use wheelchairs and who have mobility impairments. The Voter Verified Paper Audit Trail (VVPAT) style ballot felt flimsy and was difficult to insert in the verification reader because it curled so easily. The VVPAT slot is located far from a voter who is seated, and out of reach.

When the ballot is ejected from the slot, it is difficult or impossible for a voter to retrieve and orient it correctly. The ballot verification reader is positioned in a way that would make it extremely difficult for a voter in a wheelchair to insert the ballot.

Independent Verification – We found the ballot verification mechanism to be unusable for many voters with disabilities. See Appendix B where we provide detailed information on the limitations of this mechanism.

Polling Place Issues

Usability concerns for the LibertyMark system were not limited to use by voters. The relative complexity and multiple parts included in the ballot verification system raised questions about poll worker training, maintenance and privacy.

Poll worker training – the more components a system has, the more potential for problems. Also, if a system is difficult to use by voters, they will require more frequent assistance. An increased need for assistance requires more intensive training for poll workers, a need for additional poll workers to assist voters, and results in less privacy and independence for voters using the machine.

System Complexity – the more components a system has, the more difficult for poll workers to manage the system on Election Day. The complexity of the LibertyMark's verification system raised concerns that non-technical poll workers will have difficulty managing the system. The multiple parts also raised concerns about maintenance and the potential for frequent need for replacement.

Multiple Ballot Style Support – the LibertyMark has a printed display ballot and can only support one ballot style at a time. Counties using polling places with multiple Election Districts must purchase one device for each ballot style required.

Fragility of the VVPAT – the ‘ballot’ on the LibertyMark is really a VVPAT style paper roll. It felt flimsy and was difficult to insert in the verification reader. Also, because the VVPAT is ejected towards the front of the machine and could fall to the floor, concerns were raised that a wet floor (not unusual in November when voters are wearing wet boots and shoes) would degrade and invalidate the ballot.

Appendix B

Analysis of the LibertyMark Ballot Verification Design

Issue 1 - The LibertyMark VVPAT

The “ballot” is not a ballot, but a 3” wide, VVPAT style piece of paper. Printing is done on paper roll positioned behind the back screen of the device. The printed output is a line by line text description of race and result, with a bar code on the top and bottom (*Figure 1*). Also, the VVPAT slot is located approximately 3 feet from the front of the machine, making it difficult for voters using wheelchairs to reach it (*Figure 2*).



Fig. 1 –
LibertyMark VVPAT



Fig.2 - The VVPAT slot is located quite far from the voter (slot circled in white).
[Ballot Reading Device Removed for photo.]

Issue 2 – VVPAT Delivery to Voter

After the voter has completed voting and presses the “Cast Vote” button, the machine pushes the VVPAT out of the slot by only 1 inch (*Figure 3*). Since the slot is located at least three feet higher than table height, a voter using a wheelchair may not be able to reach the paper.

If the voter presses the “Cast Vote” button a second time, the VVPAT is ejected from the slot towards the front of the machine. Since this is not guided but literally sent flying, it would be nearly impossible for many voters with disabilities to be able to catch the VVPAT as it comes out (*Figure 4, 5*).

Photos on the next page demonstrate this sequence.

LibertyMark VVPAT Delivery to Voter

[Ballot Reading Device Removed for photo.]

Step 1



Fig.3 - The VVPAT sticks out only about 1 inch after the voter presses the "Cast Vote" button.

Step 2



Fig.4 - After the second press of the "Cast Vote" button, the VVPAT is ejected out the front.

Step 3



Fig.5 - It is difficult if not impossible for many voters with disabilities to find, hold, and orient the VVPAT correctly.

Issue 3 – Independent Verification, Insertion of the Ballot



Fig.6 - The LibertyProof Ballot Reading Device

After the VVPAT is ejected from the slot and retrieved by the voter, they must take the paper and orient it with the bar code facing up before attempting to place it in the reader slot. When the LibertyMark is programmed for English and Spanish support, the VVPAT contains a bar code on both ends, one which reads back audio in Spanish and the other which reads back in English. This means that when a voter inserts the VVPAT in the reader, only one of four possible orientations of the ballot will be correct (*Figure 6*). It is impossible for a voter who is blind to know which is the correct orientation, and they will need to use trial and error, inserting and reinserting the VVPAT until the correct orientation is achieved.

Another notable usability issue is that the audio headset used to vote is different from the headset used to verify the ballot. This means that a voter using the audio features will have to switch headsets prior to verifying their ballot, or unplug the headset from one audio plug and replug it into a different audio jack at the top center of the VVPAT reader. This required change may be difficult or impossible for voters with mobility or visual impairments. Also, we found that the audio cord falls in front of the reader slot, making placement of the VVPAT into the reader even more difficult (*Figure 7*).

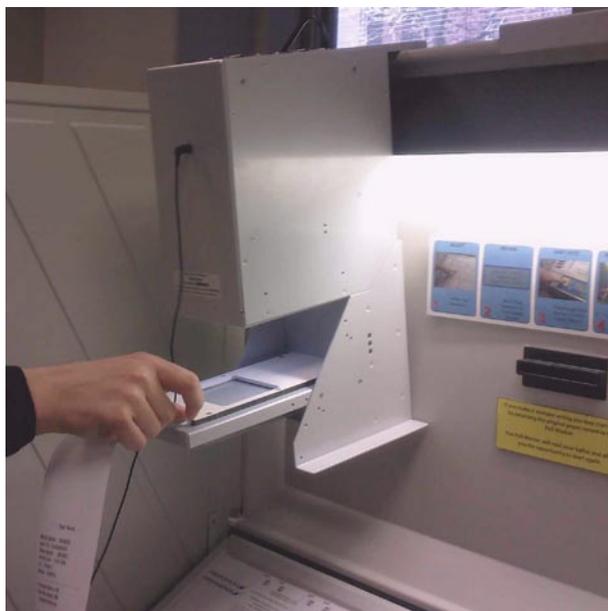


Fig.7 - The VVPAT is difficult to insert and the headset audio cord is in the way.

Issue 4 – Independent Verification, Privacy



Fig.8 - If the voter needs assistance during verification, their votes are displayed in plain view to a poll worker.

When the VVPAT is in the reader, only the leading edge is inserted while the rest of the ballot hangs out the front in plain view (*Figure 8*). There is no privacy sleeve or other provision for hiding the contents of the ballot from view by others. If a voter requests assistance, which we feel is extremely likely due to the difficulty of using the verification mechanism, the votes cast are in full view and readable to any poll worker who needs to assist the voter. This violates required privacy provisions of HAVA.

Appendix C

Notes on the Avante VoteTrakker Full Face and BMD Submissions

Our determination after review of both Avante Vote-Trakker systems was that the systems should not be authorized for use as ballot marking devices. In particular, we agreed that the mechanism for verifying the printed ballot, which is shared by both systems, is too complex and does not preserve the privacy of the ballot.

We especially noted that both machines crashed and needed rebooting frequently during our reviews. We felt this highly unstable behavior was unacceptable and we cannot recommend these systems.

HAVA Issues From Our Evaluation Matrix

Perceptual Issues and Vision– Both systems provided procedures for voters to change display font size and contrast, but we found them difficult to use. Changing the display requires multiple steps and the user interface often left us unsure how to proceed to complete the change.

Cognitive Issues – Voting on the VoteTrakker Full Face Ballot machine was confusing. The screen changes between the full face display and the single race display at each step. We found this constant back and forth will present cognitive challenges for voters.

We found the “Cast Vote” procedure required three separate steps and left us thinking we had completed casting the vote when one step still remained. This could cause many voters to leave believing they had cast their vote when actually they did not.

The undervote notification displayed an alert window over some of the highlighted names. We could not see some of the undervoted races because they were obscured.

Mobility – We found problems with accessibility for voters who use wheelchairs and with mobility impairments. In particular, the location of the large ballot printer below the sip and puff device will make it difficult or impossible for voters using wheelchairs to use the sip and puff feature.

We found the large bar on the front bottom of the machine was too far forward relative to the display. Its forward location could obstruct voters using wheelchairs and prevent them from reaching the controls.

We found the keyboard input difficult to use. It provided no way to support the keyboard other than holding it with one arm while typing with the other.

Independent Verification – The Avante systems print two separate ballots, one which contains a bar code and is scanned by the reading device, another which contains the votes in human readable form and is the ballot which is actually counted. The reading device is a separate unit attached to a laptop computer, and may be located a great distance from the ballot marking machine. We felt this system was extremely complicated and difficult to use.

The creation of two distinct ballots increases the chances for errors on the part of voters and poll workers. Many voters will be unsure of which ballot to place in the reader, and which one to place in the ballot box. Voters who are blind have no way to distinguish between the two ballots.

Privacy - The requirement to handle two separate and distinct ballots will present challenges to many voters. This will lead to many voters needing assistance with their ballots. Since no privacy sleeve or other mechanism to preserve the secrecy of the ballot is provided, we found the ballot verification mechanism will violate the privacy of many voters using these systems.

Polling Place Issues

Usability concerns for the Avante system were not limited to use by voters. The relative complexity and multiple parts included in the ballot verification system raised questions about poll worker training, maintenance and privacy.

Poll worker training – the more components a system has, the more potential for problems. Also, if a system is difficult to use by voters, or crashes frequently as the machines we reviewed did, they will require more frequent assistance. An increased need for assistance requires more intensive training for poll workers, a need for additional poll workers to assist voters, and results in less privacy and independence for voters using the machine.

System Complexity - the more components a system has, the more difficult for poll workers to manage the system on Election Day. The complexity of the Avante systems ballot verification raised concerns that non-technical poll workers will have difficulty managing the system.

The verification scheme requires an additional reader and laptop, in addition to the printer on the machine and the machine itself. These multiple components raised concerns about maintenance and the potential for frequent need for replacement.

Unit Size and Fragility - The Avante VoteTrakker Full Face Ballot is extremely large and has many moving parts. Concern was expressed that it would be impossible to deploy in some smaller poll sites due to its large size, and require large amounts of storage capacity.

Appendix D
Matrix of Evaluation Criteria
Source - NYS Board of Elections SysTest Lot 2 Test Reports

Functional Capabilities	<p>Notification to a voter identifying the contest, issues, undervotes and overvotes.(3.1.2 a, b & e)</p> <p>Notification to a voter prior casting, allowing changes to the ballot, and after the ballot have been marked (3.1.2 c &d)</p>
Alternative Languages	<p>Allow ballot selection, review and instructions in any language required by the state. (3.1.3)</p> <p>For voters who lack proficiency in reading English, or whose primary language is unwritten, provide spoken instructions and ballots in the preferred language of the voter, consistent with state and federal law (3.2.7)</p>
Cognitive Issues	<p>Minimize cognitive difficulties to the voter providing clear instructions/warnings and assistance. (3.1.4 a, b, c & d)</p> <p>Clearly indicate maximum number of candidates for a single contest and ensure a consistent relationship between candidate name and mechanism used to vote for that candidate (3.1.4 cii, ciii)</p> <p>Electronic image displays shall provide synchronized audio output to convey same information as is displayed on the screen (3.2.2.1 f)</p>
Perceptual Issues	<p>Adjustable aspects of voting machines, shall have a mechanism to reset to the default value or shall automatically reset to standard default value upon completion voter's session (3.1.5 b & c)</p> <p>Electronic voting machines shall provide minimum font size of 3.0 (measured as the height of a capital letter) and all text intended for the voter should be presented in a sans serif font.(3.1.5 d & h)</p> <p>All voting machines using paper ballots should make provisions for voters with poor reading vision (3.1.5 e)</p> <p>Color coding shall not be used as the sole means of conveying information (3.1.5 g)</p>
Interaction Issues	<p>Voting machines with electronic image displays shall not require page scrolling (3.1.6 a)</p> <p>Voting machines shall provide unambiguous feedback of voter's selections, be designed to minimize accidental activation, and no key shall have a repetitive effect as a result of being continually pressed (3.1.6 b, d & dii)</p> <p>If a response from the voter is required within a specific time, the voting machine will issue an alert at least 20 seconds before this time has expired (3.1.6 c)</p>
Privacy	<p>Preclude anyone else from determining the content of a voter's ballot without the voter's cooperation. Ballot and any input controls shall only be visible to the voter, the audio interface shall only be audible to the voter, and the voting system shall notify the voter of an attempted overvote in a way that preserves the privacy of the voter (3.1.7; 3.1.7.1 a, b & c)</p>

<p>Vision</p>	<p>Accessible to voters with visual disabilities or voters with partial vision (3.2.2. 3.2.2.1)</p> <p>Accessible to voters who are blind and provide an audio-tactile interface (ATI) that supports the full functionality of the visual ballot interface and allows the voter to control the rate of speech. (3.2.2.2, 3.2.2.2 b & cix)</p> <p>Font size of 3.0-4.0 mm and 6.3 –9.0 mm, allow high contrast and allow adjustable color for partial vision (3.2.2.1 b, c & d)</p> <p>Buttons and controls shall be distinguishable by both shape and color, all mechanically operated controls or keys shall be tactilely discernible without activating these controls and keys, and status of all locking or toggle controls or keys shall be visually discernable and also through touch and sound (3.2.2.1 e, 3.2.2.2 f & g)</p>
<p>Dexterity</p>	<p>Shall be accessible to voters who lack fine motor control or use of their hands and all controls should be operable with one hand without requiring tight grasping, pinching or twisting of the wrist. Force to activate keys or controls shall be no greater than 5 lbs. If normal procedure is for voters to submit their own ballots, the station shall provide features to these voters to enable them to perform this submission (3.2.3 a, b & e)</p> <p>Controls shall not require direct bodily contact or for the body to be part of any electrical circuit (3.2.3 c)</p> <p>Shall provide mechanism to enable non-manual input, equivalent to tactile input (3.2.3 d)</p>
<p>Mobility</p>	<p>Accessible to voters who use mobility aids, including wheel chairs. All controls, keys, jacks, and any other part of the voting station shall be within reach as specified, and all labels, displays, controls, keys, jacks, etc. shall be legible to a voter in a wheelchair with normal eyesight, who is in an appropriate position and orientation with respect to the voting station. (3.2.4, b & c)</p> <p>Voting station shall be within the clearance, obstruction and reach limits specified (3.2.4 a, bi, bii, biii, biv bv, & bvi)</p>
<p>Hearing</p>	<p>Voting station shall incorporate features under 3.2.2.2c to provide accessibility to voters with hearing disabilities, and if it provides sound cues to alert the voter, the tone shall be accompanied with a visual cue unless the station is in audio-only mode. (3.2.5 a & b)</p> <p>Electronic image displays shall provide synchronized audio output to convey same information as is displayed on the screen (3.2.2.1 f)</p>
<p>Speech</p>	<p>Voting process shall be accessible to voters with speech disabilities. No voting equipment shall require voter speech for operation (3.2.6 & 3.2.6a)</p>
<p>Independent verification</p>	<p>Permit the voter to verify (in a private and independent manner) the votes selected by the voter on the ballot before the ballot is cast and counted. (3.1 a1Ai)</p>