COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF STATE

REPORT CONCERNING THE EXAMINATION RESULTS OF ELECTION SYSTEMS & SOFTWARE, INC. EVS, VERSION 5.2.0.0 and 5.2.0.3 WITH DS200 PRECINCT OPTICAL SCAN DEVICE, AUTOMARK ADA DEVICE, EXPRESS VOTE UNIVERSAL VOTING SYSTEM AND DS850 CENTRAL OPTICAL SCAN DEVICE

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Secretary of the Commonwealth
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EXAMINATION RESULTS OF ELECTION SYSTEMS & SOFTWARE, INC. EVS 5.2.0.0 and 5.2.0.3, WITH DS200 PRECINCT OPTICAL SCAN DEVICE, AUTOMARK ADA DEVICE, EXPRESSVOTE UNIVERSAL VOTING SYSTEM AND DS850 CENTRAL OPTICAL SCAN DEVICE

I. Introduction

Article XI-A of the Pennsylvania Election Code, 25 P.S. §§ 3031.1 *et seq.*, authorizes the use of electronic voting systems. Section 1105-A of the Election Code, 25 P.S. § 3031.5, requires that the Secretary of the Commonwealth examine all electronic voting systems used in any election in Pennsylvania and that the Secretary make and file a report stating whether, in his opinion, the electronic voting system can be safely used by voters and meets all of the applicable requirements of the Election Code.

Upon the request of Elections Systems and Software ("ES&S"), the Department of State's Bureau of Commissions, Elections and Legislation ("Department") scheduled an examination for September 8, 2014, of EVS 5.2.0.0 which consists of election management software along with hardware components DS200 Precinct Tabulator Optical Scan Device, the AutoMark Americans with Disabilities Act ("ADA") Device, ExpressVote Universal Voting System and the DS850 Central Count Optical Scan Device ("EVS 5.2.0.0 Voting System"). A complete listing of items demonstrated and examined are set out in the table, *infra* at 2-3.

The Secretary of the Commonwealth appointed Jack Cobb, Laboratory Director of Pro V&V, Inc., as a professional consultant to conduct an examination of the EVS 5.2.0.0 Voting System pursuant to section 1105-A(a) of the Election Code, 25 P.S. § 3031.5(a). The Examiner performed the examination on September 8, 2014, in Training Room 12B of the Commonwealth Keystone Building, 400 North Street, Harrisburg, Pennsylvania. Stuart Keckler, (former) Deputy Commissioner of the Bureau of Commissions, Elections & Legislation and Elissa Dauberman, Accessibility Coordinator of the Division of Help America Vote Act (HAVA), represented the Secretary of the Commonwealth. Benjamin Swartz, Pennsylvania State Certification Manager, represented ES&S. The examination was open to the public and the Department videotaped the demonstration.

Subsequent to the demonstration of the EVS 5.2.0.0, ES&S submitted a modification to the voting system identified as EVS 5.2.0.3. The Election Assistance Commission examined and certified EVS 5.2.0.3. The modifications to the baseline system (EVS 5.2.0.0) resulted in updated ElectionWare and Election Reporting Manager (ERM) software for the EVS 5.2.0.3. The Examiner analyzed these updates and concluded that they would have no negative impact on the testing that was performed. Based on that conclusion, this certification report applies to both EVS 5.2.0.0 and EVS 5.2.0.3.

II. The EVS 5.2.0.0 Voting System

The following firmware/software, hardware, and peripheral components of the EVS 5.2.0.0/5.2.0.3 were presented for examination:

A. Firmware/Software

Component Name	Version
Election Management System (EMS)	
ElectionWare	4.6.0.0
Election Reporting Manager (ERM)	8.11.0.0
Removable Media Service	1.4.5.0
Event Log Service	1.5.5.0
VAT Previewer	1.8.6.0
ExpressVote Previewer	1.4.0.0
ES&S Tabulators	
DS850 Central Tabulator	2.10.0.0
DS200 Precinct Tabulator	2.12.0.0
Voter Assist Terminal	
AutoMARK	1.8.6.0
Universal Voting System	
ExpressVote	1.4.0.0

B. Hardware

Component Name	Model/Version Number	Description
DS850 Central Tabulator	1.0	central ballot scanner for tabulation of mail-in ballots, absentee ballots or Election Day ballots
DS200 Precinct Tabulator	1.2,1.3	precinct ballot scanner component of the voting system
AutoMARK	1.0, 1.1, 1.3	ADA-compliant ballot marking device

ExpressVote	1.0	universal voting solution that provides voters with disabilities the same voting experience as others

C. Peripherals

Part Name	Model/Version Number	Description
Okidata	C711	Ballot on Demand Printer
ExpressPass	1.1.0.0	Software utility to print activation cards
Toolbox	2.1.0.0	Software utility to make audio files
ExpressPass Printer	Microcon	ExpressPass printer

The following is a brief description of the EVS 5.2.0.0/5.2.0.3 voting system and is drawn from Section 2.0 ("System Overview and Identification") of the Test Report for Examination of the Election Systems & Software (ES&S) EVS 5.2.0.0, a report issued by the Examiner on July 19, 2016.

The EVS 5.2.0.0 /5.2.0.3 voting system operates both at the election headquarters for election administration purposes and at the precinct polling place. All components of the system are supported by the ElectionWare Election Management System (EMS) software. ElectionWare provides end-to-end election management activities for the EVS 5.2.0.0/5.2.0.3 System. This includes defining contests, candidates and ballot formats and performing post-election results processing. The VAT Previewer and ExpressVote Previewer within the ElectionWare software provides jurisdictions the ability to preview the on-screen display and audio prompts prior to generating Election Day media.

EVS 5.2.0.0/5.2.0.3 is a paper-based voting system comprised of both precinct and central count tabulators and either the ExpressVote universal vote capture device or AutoMark ballot marking device as an ADA compliant component. During an election, voters mark a paper ballot either 1) by hand or 2) by using the Automark. The AutoMark accepts the same pre-printed ballot that all voters receive and captures voters' choices through a touchscreen, or audio or tactile keyboard inputs and then prints the ovals blackened for the voters' selections. The marked ballot is read by the scanner exactly like all other ballots. EVS 5.2.0.0/5.2.0.3 provides a third option for marking a ballot through the ExpressVote. The ExpressVote presents voters with the candidates and offices to be elected on a touchscreen and prints a paper record containing a QR Code and a summary of the ballot selections that are digitally scanned and

immediately tabulated by either the DS200 or DS850 ballot scanners. The Quick Response (QR) code is not unique to the voter but is unique to the voter's choices. Ballots with the same choices will generate an identical QR Code. The scanner reads the code, not the summary of selections.

The 5.2.0.0/5.2.0.3 voting system can be configured in several different ways to form a complete voting system, with the accompanying software for each component, as follows:

- ElectionWare, DS200 precinct tabulation device and an AutoMark ADA device with a DS850 central tabulation device;
- ElectionWare, DS200 precinct tabulation device and an ExpressVote ADA device with a DS850 central tabulation device;
- ElectionWare, an AutoMark ADA device with a DS850 central tabulation device; or
- ElectionWare, an ExpressVote ADA device with a DS850 central tabulation device.

During an election, a voter may be presented with a pre-printed paper ballot or directed to the ADA compliant component chosen by the jurisdiction. Once the voter has made his or her selections, the ballot is either scanned and tabulated at the precinct and retained in a ballot box or retained in a ballot box for scanning centrally at the county election office.

The DS200 scans voter selections from both sides of the ballot simultaneously, immediately tabulates the selections, and creates and stores a digital image of the ballot or ExpressVote summary paper record for later viewing in the ElectionWare software. The DS200 provides information to the voter through a touchscreen regarding the status of the voter's scanned ballot. For example, the touchscreen will display error messages alerting the voter to possible overvotes, undervotes, blank ballots and unreadable ballot marks.

The DS850 features an S-Curve design that guides the ballot through the scanning process and produces a digital image of the ballot or ExpressVote summary page for later viewing in the ElectionWare software. The DS850 saves tabulation results and ballot images to an internal hard disk and exports them for Election Reporting Manager via a USB memory stick.

III. EXAMINATION APPROACH, PROCEDURES AND RESULTS

A. Examination Approach

To ascertain whether EVS 5.2.0.0/5.2.0.3 can be safely used by voters at elections in the Commonwealth and meets all of the requirements of the Election Code, the Examiner developed test protocols for the examination. The test protocols separated the requirements of Article XI-A of the Pennsylvania Election Code, sections 1101-A to 1122-A, 25 P.S. §§ 3031.1 – 3031.22, into four main areas of test execution: (1) Review; (2) Targeted Functionality; (3) System Integration; and (4) Penetration Analysis.

"Review" testing consisted of analyzing Independent Testing Authority (ITA)[1] and other third-party reports for specific tests pertaining to the requirements of the Pennsylvania Election Code and verifying that the EVS 5.2.0.0/5.2.0.3 meets the requirements of the following sections of the Election Code:

- 1105-A(a), 25 P.S. § 3031.5(a), requiring that an electronic voting system has been examined and approved by a federally recognized ITA;
- 1107-A(11), 25 P.S. § 3031.7(11), requiring an electronic voting system to be suitably designed in terms of usability and durability, and capable of absolute accuracy;
- 1107-A(13), 25 P.S. § 3031.7(13), requiring an electronic voting system to correctly tabulate every vote;
- 1107-A(14), 25 P.S. § 3031.7(14), requiring an electronic voting system to be safely transportable; and
- 1107-A(15), 25 P.S. § 3031.7(15), requiring an electronic voting system to be designed so voters may readily understand how it is operated.

In addition to the review of the ITA test reports, the Examiner reviewed the technical data documentation submitted as part of the request for certification and performed a comparative source code review of all source code from EVS 5.2.0.0 to 5.2.0.3. The purpose of the source code review was to determine whether software modifications impacted any previous security testing.

[1] Section 1105-A(a) of the Election Code requires that an electronic voting system be examined and approved "by a federally recognized independent testing authority," or ITA. 25 P.S. § 3031.5(a).

"Targeted Functionality" testing consisted of single thread test cases designed to ensure that each component of the EVS 5.2.0.0/5.2.0.3 System met the requirements set forth in the following sections of the Election Code:

- 1107-A(1), 25 P.S. § 3031.7(1), requiring that an electronic voting system provide for absolute secrecy of the vote;
- 1107-A(2), 25 P.S. § 3031.7(2), requiring an electronic voting system to permit voting on both candidates and ballot questions, according to the official ballot;
- 1107-A(3), 25 P.S. § 3031.7(3), requiring an electronic voting system to permit straight party voting, including the "Pennsylvania method" of straight party voting;
- 1107-A(4), 25 P.S. § 3031.7(4), requiring an electronic voting system to permit a voter to vote for candidates of all different parties, and write-in candidates;
- 1107-A(5), 25 P.S. § 3031.7(5), requiring an electronic voting system to permit a voter to enter write-in votes;
- 1107-A(7), 25 P.S. § 3031.7(7), requiring an electronic voting system to prevent over-votes;
- 1107-A(10), 25 P.S. § 3031.7(10), requiring an electronic voting system that registers votes electronically to permit voters to change their votes up until taking the final step to register the vote, and for systems that use paper ballots or ballot cards, permits a voter to get a new ballot in the case of a spoiled ballot, and to mark and cancel the spoiled ballot;
- 1107-A(16), 25 P.S. § 3031.7(16), requiring an electronic voting system which provides for district-level tabulation to include (1) a public counter to register how many ballots are submitted to be counted; (2) locks and security mechanisms to prevent tampering; (3) prevents vote totals from being known until voting is ended; and (4) will not tabulate an over-vote, with an option to notify a voter of an over-vote if used during voting hours; and (5) generates a printed record that counters are set to zero before voting commences; and
- 1107-A(17), 25 P.S. § 3031.7(17), requiring an electronic voting system which provides for central-count tabulation to (1) be constructed to preclude tampering during operation; (2) preclude tabulation of an over-vote; and (3) indicate that counters are set to zero before processing ballots, either by district or with the capability to generate cumulative reports.

"System Integration Testing" was performed to test proprietary hardware, software and peripherals, as well as Commercial Off-the Shelf (COTS) materials configured as a complete system, including the Election Management System, (EMS), ElectionWare, DS200, AutoMark,

ExpressVote and the DS850. This test meets many of the requirements of the Pennsylvania Election Code that were previously verified in the Targeted Functionality area of testing, but was designed to specifically test the following sections and requirements:

- 25 P.S. § 3031.1, requiring an electronic voting system to provide for a permanent physical record of all votes cast;
- 25 P.S. § 3031.7(4), requiring an electronic voting system to permit a voter to vote for candidates of all different parties, and write-in candidates;
- 25 P.S. § 3031.7(6), requiring an electronic voting system to permit a voter to cast votes for candidates and ballot questions he or she is entitled to vote for, and prevents a voter from casting votes the voter is not entitled to vote on;
- 25 P.S. § 3031.7(8), requiring an electronic voting system to prevent a person from casting more than one vote for a candidate or question, except where this type of cumulative voting is permitted by law;
- 25 P.S. § 3031.7(9), requiring an electronic voting system to permit voters to vote in their own parties' primaries, and prevents them from voting in other parties' primaries, while also permitting voters to vote for any nonpartisan nomination or ballot question they are qualified to vote on; and
- 25 P.S. § 3031.17, requiring an electronic voting system to provide for a statistical recount of a random sample of ballots.

The "Penetration Analysis" testing sought to ascertain whether the EVS 5.2.0.0/5.2.0.3 complies with 25 P.S. § 3031.7(12), which requires that a voting device "provides acceptable ballot security procedures and impoundment of ballots to prevent tampering with or substitution of any ballots or ballot cards." Precinct tabulation devices were installed for delivery to the precinct, and visual inspection and analysis of the security procedures performed. The Examiner did not test the software for security, but did review test data from NTS that included EVS 5.0.0.0 Security Matrix, Threat Matrix, Test logs, photographs, Security Test Planning Matrix and Security scans. Further, the EAC Certification report for the EVS 5.2.0.0 included the results of security testing for the ExpressVote universal voting system.

B. Examination Process and Procedures

The examination commenced on September 8, 2014, at the Commonwealth Keystone Building, Training Room 125B, 400 North Street, Harrisburg, Pennsylvania. The demonstration

portion of the examination lasted approximately three days. In accordance with the test protocols, the examination occurred in an environmentally controlled room. The room was configured such that the Examiner, the representatives of the Secretary of the Commonwealth, and ES&S each had their own independent work areas. Members of the public were allowed to observe the examination. The demonstration portion of the examination was videotaped.

All software and hardware necessary to perform the examination was received directly from the ITA. This included the trusted builds of the firmware for each device being evaluated. The firmware was installed by the Examiner before the examination, using the appropriate media for installation.

The precinct tabulation devices and ballot marking devices were configured for delivery to a polling place from a warehouse; this included all seals and locks recommended by the manufacturer. The central count was configured as set for operation in a county office. The Examiner inspected the device for the ability to tamper with the transportation case and the device inside the case. The inspection examined the ports, the outer case, and memory devices from the aspect of the device as delivered to the polling place and configured for voting. The Examiner also examined both the precinct device and the EMS for password management of administrative functions and ensured the system counter cannot be reset by unauthorized persons.

C. Examination Results

On July 19, 2016, the Examiner issued his report for the testing of the EVS 5.2.0.0/5.2.0.3. The following is a brief summary of the results of the examination as set forth in fuller detail in the Examiner's Report.

1. Review Testing Results

The Review testing performed by the Examiner demonstrates that the EVS 5.2.0.0/5.2.0.3 meets the relevant requirements of the Pennsylvania Election Code.

Specifically, the ITA reports and Election Assistance Commission (EAC) certifications submitted by ES&S satisfy the requirements of Section 1105-A(a) of the Election Code, 25 P.S. § 3031.5(a); the EVS 5.2.0.0/5.2.0.3 has been examined and approved by an ITA or, as such

authorities are now called, the Voting System Test Laboratory ("VSTL") as meeting the applicable performance and test standards established by the federal government.

The design requirements of Section 1107-A(11) and (14) of the Pennsylvania Election Code, 25 P.S. §§ 3031.7(11), (14), are met by the documented Product Safety Test and Accuracy Test.

Section 1107-A(14) of the Pennsylvania Election Code, 25 P.S. § 3031.7(14), is further met by the combination of Hardware Non-Operating Environmental Tests, which included: bench handling, vibration, low temperature, high temperature, and humidity. These components tests were designed to test the storage of precinct tabulation devices between elections, as well as transportation between the storage facility and the polling place.

The ITA reports contained specific data for summative usability reports that were accepted by the EAC. The Examiner confirmed that the EVS 5.2.0.0/5.2.0.3 ensured the removal of residual votes and produced a "zero proof report" at the opening of the polls. The Examiner confirmed that the zero proof report cannot be generated on demand after a ballot is cast.

The Examiner's review testing included a review of the test data from the ITA that included Security Matrix, Threat Matrix, Test logs, photographs, Security Test Planning Matrix and Security scans. The Examiner was not permitted access to the test cases used for the security testing. As a result of this review, he concluded that the VSTL performed an adequate penetration analysis of the system software.

2. Targeted Functionality Testing Results

As set forth in the Test Protocols, nine test cases were designed to determine compliance with the requirements of 25 P.S. §§ 3031.7(1), (2), (3), (4), (5), (7), (10) and (16). The Examiner conducted each of these tests with necessary modifications as detailed in his report. Each specific hardware component was tested for compliance with these sections of the Election Code. The Examiner also tested the Election Management software for compliance with the sections of the Election Code relevant to it. No issues or anomalies were experienced during these tests, and the objective criteria established in the test protocols were met.

If the EVS 5.2.0.0/5.2.0.3 is correctly set up pursuant to item four (4) of the Directive Concerning the Use, Implementation and Operations of Electronic Voting Systems by the County Boards of Elections issued by the Secretary of the Commonwealth on April 28, 2009, the EVS 5.2.0.0/5.2.0.3 provides the requisite voter secrecy in compliance with Section 1107-A(1) of the Election Code, 25 P.S. § 3031.7(1).

Each of the components of the EVS 5.2.0.0/5.2.0.3 successfully permitted votes for "1 of 1," "N of M," and "Question" contests for both a standard voting session and an ADA voting session in compliance with Section 1107-A(2), 25 P.S. § 3031.7(2). The EVS 5.2.0.0/5.2.0.3 successfully demonstrated the "Pennsylvania Method" of straight party voting for both a standard voting session and an ADA voting session, meeting the requirements of Section 1107-A(3), 25 P.S. § 3031.7(3) and demonstrated compliance with Sections 1107-A(4) and (5), 25 P.S. §§ 3031.7(4) and (5) for straight party voting and write-in votes. The EVS 5.2.0.0/5.2.0.3 also successfully prohibits a voter from selecting more than the number of allowable selections, including write-in votes, for both a standard voting session and an ADA voting session, in compliance with Section 1107-A(7), 25 P.S. § 3031.7(7).

The DS200 precinct tabulator can be configured to alert a voter to an overvote or undervote and provides the voter with an opportunity to spoil his or her ballot and request a new ballot. All tabulating devices presented with the EVS 5.2.0.0/5.2.0.3 provide a public counter that increments with each cast vote; provides the ability to be locked after the polls are closed; precludes the re-opening of the polls after they are closed; possesses design features that allow tamper evident locks and seals to be placed on the voting devices; and provides a zero proof and results report, as required under Section 1107-A(16), 25 P.S. § 3031.7(16).

The ExpressVote universal voting system provides a voter with a review screen and allows a voter to return to either the beginning of the ballot or an individual contest to make changes to his or her selection(s) before casting the ballot for both a standard voting session and an ADA voting session, meeting the requirements of Section 1107-A(10), 25 P.S. § 3031.7(10).

3. System Integration Testing Results

The Examiner created a set of closed primary and general election definitions. These election definitions were designed to exercise all contest types, voting variations, and possible

voting patterns used in the Commonwealth of Pennsylvania. Some of the variations include cross-party filed candidates, "N of M" contests, write-in voting, primary presidential delegation nominations, retention contest, straight party voting, split precincts, and both Spanish and English. Both the general election and the closed primary election definitions provide the voting variations, geographic subdivisions, parties, supported languages and test voting pattern with results being tested. The only languages required for this examination were English and Spanish. The Department provided the Spanish translation. Each test voting pattern provided the input method and device. For all write-in selections, the name was input as "John Doe." For multiple write-in selections, the name was appended with the character "I" for the number of write-in selections (*i.e.,* "John Doe I," "John Doe II," "John Doe III," and "John Doe IV" in a "Vote for Four" contest with four write-ins).

The EVS 5.2.0.0/5.2.0.3 successfully completed both the general and closed primary elections. The Examiner experienced no issues or anomalies during these tests, and the EVS 5.2.0.0/5.2.0.3 met the objective criteria set forth in the test protocols. The EVS 5.2.0.0/5.2.0.3 provides for a permanent physical record in the format of the cast vote record and voter marked paper ballots. These features meet the requirements of Sections 1101-A, 25 P.S. § 3031.1. The paper ballots and ExpressVote summary sheets can be used to conduct a statistical recount and enables counties to comply with 1117-A of the Pennsylvania Election Code, 25 P.S. §3031.17. The System Integration testing further confirmed that the EVS 5.2.0.0/5.2.0.3 complies with Section 1107-A(4), 25 P.S. § 3031.7(4), because the system successfully allowed voters in a general election to vote for candidates from all parties and political bodies, including write-in candidates. The EVS 5.2.0.0/5.2.0.3 complies with Section 1107-A(9), 25 P.S. § 3031.7(9), because test voters in the primary election were only able to vote for candidates seeking nomination from their party and the system rejected attempts to vote for party candidates seeking nomination from the other party. The EVS 5.2.0.0/5.2.0.3 meets the requirements for Sections 1107-A(6) and (8), 25 P.S. §§ 3031.7(6) & (8), because the test voters cast votes on different ballot styles for candidates and questions and the EVS 5.2.0.0/5.2.0.3 precluded test voters from over voting.

4. Penetration Analysis Results

During the conduct of the penetration analysis performed by the Examiner, the EVS 5.2.0.0/5.2.0.3 provided acceptable ballot security procedures and impoundment of ballots to prevent tampering with or substitution of any ballots or ballot cards based on the inspection of the physical seals and locks on the system. It also provided acceptable password management and restriction of access to administrative functions. Therefore, the EVS 5.2.0.0/5.2.0.3 meets the requirements of Section 1107-A(12) of the Election Code, 25 P.S. § 3031.7(12

D. Observations

During the demonstration portion of the examination, and in connection with the Examiner's review of documentation, the Examiner noted the following observations:

1. The voting system presented for demonstration was the 5.2.0.0. While the examination report was being written, an issue with the compatibility between the COTS cryptography library and Microsoft Crypto Library was discovered in the field. ES&S modified the software and submitted EVS 5.2.0.3 to the EAC for certification. On August 5, 2015, the EAC issued their Grant of Certification of the EVS 5.2.0.3, signifying successful completion of conformance testing to the 2005 *EAC Voluntary Voting System Guidelines (VVSG)*. The Examiner analyzed the software modifications to remedy the compatibility issues and concluded that the changes in the software would have no impact on the testing that was previously performed. In the Examiner's opinion, testing of the EVS 5.2.0.3 would not produce substantially different results from the testing of the EVS 5.2.0.0. The Secretary accepts this conclusion and this certification applies to the 5.2.0.3.

2. The Examiner performed a comparative source code review of all source code from EVS 5.2.0.0 and EVS 5.2.0.3. The Examiner performed this review at the request of the Department to examine the effects of the software modification on system security. The Examiner noted a security-related concern in modifications to the modem function. However, the Commonwealth does not allow voting devices to be connected to an external network. The Commonwealth's prohibition of external network connection was discussed with ES&S during the demonstration and ES&S was informed that the certified configuration would not be allowed to connect to a modem.

3. At the time of initial engagement and during the testing process, the Examiner did not conduct any security testing of the system or of the software of individual components or on the system as a whole. The Examiner reviewed previous security reports prepared by the VSTL on EVS 5.0.0.0, and performed a comparative source code review of the various EVS versions. The vendor informed the Department that the difference between 5.0.0.0 and 5.2.0.0 was the addition of the ExpressVote universal voting system component. The Examiner concluded that the VSTL conducted adequate security testing that complied with the federal Voluntary Voting System Guidelines. The Department staff discussed testing that was performed on the EVS 5.2.0.0 with other states, namely Florida. Based on the Examiners' review, and based on the Department's discussions with other states, the Secretary accepts the Examiner's conclusion that adequate security testing occurred. Moreover, because the EVS 5.2.0.0/5.2.0.3 provides a software independent record of voter intent in the voter-marked paper ballots, and provides a written record of the voter's choices from the ExpressVote module, the certification includes a condition for jurisdictions to perform audits of the cast vote records, see section IV.D., below.

4. The Examiner noted that the observer reported being able to see parts of the ballot and voter inputs while executing both the standard voting and ADA test cases on the ExpressVote Universal Voting System and the AutoMark Ballot Marking Device for Section 1107-A(1) of the Election Code, 25 P.S. § 3031.7(1), which requires an electronic voting system to provide for voting in secrecy. The Examiner concluded, however, that if these components are set up pursuant to item four (4) of the Directive Concerning the Use, Implementation and Operations of Electronic Voting Systems by the County Boards of Elections issued by the Secretary of the Commonwealth on April 28, 2009, provides the requisite voter secrecy so that an observer is unable to see who a voter voted for, in compliance with the Pennsylvania Election Code and Pennsylvania Constitution.

5. The ExpressVote touch screen interface has a limited number of candidates that it can display at one time. Currently, the ExpressVote only displays up to nine candidates per screen. If a race has more than nine candidates, the voter must use navigation buttons to move between screens. Further, in vote for "N of M" contests, if a voter has already selected "N" but wants to choose additional candidates or change his or her selections, the voter must return to the initial selections and de-select the previous selections. The voter is presented with two sets of

buttons for navigation: "More" with up or down arrows and "Previous" and "Next" buttons. The Previous and Next buttons navigate between contests, while the "More" arrows navigate among the list of candidates. Some voters and observers of the system in other states noted that when users pressed the "Previous" or "Next" buttons they were taken out of the contest with multiple pages and had difficulty returning to that contest. The Examiner noted that the navigation problems did not present when a user was navigating with audio cues only.

6. The ExpressVote Universal Voting system generates Quick Response (QR) codes on the summary sheet. The EVS 5.2.0.0/5.2.0.3 can scan those codes and print a marked ballot on an attached printer. Similarly, the ExpressVote includes an optional attached scanner that can retrieve marked ballots from a QR code that is generated outside of the polling place e.g. on a voter's home computer. The QR codes are not unique to an individual ballot, but are unique to how a ballot is marked; therefore, a ballot marked the same will have the same QR code. The Examiner noted that the fact that the QR codes are not unique could introduce the possibility of mass produced ballots that could lead to vote coercion or vote selling. As a result, the Examiner did not recommend that the optional QR scanner attached to the ExpressVote should be certified in Pennsylvania. The Secretary agrees with the Examiner's recommendation not to certify the optional QR code scanner.

IV. Conditions for Certification

Given the results of the examination that occurred on September 8, 9 and 10, 2014 and the findings of the Examiner as set forth in his July 19, 2016 report, the Secretary of the Commonwealth certifies the EVS 5.2.0.0 and EVS 5.2.0.3 subject to the following conditions:

A. Pennsylvania counties using the EVS 5.2.0.0/5.2.0.3 must comply with the Directive Concerning the Use, Implementation and Operations of Electronic Voting Systems by the County Boards of Elections issued by the Secretary of the Commonwealth on April 28, 2009, and in particular adhere to item four (4) of the directive when setting up and positioning the AutoMark ADA component and the ExpressVote Universal Voting System in the polling place to assure compliance with the constitutional and statutory requirements that secrecy in voting be preserved (*see* Pa. Const. Art. VII. § 4; and Section 1107-A(1) of the Election Code, 25 P.S. § 3031.7(1)).

B. No components of the EVS 5.2.0.0/5.2.0.3 shall be connected to any modem or network interface, including the Internet, at any time, except when a standalone local area network configuration in which all connected devices are certified voting system components is used. Transmission of unofficial results can be accomplished by writing results to media, and moving the media to a different computer that may be connected to a network. ES&S was advised during testing that the EVS 5.2.0.0/5.2.0.3 may not be configured with a modem connection.

C. The ExpressVote Universal Voting System is certified for use as an ADA compliant component only. Jurisdictions are free to purchase it for the use of voters with disabilities but it may not be used as the primary voting system in its current form. See section V, below, for recommendations to enable the ExpressVote to be used as the primary voting system.

D. The optional QR code scanner attached to the ExpressVote Universal Voting System is not certified based on the examiner's recommendation. This component is only used to retrieve voter's selections encoded in a QR code when the voter has selected his or her choices on a device outside of the polling place. The ExpressVote Universal Voting System must not be configured with the attached QR scanner or it must not be enabled for use.

E. Because EVS 5.2.0.0/5.2.0.3 is a paper-based system, counties using the EVS 5.2.0.0/5.2.0.3 must comply at a minimum with section 25 P.S. § 3031.17 that requires "statistical recount of a random sample of ballots after each election using manual, mechanical or electronic devices of a type different than those used for the specific election." This audit must be conducted via a manual count of the paper ballots or ExpressVote summary sheets. Counties must include in the sample ballots marked by ADA compliant components, either the AutoMark or ExpressVote. Counties are advised to consult the Directive Concerning the Use, Implementation and Operations of Electronic Voting Systems by the County Boards of Elections issued by the Secretary of the Commonwealth on April 28, 2009 and any future revisions that may apply to audits of electronic voting systems.

F. In addition, pursuant to the Directive on Electronic Voting Systems issued by the Secretary of the Commonwealth on August 8, 2006, the Directive Concerning the Use, Implementation and Operation of Electronic Voting Systems by the County Boards of Elections issued on April 28, 2009, and section 1105-A(d) of the Pennsylvania Election Code, 25 P.S. § 3031.5(d), this certification and approval is valid only for the voting system discussed in this Report. If the vendor or a County Board of Elections makes **any** changes to the EVS 5.2.0.0/5.2.0.3 Voting System subsequent to the date of its examination, it must **immediately** notify both the Pennsylvania Department of State and the relevant federal testing authority or laboratory, or their successors. Failure to do so may result in the decertification of the EVS 5.2.0.0/5.2.0.3 Voting System in the Commonwealth of Pennsylvania.

G. All jurisdictions implementing the EVS 5.2.0.0/5.2.0.3 must implement EVS 5.2.0.0/5.2.0.3 under this certification and must comply with the conditions and directives found in this report, and any directives issued by the Secretary of the Commonwealth regarding the use of this System, in accordance with Section 1105-A(a)-(b) of the Election Code, 25 P.S. § 3031.5(a)-(b).

H. Because EVS 5.2.0.0/5.2.0.3 is a paper-based system, implementation of the system for precinct or central count scanning is scalable. Jurisdictions should calculate the number of voting booths necessary to accommodate the number of registered voters in a precinct to avoid long lines. Jurisdictions must include either the AutoMark Ballot Marking Device or the ExpressVote Universal Voting System as an ADA compliant device in configuring a precinct polling place.

V. Recommendations

In future revisions to the ExpressVote Universal Voting system, the Secretary recommends that ES&S modify the screen to permit more than 9 candidates in a single race and modify the logic to improve the candidate selection process to avoid voter confusion. When those revisions are made, and if the revised version is presented for certification, the Secretary will examine the system to determine if the ExpressVote may be used as the primary voting system in a precinct.

VI. Conclusion

As a result of the examination, and after consultation with the Department's staff and the Examiner, the Secretary of the Commonwealth concludes that the EVS 5.2.0.0 and 5.2.0.3 can be safely used by voters at elections as provided in the Pennsylvania Election Code and meet all of the requirements set forth in the Code, **provided the voting system is implemented with the conditions listed in Section IV of this report**. Accordingly, the Secretary certifies EVS 5.2.0.0 and 5.2.0.3 for use in this Commonwealth.

The ExpressVote universal Voting System can accommodate 15 ballots per hour when configured as an ADA device. The Automark Ballot Marking Device can accommodate 80 voters with disabilities during an election day or 250 voters when used as the primary voting system.