COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF STATE

REPORT CONCERNING THE EXAMINATION RESULTS OF ELECTIONS SYSTEMS AND SOFTWARE EVS 6030 WITH DS200 PRECINCT SCANNER, DS450 AND DS850 CENTRAL SCANNERS, EXPRESSVOTE HW 2.1 MARKER AND TABULATOR, EXPRESSVOTE XL TABULATOR AND ELECTIONWARE EMS

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Kathy Boockvar

Kathy Boockvar
Secretary of the Commonwealth
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EXAMINATION RESULTS OF ELECTION SYSTEMS AND SOFTWARE EVS 6030 WITH DS200 PRECINCT SCANNER, DS450 AND DS850 CENTRAL SCANNERS, EXPRESSVOTE HW 2.1 MARKER AND TABULATOR EXPRESSVOTE XL TABULATOR AND ELECTIONWARE EMS

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 Pennsylvania Election Code, 25 P.S. § 3031.5, requires that the Secretary of the Commonwealth (Secretary) examine all electronic voting systems used in any election in Pennsylvania and that the Secretary make and file a report stating whether, in her opinion, the electronic voting system can be safely used by voters and meets all applicable requirements of the Election Code.

Upon the request of Election Systems and Software (ES&S), the Department of State's Bureau of Election Security and Technology (Department) scheduled an examination of EVS 6.0.3.0 (EVS 6030). The system presented for certification in Pennsylvania included the following components - Electionware® (Electionware) election management software used in conjunction with the following components: 1) the ExpressVote XL™ (ExpressVote XL) hybrid paper-based polling place voting device; 2) the ExpressVote® Hardware 2.1 (ExpressVote 2.1), a hybrid paper-based polling place voting device that provides touch screen vote capture that can be configured as a ballot marking device (BMD) or a BMD and tabulation unit; 3) the DS200® (DS200) precinct scanner; 4) the DS450®(DS450) central scanner; and 5) the DS850® high speed central scanner. EVS 6030 is an upgraded version of EVS 6021 certified by the Secretary in November 2018. The EVS 6030 release does not include any firmware changes from EVS 6021. The only change between EVS 6030 and EVS 6021 is in the Election Management System software.

The Secretary of the Commonwealth (Secretary) appointed SLI Global Solutions (SLI) and Center for Civic Design (CCD) as professional consultants to conduct an examination of EVS 6030. The examination process included a functional examination (functional examination) and security testing. The functional examination and security

testing were performed at SLI's facilities located at 4720 Independence Street, Wheat Ridge, Colorado. The functional examination was completed at SLI to enable having the testing activities conducted in a timely manner considering the COVID-19 pandemic restrictions. Mike Santos, Senior Test Manager, and Alex Nestico, Senior Test Engineer (collectively, Functional Examiner), of SLI, conducted the functional examination of the EVS 6030 pursuant to Section 1105-A(a) of the Election Code, 25 P.S. § 303l.5(a). The examination commenced on July 28, 2020 and lasted approximately two days. Sindhu Ramachandran, Voting Systems Analyst, and John Hartzell, Deputy Chief Counsel, Department of State Office of Chief Counsel, represented the Secretary of the Commonwealth and observed the examination via video conference. The examination was video recorded by SLI. Benjamin Swartz, State Certification Manager, represented ES&S. Mike Santos, Senior Test Manager, and Jesse Peterson, Security Specialist, at SLI, collectively served as the Security Examiners for the EVS 6030 security testing. The Department consulted with accessibility examiner Whitney Quesenbery about the changes reflected herein, and concluded that an accessibility examination was not necessitated as there were no firmware changes to the polling place devices for the EVS 6030 release, and the software changes were only to the election management system and not material to the accessibility of the voting system.

II. THE EVS 6030 VOTING SYSTEM

EVS 6030 is a paper-based voting system that provides end-to-end election support; from defining an election to generating final reports. The system is comprised of both precinct and central count tabulators and Universal Voting System and/or Ballot Marking Devices as ADA components. The system hardware components include: ExpressVote XL™ Full-Faced Universal Voting System, ExpressVote Universal Voting System hardware 2.1, DS450 High-Throughput Central Tabulator, DS850 High-Speed Central

Tabulator and DS200 Precinct-Based Tabulator[1].

The following is a description of the EVS 6030 components summarized from Section 2.0 (System Overview) of the Test Report for Examination of EVS 6030, prepared by the Functional Examiner and the System Overview document submitted by ES&S as part of the Technical Data Package (TDP).

Electionware®

Electionware election management software is an end-to-end election management software application that provides election definition, ballot formation, equipment configuration, result consolidation, adjudication and report creation. Electionware is composed of five software groups: Define, Design, Deliver, Results and Manage. Electionware can be configured as a Standalone EMS Workstation or as a closed Local Area network with EMS server and client/s.

ExpressVote XL™

The ExpressVote XL is a hybrid paper-based polling place voting device that provides touch screen vote capture that incorporates the printing of the voter's selections on a machine-marked paper ballot, with scanning and tabulation in a single unit. The screen provides a display of the full ballot. This device can serve all voters, including those with special needs, allowing all voters to cast machine-marked paper ballots autonomously. Voters navigate ballot selections using the touch screen, detachable UVC keypad or ADA support peripherals, such as a sip and puff device. ExpressVote XL guides voters through the ballot selection process with screen prompts, symbols and ballot audio. The voter can

[1] The federal Election Assistance Commission (EAC) certified system also includes ExpressTouch Electronic Universal Voting System and ExpressVote Universal Voting System hardware 1.0, but those components are not part of the system presented for certification in Pennsylvania.

print the machine-marked paper ballot once they are ready to cast the vote. Once printed, the ExpressVote XL internally processes the ballot for tabulation. The ballot is printed, reviewed by the voter, tabulated, and deposited into a removable, secure card container attached to the ExpressVote XL cart.

ExpressVote® Hardware 2.1

The ExpressVote Universal Voting System Hardware 2.1 (ExpressVote HW2.1) is a hybrid paper-based polling place voting device that provides touch screen vote capture and incorporates the printing of the voter's selections on a machine-marked paper ballot. This system, capable of serving all voters, can operate in either marker or tabulator mode, depending on the configuration that is selected in Electionware. In marker mode, the voter marks a ballot and prints it using the internal thermal printer. The ballot is then scanned on the DS200 precinct scanner, or the central scanners, DS450 or DS850. When utilized as a tabulator, the ExpressVote 2.1 provides the capability of scanning and tabulating printed machine-marked paper ballots in a single unit. ExpressVote 2.1 incorporates an attached removable, secure container to hold the ballots, allowing the voters to cast the ballots. The ExpressVote as a Tabulator uses a Master Media USB device for Poll Open and Poll Close functions.

DS200®

The DS200 is a polling place paper-based system, specifically a digital scanner and tabulator that simultaneously scans the front and back of a hand-marked paper ballot and/or a machine-marked paper ballot in any of four orientations for conversion of voter selection marks to electronic Cast Vote Records (CVR) to be saved on USB media. The DS200 scans and tabulates hand-marked paper ballots and machine-marked paper ballots. It also has a touch screen for voter communication, an integrated thermal printer for printing reports and internal battery backup.

DS450®

The DS450 is a central scanner and tabulator that simultaneously scans the front and

back of a hand-marked paper ballots and/or machine-marked paper ballots from the ExpressVote 2.1 and ExpressVote XL in any of four orientations for conversion of voter selection marks to electronic CVR's. It sorts tabulated ballots into discrete output bins without interrupting scanning. The tabulation results can be physically transported using USB drives, or the device may be configured to transmit tabulation results to the results server through a closed network connection.

DS850®

The DS850 is a central scanner and tabulator that simultaneously scans the front and back of hand-marked paper ballots and/or machine-marked paper ballots from ExpressVote 2.1 and ExpressVote XL in any of four orientations for conversion of voter selection marks to electronic CVR's. The tabulation results can be physically transported using USB drives or the device may be configured to transmit tabulation results to the results server through a closed network connection. The DS850 provides higher throughput than the DS450.

The following is a listing of the software/firmware components that comprise the entire EVS 6030 system:

Manufacturer Software/Firmware

The **EVS 6.0.3.0** voting system consists of the following software and firmware components:

Application	Version
Electionware – Client/Server	5.0.1.1
Event Log Service	1.6.0.0
Removable Media Service	1.9.0.0
ExpressVote Previewer	2.4.3.0
DS450	3.1.0.0
DS850	3.1.0.0
DS200	2.17.0.0
ExpressVote HW2.1	2.4.3.0
ExpressVote XL	1.0.1.0
Optional Utility: ExpressLink	1.4.0.0

Application	Version
Optional Utility: Toolbox	3.6.0.0

- **Electionware** Election database creation, media programming and tally/reporting software
- **DS450** Central Count scanner and tabulator, Central Tabulator firmware
- **DS850** Central Count scanner and tabulator, Central Tabulator firmware
- **DS200** Precinct scanner and tabulator, Precinct Tabulator firmware
- **ExpressVote HW2.1** Precinct ballot marker and/or Precinct scanner and tabulator, Universal Voting System firmware
- **ExpressVote XL** Precinct ballot marker with tabulator, using a full-face touchscreen and Universal Voting System firmware
- **ExpressLink™** standalone application that interfaces with voter registration (e.g. electronic Pollbook) systems and the ExpressVote Activation Card Printer to print the ballot activation code on an ExpressVote and ExpressVote XLcards
- **Electionware Toolbox** set of utilities that can be integrated into the Electionware EMS to enhance the software usability experience and streamline various processes. These add-on utilities include Test Deck and Text to Speech.

COTS Software/Firmware

Additional COTS software and firmware included in the system have been defined as part of the EAC system certification scope added to this report as Attachment A.

Hardware

Below is a listing of the hardware components that comprise the entire EVS 6.0.3.0 system categorized by system functionality:

Hardware	HW Revision
ExpressVote HW2.1	2.1.0.0, 2.1.2.0
ExpressVote XL	1.0
DS200 Precinct-based Scanner and Tabulator	1.2, 1.3
DS450 Scanner and Tabulator	1.0
DS850 Scanner and Tabulator	1.0
ExpressVote Rolling Kiosk	1.0
ExpressVote Voting Booth	N/A
ExpressVote ADA Table	N/A

Hardware	HW Revision
DS200 Collapsible Ballot Box	1.0, 1.1
DS200 Plastic Ballot Box	1.2, 1.3, 1.4, 1.5
DS200 Tote Bin	1.0
DS450 Cart	N/A
DS850 Cart	N/A

Test Materials

Test support materials utilized during the examination included:

- Thermal receipt paper for the **ExpressVote 2.1** and the **ExpressVote XL**.
- Ballot card stock for processing ballots on the **ExpressVote 2.1** and the **ExpressVote XL**.
- Ballot stock, for printing of ballots to be processed by the **DS200, DS450** and **DS850**.
- USB thumb drives.
- Ballot marking pens.
- Printer paper rolls.

III. EXAMINATION APPROACH, PROCEDURES AND RESULTS

A. Examination Approach

To ascertain whether EVS 6030 can be safely used by voters at elections in the Commonwealth and meets all the requirements of the Pennsylvania Election Code, the Examiners developed test protocols for the examination. EVS 6030 is a release with no firmware changes to DS200, ExpressVote 2.1, ExpressVote XL, DS450 and DS850. The only changes to the EVS 6030 release are the executables that are part of the Election Management System. The EVS 6030 release includes moving to 64-bit application

foundation to improve efficiencies during the execution of results reporting such as exports, adjudication, and printing reports.

Functional 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 five main areas of test execution: (1) Documentation Review; (2) System Level Testing; (3) Security Analysis; (4) Privacy Analysis; and (5) Usability Analysis.

Documentation Review was performed to verify that the portions of the Pennsylvania Election Code, which reference documentation detail, are sufficiently met by the EVS 6030 documentation. The Functional Examiner validated compliance of the system to the following sections of the Election Code during the documentation review.

- 1105-A(a), 25 P.S. § 3031.5(a), requiring that an electronic voting system has been examined and approved by a federally recognized independent testing authority (ITA), or voting system test laboratory (VSTL), as these entities are now referred to;
- 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.

The System Level Testing examined the EVS 6030 voting system in terms of conducting an election. Election definitions were created using Electionware and populated the voting devices (ExpressVote XL, ExpressVote 2.1, DS200 – Precinct Scanner, DS450 Central Count Scanner and DS850 Central Count Scanner) with election definitions using transport media. Votes were captured and machine-marked ballots were printed and tabulated via the ExpressVote XL and ExpressVote 2.1 configured as tabulator. Hand-

marked paper ballots were marked manually and then tabulated through the polling place DS200 scanner. ExpressVote 2.1 ballots were also tabulated through the DS200 scanner. All marked ballots (*i.e.*, hand-marked paper ballots and machine-marked paper ballots) were then tabulated through the DS450 and DS850. Tabulation results for ExpressVote 2.1 in Tabulator mode, ExpressVote XL, DS200, DS450 and DS850 were then processed into Electionware, write-in votes were adjudicated, and reports were generated with results for the election. Hand-marked paper ballots were tabulated three times, once each on scanning devices DS200, DS450 and DS850. The ExpressVote 2.1-marked paper ballots were tabulated a total of four times, once on each scanning device and once on the ExpressVote tabulator. The ExpressVote XL-marked paper ballots were tabulated a total of four times, once on each scanning device and once on the ExpressVote XL device. The ExpressVote 2.1 in Tabulator mode, ExpressVote XL, DS200, DS450 and DS850 were all exercised to verify that they met all pertinent requirements of the Pennsylvania Election Code. The results reports were validated against the expected results of the voted ballots. The test cases were designed to ascertain compliance with the following sections of the Election Code:

- 1101-A, 25 P.S. § 3031.1, requiring an electronic voting system to provide for a permanent physical record of all votes cast;
- 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(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 for 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(6), 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 prevent a voter from casting votes the voter is not entitled to vote on;
- 1107-A(7), 25 P.S. § 3031.7(7), requiring an electronic voting system to prevent over-votes;
- 1107-A(8), 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;

- 1107-A(9), 25 P.S. § 3031.7(9), requiring an electronic voting system to permit voters to vote in their own parties' primaries, and prevent 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

- 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 permits the voter to get a new ballot in the case of a spoiled ballot;

- Parts of 1107-A(16), 25 P.S. § 3031.7(16), requiring an electronic voting system which provides for district-level tabulation (i) to include a public counter to register how many ballots are submitted to be counted; (iv) not to tabulate any vote if the voter has recorded more than the number of choices allowed in a contest(overvote), and must notify a voter of an overvote if used during voting hours; and (v) to generate a printed record indicating that counters are set to zero before voting commences; and

- Parts of 1107-A(17), 25 P.S. § 3031.7(17), requiring an electronic voting system which provides for central-count tabulation to (ii) preclude tabulation of an over-vote; and (iii) indicate that counters are set to zero before processing ballots, either by district or with the capability to generate cumulative reports.

The Functional Examiner also used the System Level Testing to further evaluate the design and accuracy aspects of the system as required by Sections 1107-A(11) and (13), 25 P.S. §§ 3031.7(11) & (13) through his use of the system during the testing process, even though the accuracy and design requirements were already validated in the documentation review phase by reviewing EAC certification reports.

The Security Analysis examined the voting system's compliance with the requirements of the Pennsylvania Election Code by analyzing physical security procedures and impoundment of ballots. The examiner leveraged previous test results from the EVS 6021 examination where there were no pertinent changes that need to be re-evaluated. Precinct tabulation devices were installed as for use at polling places, and the Functional Examiner analyzed the pertinent security procedures performed on each device to ascertain compliance with Section 1107-A(12), 25 P.S. § 3031.7(12), requiring an electronic voting system to provide acceptable ballot security procedures and impoundment of ballots to prevent tampering with or substitution of any ballots or ballot cards. The Functional

Examiner also used the Security Analysis phase of testing to validate compliance with parts of Sections 1107-A(16) and (17), 25 P.S. §§ 3031.7(16) & (17), that relate to system security.

The Privacy Analysis examined the voting system's compliance with Section 1107-A(l) of the Election Code, 25 P.S. § 3031.7(1), requiring that an electronic voting system provide for absolute secrecy of the vote, by analyzing how the polling place devices met the pertinent privacy requirements. The examiner leveraged previous test results from EVS 6021 where there were no pertinent changes that needed re-evaluation.

The Usability analysis evaluated the compliance of the voting system with Sections 1107-A(14) and (15), 25 P.S. §§ 3031.7(14) & (15). The results from the tests were used by the Functional Examiner to supplement his conclusions from the documentation review phase. The examiner leveraged previous test results from EVS 6021 examination for areas where no pertinent changes occurred from previous examinations.

Accessibility Examination

The Department worked with the accessibility examiner and determined that there was no need to undertake a separate Accessibility Examination on EVS 6030. There have been no changes to the firmware from the previously certified EVS 6021 release for the voter-facing devices.

Security Testing

The Security testing provided a means to assess the required security properties of the voting system under examination, and to ascertain compliance with the Pennsylvania Election Code requirements, including 25 P.S. §§ 3031.7(11), (12), (16), & (17). The security tests specifically addressed confidentiality, vote anonymity, integrity, availability, and auditability of the voting systems. The Security Examiner also conducted a vulnerability assessment and penetration testing against systems that were configured and secured in the same manner that would be used in a live election. The security testing for

EVS 6030 focused on the changes to the system from the previously certified EVS 6021 release.

B. Examination Process and Procedures

The examination process and procedures followed for EVS 6030 are listed in this section.

Functional Examination

The functional examination commenced on July 28, 2020, at SLI lab facilities in Wheat Ridge, Colorado. The test execution tasks took approximately two days. The Functional Examiner performed System Level Testing by running a closed primary and general election. Results from the EVS 6021 examination were leveraged for Security, Privacy and Usability Analysis.

ES&S supplied all the hardware equipment required for the examination. All software and firmware necessary to perform the examination was received directly from the Voting System Test Laboratories (VSTL) that tested the voting system for EAC certification. The trusted build of the software and firmware for each device being evaluated were installed using the appropriate media for installation. The hash codes for all system components were captured using the process listed in the manufacturer's Technical Data Package (TDP) by the Functional Examiner with assistance from the ES&S representative. The Functional Examiner further compared and confirmed that all the captured hash codes matched the hash codes for the EAC certified system executables before executing the test scripts.

An election definition was created using Electionware, and transport media was prepared to load the election to vote capture and scanning devices. Precinct tabulation device DS200, polling place vote capture devices ExpressVote XL and Express Vote 2.1, and central scanners DS450 and DS850 were prepared using transport media. The polling

place was set up using ExpressVote XL, ExpressVote 2.1 Marker, ExpressVote 2.1 Tabulator and DS200. A primary and general election were then run using polling place devices and central scanners. Ballots were tabulated via the polling place tabulation devices and central scanners. Results were then tabulated using Electionware and validated against expected results.

Accessibility Examination

As mentioned in the examination approach section of this document, no additional accessibility examination was performed on EVS 6030 since there were no firmware changes.

Security Testing

The Security Testing was done at SLI lab facilities in Wheat Ridge, Colorado. The Security Testing concentrated on the changes to the system from the previously certified release EVS 6021. The Security Examiner also created a vulnerability assessment and performed penetration testing of the EVS 6030 system.

C. Examination Results

Functional Examination

1. Documentation Review

The Documentation Review testing performed by the Functional Examiner demonstrates that the EVS 6030 meets the relevant requirements of the Pennsylvania Election Code. The Examiner reviewed the "Test Report for EAC 2005 VVSG Certification Testing of ES&S EVS 6.0.3.0 Voting System."

The EAC test reports and the EAC certifications submitted by ES&S satisfy the requirements of Section 1105-A(a) of the Election Code, 25 P.S.§ 3031.5(a): requiring that an electronic voting system has been examined and approved by a federally recognized independent testing authority (ITA), or VSTL as such authorities are now called, and

meeting the applicable performance and test standards established by the federal government.

The Functional Examiner concluded that the design requirements of Sections 1107-A(11) and (14) of the Pennsylvania Election Code, 25 P.S. §§ 3031.7(11) & (14), are met by the combination of EAC hardware Non-Operating Environmental Tests, which included bench handling, vibration, low temperature, high temperature, humidity and product safety tests. The system accuracy testing completed during EAC certification testing provided confirmation of system accuracy as required by Section 1107-A(11) of the Pennsylvania Election Code, 25 P.S. § 3031.7(11).

The system summative usability test reports were accepted by the EAC as part of the Federal Certification. This, along with the Functional Examiner's use of the system, demonstrates that the system can be readily learned, and hence satisfied the usability requirement of Section 1107-A(15) of the Pennsylvania Election Code, 25 P.S. § 3031.7(15).

2. System Level Testing

As set forth in the examination approach, System Level Testing was divided into two separate tests, a closed primary election and a general election. The ballots defined had contests with voting variations supported in Pennsylvania.

A closed primary election consisting of two parties (Republican, Democratic), three precincts, was run utilizing Electionware, ExpressVote 2.1, ExpressVote XL, DS200, DS450 and DS850. Referendum contests were added to test the generation of non-partisan ballots. The Republican ballot contained 10 "vote for one" contests, 1 vote for "no more than two" contest, 4 "vote for no more than three" contests, 1 "vote for no more than four" contest, and 1 "vote for no more than fifteen" contest, as well as 2 referendums. The Democratic ballot contained 11 "vote for one" contests, 1 "vote for no more than two" contest, 1 "vote for no more than three" contest, 5 "vote for no more than four" contests, 1 "vote for no more than fifteen" contest, as well as 2 referendums. The non-partisan ballot contained 2 referendum questions. The Functional Examiner validated compliance of the

system to Sections 1101-A and 1107-A(2), (5)-(11), 25 P.S. §§ 3031.1, 3031.7(2), (5)-(11). No issues or anomalies were experienced during these tests, and the objective criteria established in the test protocols were met.

A general election consisting of four parties (Republican, Democratic, Green and Libertarian), three precincts (one of which was a split precinct), and 21 contests: 19 contests and 2 retention questions were run utilizing Electionware, ExpressVote 2.1, ExpressVote XL, DS200, DS450 and DS850. The contests included 10 "vote for one" contests, 2 "vote for no more than two" contests, 6 "vote for no more than three" contests, and 1 "vote for no more than fifteen" contest.

The Functional Examiner examined the compliance of the system with Sections 1101-A and 1107-A(2),(4), (5), (6), (7), (8), (10)-(11) and (13), 25 P.S. §§ 3031.1, 3031.7(2),(4), (5), (6), (7), (8), (10)-(11) and (13).

The Functional Examiner included test cases to validate Sections 1107-A(16) and (17), 25 P.S. §§ 3031.7(16) & (17), which mandate voting systems generate zero proof reports and correctly handle over-votes during the election runs. The remainder of the requirements of 25 P.S. §§ 3031.7(16) and (17) were validated by the Functional Examiner during the Security/Penetration Analysis.

Election definitions for both primary and general elections were created within Electionware, and transport media was created to populate ExpressVote 2.1, ExpressVote XL, DS200, DS450 and DS850. Polls were opened and ballots were marked manually and tabulated through the polling place DS200 scanner. Ballots were marked and tabulated utilizing the polling place ExpressVote 2.1 in Tabulator mode and the ExpressVote XL devices. Ballots from the ExpressVote 2.1 and ExpressVote XL were scanned through the polling place DS200. All ballots created (hand-marked paper ballots and ExpressVote 2.1 and ExpressVoteXL machine-marked ballots), were then scanned through the DS450 and DS 850. Thus, each hand-marked paper ballot was tabulated a total of three times, once for

each scanning device; and each machine-marked ballot (ExpressVote 2.1 and ExpressVote XL), was tabulated a total of four times.

The Functional Examiner used English and Spanish ballots for the test. Reports were generated after closing polls and results were validated against expected results. Each specific hardware and software component were tested for compliance with the required sections of the Election Code.

The EVS 6030 is a paper-based system and paper ballots provide a permanent physical record of each vote cast adhering to Section 1101-A, 25 P.S. § 3031.1. Hand-marked paper ballots and ExpressVote 2.1's machine-marked paper ballots in marker mode allow voters to use the precinct scanner DS200 for tabulation. The ExpressVote 2.1 in tabulator mode and the ExpressVote XL create machine-marked paper ballots based on a voter's selections, which are tabulated after the voter reviews the ballot and affirms that he/she is ready to cast a vote.

The primary and general election definitions were created using Electionware and loaded to polling place devices and central scanners, which provided assurance that the system can perform ballot creation activities. The Functional Examiner successfully added contests, parties, choices, precincts, ballot styles, referendum questions and retention contests with appropriate candidates and choices. The ExpressVote 2.1, ExpressVote XL and DS200 components of the EVS 6030 successfully permitted votes for "1 of 1," "N of M," and "Question" contests for a standard and ADA voting session. The Functional Examiner thus concluded that the system is in compliance with Section 1107-A(2), 25 P.S. § 3031.7(2).

EVS 6030 components allowed the test voter to cast votes for any candidate on the ballot, and write-in votes and demonstrated compliance with Section 1107-A(4), (5), 25 P.S. § 3031.7(4),(5).

EVS 6030 meets the requirements for Section 1107-A(6), 25 P.S. § 3031.7(6), because the test voters cast votes on different ballot styles for candidates and questions and

the ExpressVote 2.1 and ExpressVote XL displayed only contests for which the voter was entitled to vote.

The system's compliance with Section 1107-A(7), 25 P.S. § 3031.7(7) was demonstrated by the DS200's functionality of indicating overvotes for any office, and the voter's ability to either spoil the ballot or cast the ballot with overvotes if the voter decides to do so. The ExpressVote XL and ExpressVote 2.1 did not allow overvotes. The Functional Examiner also noted that the system allowed undervotes but warned the user about the undervote when configured to do so.

The successful validation of the election results demonstrated that central scanners DS450 and DS850, as well as precinct tabulator DS200, include the capability to reject all choices recorded on the ballot for an office or question if the number of choices exceeds the number for which the voter is entitled to vote, adhering to Section 1107-A(8), 25 P.S. § 3031.7(8).

The EVS 6030 complies with Section 1107-A(9), 25 P.S. § 3031.7(9), because test voters in the closed primary election were only able to vote for referendum questions and candidates seeking the nomination of their party.

Adherence to Section 1107-A(10), 25 P.S. § 3031.7(10), was demonstrated for both ADA and standard voting sessions. ExpressVote 2.1 and ExpressVote XL allowed the voters to review their ballots before printing for tabulation on DS200 or central scanners DS450 or DS850. The Functional Examiner attempted to change votes on the ExpressVote 2.1 and ExpressVote XL for candidates within the contest, as well as after leaving the contest and then returning to other contests, and while reviewing the summary screen. The tests demonstrated that the ExpressVote and ExpressVote XL allowed changing the selections until the voter decides to print or cast the ballot. The DS200 precinct scanner of EVS 6030 provides the voter with a caution message when the ballot contains potential errors, such as the presence of overvotes or undervotes. The voter is also presented an error report on the screen when the tabulator detects potential errors. The voter can either decide to affirm their intent by casting the ballot, or they can spoil the

ballot and fill out another ballot.

Accuracy requirements of 1107-A(11), 25 P.S. § 3031.7(11), that were ascertained by reviewing EAC test reports were further validated by the successful tabulation and validation of the primary and general elections run by the Functional Examiner.

The Functional Examiner validated via test cases during the primary and general election that the tabulating devices DS200, DS450 and DS850 generated zero-proof reports only before ballots were cast, the system rejected all votes for the contest in an overvote situation, and produced a results report when appropriately configured as required under Sections 1107-A(16) and (17), 25 P.S. §§ 3031.7(16) & (17). The Functional Examiner confirmed that the zero-proof report cannot be generated on demand after a ballot is cast.

3. Security Analysis

The Functional Examiner adopted a strategy to review each pertinent requirement for this test individually and then created test cases to address them via a documentation review, a functional test, or both. Results from the previous examination of EVS 6021 were leveraged when there were no changes that needed evaluation. Precinct tabulation devices and ballot marking devices were configured for delivery to a polling place from a warehouse including all seals and locks recommended by the manufacturer. The central scanners were configured for operation in a county office. The devices were inspected for the ability to be tampered with: the inspection examined ports, the outer case and memory devices to confirm that they are all secure, and the locks and seals are tamper proof and evident. The Functional Examiner also examined the components of the EVS 6030 system for password management of administrative functions and ensured that the system counter could not be reset by unauthorized persons. In addition, the Functional Examiner also reviewed the "ES&S System Security Specification" document for ballot security procedures at the polling place and central location to ensure that the manufacturer recommended the required steps for configuring the EVS 6030 securely for the election. Based on the tests, the Functional Examiner concluded that that the system complies with Section 1107-A(12), 25 P.S. § 3031.7(12).

The Functional Examiner included test cases during the Security Analysis phase of the testing to evaluate the security requirements mandated by Sections 1107-A(16) and (17), 25 P.S. §§ 3031.7(16) & (17). The Functional Examiner validated that the tabulation devices ExpressVote XL, ExpressVote 2.1 (tabulator) and DS200 had a visible public counter and the system prevented authorized and unauthorized users any access to vote data while polls are open. Tests were completed to determine that USB ports do not allow any data or information to be transferred to the ExpressVote XL, ExpressVote 2.1 (tabulator) and DS200, and no maintenance, poll worker or administrative modes allow tampering with the tabulating element. The system did not allow polls to be opened without running a zero-proof report, and the content of the report showed that all candidate positions, each question and the public counter were all set to zero. The functionality of the system to generate the close of polls report was verified and the report contents were analyzed to ensure that it contained the total number of ballots tabulated and total number of votes for each candidate and question on the ballot. Based on the above tests and the test cases executed while running the elections, the Functional Examiner concluded that EVS 6030 complies with all requirements mandated by 25 P.S. §§ 3031.7(16) and (17).

4. Privacy Analysis

The Functional Examiner reviewed and inspected the privacy aspects of the EVS 6030 system to determine compliance with Section 1101-A(1) of the Election Code, 25 P.S. § 3031.7(1). Results from previous examination of EVS 6030 were leveraged when there were no changes that needed evaluation. The Functional Examiner determined that the components of the system used at the polling place comply with 25 P.S. § 3031.7(1) by review of system documentation and physical inspection. Central scanners were physically examined by the Functional Examiner for adequate visual secrecy. The Functional Examiner also verified that no voter data, including stored ballot images, are tied back to any specific voter in a manner that would compromise voter secrecy.

5. Usability Analysis

The Functional Examiner determined that EVS 6030 demonstrated compliance with

the usability requirements of Section 1107-A(14) and (15) of the Election Code, 25 P.S. §§ 3031.7(14) & (15), by reviewing appropriate EAC certification reports and from his experience of using all the functionalities of the system during the examination.

EVS 6030 Accessibility Examination

There was no specific accessibility examination performed on EVS 6030 since the system did not have any voter facing changes from EVS 6021. All applicable findings from EVS 6021 remain valid. Attachment B of this report lists all the findings from EVS 6021 accessibility examination.

EVS 6030 Security Examination

As mentioned in the Examination Approach section of this document, the Security Examiner defined the Security Testing to be comprised of a series of test suites which are utilized for verifying that a voting system will correspond to applicable security requirements for use in Pennsylvania. The examiner analyzed the test results and summarized any identified deficiencies into four major categories: documentation, source code, hardware, and functional. The Security Examiner then evaluated the physical security, software hardening and existing system controls in place. The examiner also provided recommendations on secure implementation and deployment. The Security Examiner recommended the system for use and suggested the need to implement it utilizing a combination of vendor recommendations as well as election best practices.

The Functional Examiner also noted that the paper ballots will allow statistical recounts as required by Section 1117-A, 25 P.S. § 3031.17.

EVS 6030 was certified by the EAC on July 27, 2020, and hence complies with Section 1105-A(a) of the Election Code, 25 P.S.§ 3031.5(a), which requires that a voting system must be examined and approved by a federally recognized independent testing authority (ITA), or VSTL as such authorities are now called. The final EAC certification scope is added to this report as Attachment A.

The Functional Examiner identified that the following within Article XI-A of the Pennsylvania Election Code, Sections 1101-A to 1122-A, 25 P.S. §§ 3031.1 – 3031.22. are not applicable to the current examination, as each deal with non-functional testing aspects of acquisition, and use and maintenance aspects of a voting system:

- 25 P.S. § 3031.2;
- 25 P.S. § 3031.3;
- 25 P.S. § 3031.4;
- 25 P.S. § 3031.6;
- 25 P.S. § 3031.8;
- 25 P.S. § 3031.9;
- 25 P.S. § 3031.10;
- 25 P.S. § 3031.11;
- 25 P.S. § 3031.12;
- 25 P.S. § 3031.13;
- 25 P.S. § 3031.14;
- 25 P.S. § 3031.15;
- 25 P.S. § 3031.16;
- 25 P.S. § 3031.18;
- 25 P.S. § 3031.19;
- 25 P.S. § 3031.20;
- 25 P.S. § 3031.21; and
- 25 P.S. § 3031.22.

After all the testing activities, the Examiners and Department concluded that the EVS 6030 demonstrates compliance with all requirements as delineated in Article XI-A of the Pennsylvania Election Code, Sections 1101-A to 1122-A, 25 P.S. §§ 3031.1 – 3031.22.

D. Observations

During the examination, and in the review of documentation, the Examiner and/or Department staff made the following observations:

1. EVS 6030 does not support cumulative voting.

2. The system allows a configuration on ExpressVote 2.1 as tabulator where the voter can proceed to cast a vote without reviewing the paper ballot. If the system is configured to do so, the voter after reviewing the ballot on the ExpressVote 2.1 screen, can cast the ballot.

With this configuration, the voter doesn't have the opportunity to verify the paper ballot before casting the vote. This is not a permitted configuration in Pennsylvania.

3. The ExpressVote XL can be configured without the option for voter to review the machine-marked paper ballot. This is not a permitted configuration in Pennsylvania.

4. The Functional Examiner noted that ExpressVote XL must be configured to print terminal level reports to be compliant with the requirements mandated by 25 P.S. § 3031.7(16) when only one device is used at a polling place.

5. The USB devices and other portable media used with the voting system components needs to be reformatted, or new before use in an Election.

IV. Conditions for Certification

Given the results of the examination of EVS 6021 that occurred in June and September 2018, and EVS 6030 that occurred in July 2020 and the findings of the Examiners as set forth in his reports, **the Secretary of the Commonwealth certifies the EVS 6030 subject to the following conditions:**

A. Pennsylvania counties using the EVS 6030 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 June 9, 2011, and any future revisions or directives. In particular, Pennsylvania counties must adhere to item four (4) of the directive when setting up and positioning the ExpressVote 2.1 and ExpressVote XL 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(l) of the Election Code, 25 P.S. § 3031.7(1)).

B. No components of the EVS 6030 shall be connected to any modem or network interface, including the Internet, at any time. A standalone local area wired network configuration may be considered, in which all connected devices are certified voting system components. 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. Any wireless access points in the district components of EVS 6030, including wireless LAN cards, network adapters, must be uninstalled or disabled prior to shipping to a county board of elections.

C. Because EVS 6030 is a paper-based system, counties using the EVS 6030 must comply at a minimum with Section 1117-A of the Election Code, 25 P.S. § 3031.17, that requires a "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 exclusively via a manual count of the voter marked paper ballots. Counties must include in the sample ballots such samples as may be marked by ADA compliant components. 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 June 9, 2011 and any future revisions or directives that may apply to audits of electronic voting systems.

D. All jurisdictions implementing the EVS 6030 need to carry out a full Logic and Accuracy test on each device without fail and maintain evidence of Logic and Accuracy (L&A) testing in accordance with the statutory requirements for pre-election and post-election testing. The Department does not recommend automated L&A testing and discourages the use of preprinted ballots provided by vendors. All components being used on election day, including any Electronic Poll Books being used, must be part of the L&A testing.

E. EVS 6030 is a paper-based system, and hence, 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 the ExpressVote 2.1 or ExpressVote XL as an ADA compliant device in configuring a precinct polling place. Jurisdictions must also take into consideration the ballot box capacities of polling place components when deciding on the number of voting booths. Jurisdictions must also take into consideration that the

ExpressVote XL and the ExpressVote 2.1, when used as a tabulator, require the ballot bin to be changed or emptied after about 300 ballots. For DS200 ballot box capacities, jurisdictions can refer to the DS200 operators guide from ES&S.

F. All jurisdictions implementing the EVS 6030 must implement administrative safeguards and proper chain of custody, and document the same, to facilitate the safety and security of electronic systems pursuant to the Guidance on electronic Voting System Preparation and Security, September 2016, and any future revisions or directives.

G. Jurisdictions implementing the EVS 6030 with the Central Count Tabulator DS450 or DS 850 as the primary system where votes are counted only at the central counting location using central scanners, must comply with Section 301(a) of Help America Vote Act of 2002. The mandate requires counties using central count paper-based systems to develop voting system specific voter education programs that inform voters of the effect of over voting and instruct voters on how to correct a ballot before it is cast, including instructions on obtaining a replacement ballot. Additionally, the mandate requires that the central count voting system must be designed to preserve voter confidentiality.

H. All jurisdictions implementing the EVS 6030 must ensure that no default passwords are used on any devices and that all passwords are complex and secured. Counties must implement an audit process to review and ensure that no default passwords are used upon equipment install/reinstall and routinely change passwords (at least once prior to preparing for each primary and election) to avoid the possibility of any password compromise. The passwords and permissions management must at a minimum comply with the password requirements outlined in NIST 800-63. This publication can be accessed at https://pages.nist.gov/800-63-3/sp800-63-3.html

I. All jurisdictions implementing EVS 6030 must configure the polling place components of the voting system to notify voters when they attempt to overvote. The DS200 tabulation device options must be set to “Query Voter Preference” for overvoted hand marked paper ballot. This is to ensure that the system implementation adheres to the requirement of notifying the voter of overvotes as mandated by 25 P.S. § 3031.7(16).

J. All jurisdictions implementing EVS 6030 must work with ES&S to ensure that only the certified system configuration is installed both on first purchase, as well as any time a system component is replaced or upgraded. Jurisdictions must as part of their user acceptance test verify the implementation to ensure that the components, software and firmware belong to the certified system. Jurisdictions must also perform a trusted build validation as part of the election preparation activities and post-election canvass activities utilizing the vendor supplied methods of validation and verification of voting system integrity. A sample format that can be used for the attestation is included as Attachment C to this document.

K. ExpressVote 1.0 and ExpressTouch devices are not certified for use in Pennsylvania with EVS 6030. These devices were not presented to the Secretary for certification by ES&S.

L. Jurisdictions can make use of the Electionware adjudication functionality to adjudicate write-ins and evaluate questionable ballots, contests or selections to determine voter intent. Any decisions made during the adjudication process must be agreed upon by a team of at least two reviewers authorized by the election official following election code requirements. The election official should when necessary consult the paper ballot to assist with determinations made during adjudication. In the event of a recount, the voter verified paper ballots must be used for the count.

M. Jurisdictions implementing EVS 6030 must work with ES&S to ensure that the implemented configuration is capable of operating for a period of at least two hours on backup power as required by the VVSG. If the system components don't include internal battery packs for reliable power, the Uninterruptible Power Supply (UPS) specified in the EAC certified configuration must be purchased and used at the polling places.

N. Jurisdictions using the services of ES&S or a third-party vendor for election preparation activities must work with ES&S or the vendor to ensure that systems used for ballot definition activities are considered part of the voting system, and they must use certified voting system components. The systems used for ballot definition must be configured securely following conditions outlined in this report and following any

Directives and Guidance issued by the Secretary. Any data transfer between the vendor and county must be done using encrypted physical media or a secure file transfer process. The file transfer and download must be tracked and audited to make sure that data has not been accessed by unauthorized personnel.

O. Jurisdictions must work with ES&S to thoroughly test and review audio ballot instructions to ensure that the voters using an audio ballot can cast the ballot without requesting assistance. Jurisdictions must consider the following while reviewing the ballot:

- The audio ballot must fully inform the voter what has happened and is occurring, and how to select/deselect their choices;
- The feedback messages must explain to voters what is happening, including the number and names of candidates being deselected;
- The audio ballot must provide feedback on the reason for the changes in any selections; and
- The audio ballot instructions on messages on the system must have the specific information for the task or screen displayed and communicated before the general, repeated instructions.

P. Jurisdictions implementing ExpressVote XL must ensure that the configuration allows voters to review their vote selections on the screen and on the machine-marked paper ballot before it is cast.

Q. Jurisdictions selecting the XL must implement proper poll closing and vote record transportation procedures so that collection bins containing paper machine-marked paper ballots are sealed and transported with proper chain of custody to the county office. Poll worker training must include the details of the procedures to ensure that collection bins remain sealed until delivered to the county office. Collection bins must be opened in the presence of board of election members and must be commingled before canvass and storage, in a manner consistent with the procedure outlined for the canvassing of absentee ballots

under Section 1308(e) of the Election Code, 25 P.S. § 3146.8(e).

R. Jurisdictions implementing the XL must ensure that the on-screen instructions for XL include specific voter and poll worker instructions added on the screen detailing spoiling procedures and cues to protect voter privacy. In addition, poll worker training must:

- Emphasize the need to obscure any view of the paper machine-marked paper ballot during the process of spoiling the record;

- Educate poll workers on the proper steps to be taken when they respond to a voter request for spoiling the machine-marked paper ballot to ensure that the secrecy of the spoiled record is maintained. These steps include ensuring that the voter intends to spoil the record, has read the instructions on the screen and has been informed by the poll worker how to prevent inadvertent view of the machine-marked paper ballot before the poll worker enters inside the privacy curtain.

S. Jurisdictions implementing the ExpressVote 2.1 as a Tabulator must ensure that the system is implemented in a configuration that allows physical review of the machine-marked paper ballot, before casting the vote. The system **must not** be configured to have the voter validate the selections on the screen and "Autocast" the ballot, thus causing a situation where the voter has not verified what was printed on the paper ballot.

T. Jurisdictions implementing ExpressVoteXL and ExpressVote 2.1 as tabulator must ensure that the system is configured to generate a printed report at the close of polls. The report must at a minimum indicate the total number of voters whose ballots have been tabulated, the total number of votes cast for each candidate whose name appears on the ballot, and the total number of votes cast for, or against, any question appearing on the ballot.

U. The electronic voting system must be physically secured and protected while in transit, storage, or while in use at their respective locations. Unmonitored physical access to devices can lead to compromise, tampering, and/or planned attacks.

V. Jurisdictions must implement processes and procedures involving management, monitoring and verification of seals, locks/keys, and other access methods, before, during and after the election.

W. Jurisdictions must seal any unused ports on the voting system components using tamper evident seals even if the port is inside a locked compartment. Jurisdictions must work with ES&S and use physical port blocking plugs to close unused ports whenever possible before placing the tamper evident seal. The Department also recommends using port blocking plugs for exposed ports for components of the voting system housed in county office which can be removed by authorized personnel when the port is needed.

X. Jurisdictions utilizing the standalone installation of the EMS server must take necessary steps to protect the laptops from accidental loss or theft. Suggested mitigations include but are not limited to - cable locks, tamper evident seals, proper password management which utilizes passwords of sufficient strength in each election, as well as locking containers. All standalone electionware instances should remain in a protected environment protected by sufficient security mitigations to prevent unauthorized access. The chain of custody for the standalone EMS systems must be maintained by the jurisdiction at all times, and periodic auditing of the system's chain of custody procedures are required. Jurisdictions must implement processes to determine exact electionware system usage by election official for enhanced auditability.

Y. Jurisdictions must implement processes to gather and safekeep system logs for each component of the voting system after each election. Consistent auditing of system logs and reports is vital to maintain system transparency and to ensure that any compromise or malfunction is observed, reported and resolved in a timely manner.

Z. Jurisdictions implementing EVS 6030 must ensure that the USB devices and any other removable media used for election activities are maintained with strict chains of custody. There must be a process to manage the removable media inventory to avoid misplaced and lost media. The devices must be reformatted before use in each election. Appropriate steps must be taken to ensure that the format is a full reformat of the USB

devices.

AA. Jurisdictions implementing EVS 6030 must work with ES&S to ensure appropriate levels of training for election officials is planned on implementation. Counties must ensure that training adheres to the "Minimum Training Requirements" specified in Attachment D of this document.

BB. Jurisdictions implementing EVS 6030 must include voter and poll worker training as part of the implementation plan. The training must include hands on practice for both voters and poll workers. Specific consideration must be given to voters using assistive devices, and also to poll worker education that includes training on how to assist voters with disabilities. Refer to Appendix B, listing detailed recommendations for deployment noted by the Accessibility Examiner. Follow-on training for replacement poll workers, and for refresher training, must also be considered.

CC. Jurisdictions implementing EVS 6030 must consider the following during voting booth set up for serving voters requiring assistive devices:

- Voters with disabilities may have assistive technology or personal notes that they need to be placed within reach. They may also need room to place the printed ballot on a flat surface to use personal technology such as magnifiers or text readers to verify it.

- For the ExpressVote 2.1 configured as a marker where the voter has to complete the voting process by scanning the ballot on a DS 200 precinct scanner, the path to the DS 200 scanner should be as easy as possible, ideally a straight line with no obstructions. The path should include ample room to turn and maneuver a wheelchair if the machine is positioned with the screen facing the wall. The ADA standards suggest a minimum of 60 x 60 inches for this.

Refer to Appendix B, listing detailed recommendations for deployment noted by the Accessibility Examiner.

DD. ES&S must submit the following system education materials to the Department of State and must consent to the publication and use of the video on any websites hosted by any Pennsylvania counties and the Pennsylvania Secretary of the Commonwealth, or any publicly available social media platform. The videos must be closed captioned for the visually impaired.

- A video (in an electronic format) for voters that demonstrates how to cast a vote and ballot using the Voting System.
- A video (in an electronic format) for precinct election officials that demonstrates how to setup, operate, and shutdown the Voting System components on an Election Day. The video must demonstrate how to set up and operate the voting system accessible devices for use by voters.
- A "quick reference guide" for precinct election officials to consult on Election Day. The guide must be specific to the purchasing county's setup and use of the Voting System, including accessible options.
- A "quick reference guide" with images that demonstrates to voters how to cast a vote. This must be provided in additional languages for any jurisdictions required to meet language thresholds requirements of the Voting Rights Act.

EE. ES&S must adhere to the following reporting requirements and submit the following to the Secretary:

- Equipment Reporting. Reported field issues or anomalies that occur in Pennsylvania or elsewhere with any piece of equipment deployed in the Commonwealth of Pennsylvania within 3 days of the occurrence;
- Advisory Notices. System advisory notices issued for any piece of equipment

deployed in the Commonwealth of Pennsylvania regardless of whether the incident behind the notice occurred in Pennsylvania or elsewhere;

- Ownership, Financing, Employees, Hosting Location. Any changes to information on the Supplier's employees and affiliates, locations, company size and ability to provide technical support simultaneously to several counties in the Commonwealth of Pennsylvania and other jurisdictions that use its Voting System. Additionally, ES&S must provide information on foreign ownership/financing, data hosting, and production for any equipment or ancillary products, including any potential conflict of interest that may have developed for employees and affiliates;

- Security Measures and any updated security testing or risk/vulnerability assessments conducted by the Supplier or a third-party;

- SOC 2 Reporting – ES&S shall provide the Secretary with its annual American Institute of Certified Public Accountants (AICPA) Attestation Standard (AT) Sec. 101 Service Organization Control ("SOC") 2, Type 2 certification (AT Sec. 101 SOC 2, Type 2), or an equivalent certification approved by the Commonwealth. Equivalent certifications include, but are not limited to: International Organization of Standards (ISO) 2700x certification; certification under the Federal Information Security Management Act (FISMA); and AT Sec. 101 SOC 3 (SysTrust/WebTrust) certification.

FF. ES&S must adhere to the "Source Code and Escrow Items Obligations" specified in Attachment F of this document.

GG. ES&S must work with jurisdictions to ensure that the system is configured to comply with all applicable requirements of the Pennsylvania Election Code delineated in Section Article XI-A of the Pennsylvania Election Code, Sections 1101-A to 1122-A, 25 P.S. §§ 3031.1 – 3031.22.

HH. Jurisdictions implementing the EVS 6030 and ES&S must work together to

implement the system under this certification and must comply with the conditions 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. § 303l.5(a)-(b). ES&S must ensure that future releases of the voting system with enhanced security and accessibility features are presented for approval to the Secretary.

II. ES&S must work with counties and Department of State to ensure that the system can integrate with Pennsylvania Department of State's Election Night Reporting (ENR) system. 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 June 9, 2011 and Section 1105-A(d) of the Pennsylvania Election Code, 25 P.S. § 3031.5(d), this certification and approval is valid only for EVS 6030. If the vendor or a County Board of Elections makes any changes to the EVS 6030 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 6030 Voting System in the Commonwealth of Pennsylvania.

V. Recommendations

A. All jurisdictions implementing EVS 6030 Voting System should ensure that the system is correctly set up pursuant to all the recommendations 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 June 9, 2011 and Guidance on Electronic Voting System Preparation and Security, September 2016.

B. All jurisdictions implementing EVS 6030 should take appropriate steps to ensure that voter education is part of the implementation plan.

C. All jurisdictions implementing the EVS 6030 should ensure that precinct election officials and poll workers receive appropriate training and are comfortable using the system.

D. All jurisdictions considering purchase of the EVS 6030 should review the System Limits as mentioned in the EAC certification scope added as Attachment A to this report.

E. The Secretary recommends that ES&S and counties work with the Department on any changes to their voting equipment including, but not limited to, purchase and upgrades.

F. The Secretary recommends in-house ballot definition activities at a county location whenever possible. If an external vendor location is used, the county should implement oversight measures to ensure that election data, including ballot definition files and audit logs stored on devices outside of the county, are protected from unauthorized access.

VI. Conclusion

As a result of the examination, and after consultation with the Department's staff, counsel and the examiners, the Secretary of the Commonwealth concludes that the EVS 6030 can be safely used by voters at elections as provided in the Pennsylvania Election Code and meets all of the requirements set forth in the Election Code, **provided the voting system is implemented under the conditions listed in Section IV of this report.** Accordingly, the Secretary certifies EVS 6030 for use in this Commonwealth.

The ExpressVote XL and ExpressVote 2.1 can accommodate 10-12 voters with disabilities per hour or 20-60 voters per hour when used as the primary voting system depending on size of the ballot. DS200 can serve 120-180 voters per hour. The ExpressVote XL and ExpressVote 2.1 ballot box will hold approximately 300 ballots, and DS 200 ballot boxes can hold 1250 to 3000, 19-inch ballots depending on the type of ballot

box used. After the capacity is reached the poll workers will need to change the ballot box or empty the contents to a secure box and replace the ballot box.

Attachment A – EAC Certification Scope

ES&S EVS6030
Certificate and Scope

United States Election Assistance Commission

Certificate of Conformance

ES&S EVS 6.0.3.0

The voting system identified on this certificate has been evaluated at an accredited voting system testing laboratory for conformance to the *Voluntary Voting System Guidelines Version 1.0 (VVSG 1.0)* . Components evaluated for this certification are detailed in the attached Scope of Certification document. This certificate applies only to the specific version and release of the product in its evaluated configuration. The evaluation has been verified by the EAC in accordance with the provisions of the EAC *Voting System Testing and Certification Program Manual* and the conclusions of the testing laboratory in the test report are consistent with the evidence adduced. This certificate is not an endorsement of the product by any agency of the U.S. Government and no warranty of the product is either expressed or implied.

Product Name: EVS

Model or Version: 6.0.3.0

Name of VSTL: Pro V&V

EAC Certification Number: ESSEVS6030

Date Issued: July 27, 2020

Mona Harrington

Executive Director

Scope of Certification Attached

Scope of Certification

This document describes the scope of the validation and certification of the system defined above. Any use, configuration changes, revision changes, additions or subtractions from the described system are not included in this evaluation.

Significance of EAC Certification

An EAC certification is an official recognition that a voting system (in a specific configuration or configurations) has been tested to and has met an identified set of Federal voting system standards. An EAC certification is **not**:

- An endorsement of a Manufacturer, voting system, or any of the system's components.
- A Federal warranty of the voting system or any of its components.
- A determination that a voting system, when fielded, will be operated in a manner that meets all HAVA requirements.
- A substitute for State or local certification and testing.
- A determination that the system is ready for use in an election.
- A determination that any particular component of a certified system is itself certified for use outside the certified configuration.

Representation of EAC Certification

Manufacturers may not represent or imply that a voting system is certified unless it has received a Certificate of Conformance for that system. Statements regarding EAC certification in brochures, on Web sites, on displays, and in advertising/sales literature must be made solely in reference to specific systems. Any action by a Manufacturer to suggest EAC endorsement of its product or organization is strictly prohibited and may result in a Manufacturer's suspension or other action pursuant to Federal civil and criminal law.

System Overview

The ES&S EVS 6.0.3.0 (EVS6030) voting system is a modification of the ES&S EVS 6.0.2.0 voting system, certified on October 4, 2018. EVS6030 introduces multiple performance and optimization improvements for Electionware.

EVS6030 includes the following hardware: ExpressTouch Electronic Universal Voting System, ExpressVote XL™ Full-Face Universal Voting System, ExpressVote Universal Voting System hardware 1.0, ExpressVote Universal Voting System hardware 2.1, DS450 High-Throughput Central Tabulator, DS850 High-Speed Central Tabulator and DS200 Precinct-Based Tabulator.

Electionware® election management software is an end-to-end election management software application that provides election definition creation, ballot formation, equipment configuration,

result consolidation, adjudication and report creation. Electionware is composed of five software groups: Define, Design, Deliver, Results and Manage.

ExpressVote XL™ is a hybrid paper-based polling place voting device that provides a full-face touchscreen vote capture that incorporates the printing of the voter's selections as a cast vote record, and tabulation scanning into a single unit.

ExpressTouch® is a DRE voting system which supports electronic vote capture for all individuals at the polling place.

ExpressVote® Hardware 1.0 is a hybrid paper- based polling place voting device that provides touch screen vote capture that incorporates the printing of the voter's selections as a cast vote record, to be scanned for tabulation in any one of the ES&S precinct or central scanners.

ExpressVote® Hardware 2.1 is a hybrid paper-based polling place voting device that provides touch screen vote capture that incorporates the printing of the voter's selections as a cast vote record, and tabulation scanning into a single unit. ExpressVote HW2.1 is capable of operating in either marker or tabulator mode, depending on the configurable mode that is selected in Electionware.

There are two separate versions of the ExpressVote hardware version 2.1: 2.1.0.0 and version 2.1.2.0. Please note that all future references to ExpressVote HW 2.1 as used throughout the document refers to both hardware versions.

DS200® is a polling place paper-based voting system, specifically a digital scanner and tabulator that simultaneously scans the front and back of a paper ballot and/or vote summary card in any of four orientations for conversion of voter selection marks to electronic Cast Vote Records (CVR).

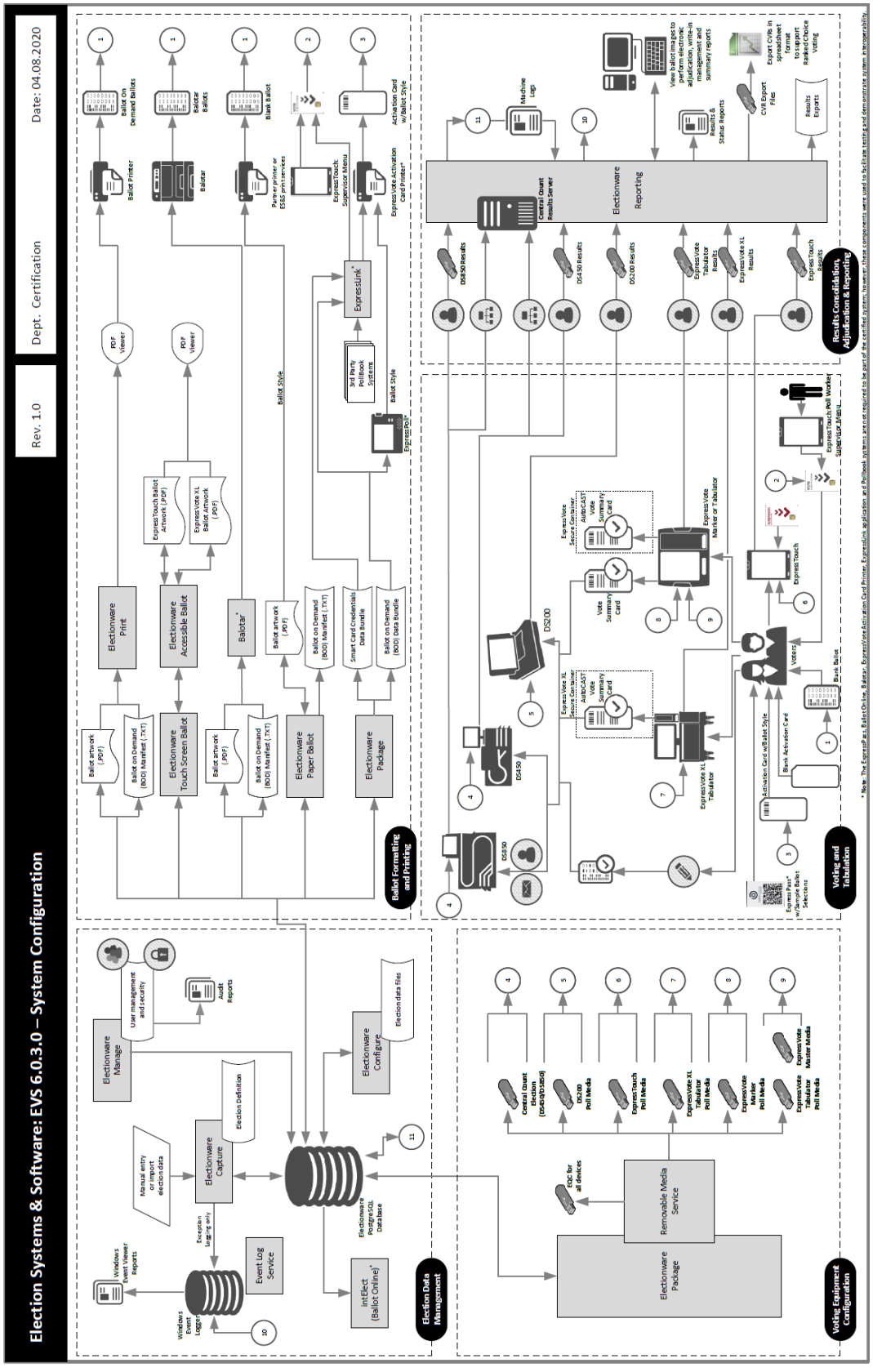
DS450® is a central scanner and tabulator that simultaneously scans the front and back of a paper ballot and/or vote summary card in any of four orientations for conversion of voter selection marks to electronic Cast Vote Records (CVR).

DS850® is a central scanner and tabulator that simultaneously scans the front and back of a paper ballot and/or vote summary card in any of four orientations for conversion of voter selection marks to electronic Cast Vote Records (CVR).

Event Log Service (ELS) monitors and logs users' interactions with the Election Management System. Events that happen when a connection to the database is not available are logged to the Windows Operating System log through the ELS.

Removable Media Service (RMS) is a utility that runs in the background of the Windows operating system. RMS reads specific information from any attached USB devices so that ES&S applications such as Electionware can use that information for media validation purposes.

System Diagram



Certified System before Modification (If applicable):

EVS 6.0.2.0

Changes addressed by modification

Cross-Product Changes

- Arial Fonts

  Included the recommended Arial fonts, which allows states to have better flexibility for ballot/election layout.

  Impacted products: Election Management System

- Increased RAM Potential

  Provided the option for increased physical RAM on the EMS in the client, server and/or standalone configurations (optional). Increased the amount of virtual RAM available to Electionware (optional).

  Impacted products: Election Management System

- Modified Password Policy

  Provided a method for modifying the Microsoft Windows password policy to not expire on the EMS (optional).

  Impacted products: Election Management System

Electionware

- Adjudication
  - Provided an additional user logging message to enhance the transparency and security of the database. This additional logging is included within the Reporting module to assist users during ballot adjudication.
- Performance Improvement
  - Provided an additional internal Postgres system logging message to enhance the security and performance of the database. This additional logging is included within the internal Postgres logging for analytical, internal traceability and allows for further indexing for added performance
  - Migrated Electionware from a 32-bit to a 64-bit application. This allows increased memory allocation and improves system performance.

- Exports/Reporting
    - Removed all empty entries in the CVR export report.

Removable Media Service

- Performance Improvement
    - Modified the installation directory to accommodate 64-bit Electionware application.

Mark Definition

ES&S' declared level mark recognition for the DS200, DS450 and DS850 is a mark across the oval that is 0.02" long x 0.03" wide at any direction.

Tested Marking Devices

Bic Grip Roller Pen

Language Capability

EVS 6.0.3.0 supports English, Spanish, Chinese, Korean, Japanese, Hindi, Bengali, Vietnamese, Tagalog, Creole, Russian, and French. In addition, Punjabi and Gujarati are supported by ExpressVote XL and Electionware only.

Proprietary Components Included

This section provides information describing the components and revision level of the primary components included in this Certification.

System Component	Software or Firmware Version	Hardware Version	Model	Comments
Electionware	5.0.1.1			
ES&S Event Log Service	1.6.0.0			
Removable Media Service	1.9.0.0			
ExpressVote HW 1.0	1.5.0.0, 1.5.1.0	1.0		Paper-based vote capture and selection device
ExpressVote Previewer (1.0)	1.5.0.0, 1.5.1.0			
ExpressVote HW 2.1	2.4.0.0, 2.4.3.0	2.1.0.0 2.1.2.0		Hybrid paper-based vote capture and selection device and precinct count tabulator
ExpressVote Previewer (2.1)	2.4.0.0, 2.4.3.0			
DS200	2.17.0.0	1.2, 1.3		Precinct Count Tabulator
DS450	3.1.0.0	1.0		Central Count Scanner and Tabulator
DS450 Cart	---	---	Model 3002	DS450 Cart
DS850	3.1.0.0	1.0		Central Count Scanner and Tabulator
DS850 Cart	---	---	Model 6823	DS850 Cart
ExpressVote XL	1.0.0.0, 1.0.1.0	1.0		Hybrid full-faced paper-based vote capture and selection device and precinct count tabulator
ExpressTouch	1.0.0.0	1.0		DRE
ExpressVote Rolling Kiosk		1.0	98-00049	Portable Voting Booth
Voting Booth		N/A	98-00051	Stationary Voting Booth
Voting Booth Workstation		N/A	87035	Stationary Voting Booth
ExpressVote Single Table		N/A	87033	Voting Table for One Unit
ExpressVote Double Table		N/A	87032	Voting Table for Two Units

System Component	Software or Firmware Version	Hardware Version	Model	Comments
ADA Table		N/A	87031	Voting Table for One Unit
DS200 Ballot Box		1.0, 1.1	98-00009	Collapsible Ballot Box
DS200 Ballot Box		1.2, 1.3, 1.4, 1.5	57521	Plastic ballot box
DS200 Tote Bin		1.0	00074	Tote Bin Ballot Box
Universal Voting Console		2.0	98-00077	Detachable ADA support peripheral
Tabletop Easel		N/A	14040	
ExpressTouch Voting Booth		N/A	98-00081	Stationary Voting Booth
SecureSetup	2.0.0.1			Proprietary Hardening Script

COTS Software

Manufacturer	Application	Version
Microsoft Corporation	Server 2008	R2 w/ SP1 (64-bit)
Microsoft Corporation	Windows 7 Professional	SP1 (64-bit)
Microsoft Corporation	WSUS Microsoft Windows Offline Update Utility	11.1.1
Symantec	Endpoint Protection	14.0.1 (64-bit)
Symantec	Symantec Endpoint Protection Intelligent Updater (File-Based Protection)	20180116-002-core3sdsv5i64.exe
Symantec	Symantec Endpoint Protection Intelligent Updater (Network-Based Protection)	20180115-040-IPS_IU_SEP_14RU1.exe
Symantec	Symantec Endpoint Protection Intelligent Updater (Behavior-Based Protection)	20180108-003-SONAR_IU_SEP.exe
Cerberus	CerberusFTP Server – Enterprise	9.0.3.1 (64-bit)
Adobe	Acrobat	XI
Microsoft Corporation	Visual C++ Redistributable	vc_redist.x86.exe (32-bit)
RSA Security	RSA BSAFE Crypto-C ME for Windows 32-bit	4.1
OpenSSL	OpenSSL	2.0.12
OpenSSL	OpenSSL	2.0.16
OpenSSL	OpenSSL	1.02d
OpenSSL	OpenSSL	1.02h
OpenSSL	OpenSSL	1.02k

COTS Hardware

Manufacturer	Hardware	Model/Version
Dell	EMS Server	PowerEdge T430, T630
Dell	EMS Client or Standalone Workstation	Latitude 5580, OptiPlex 5040, 5050, 7020
Innodisk	USB EDC H2SE (8GB) for ExpressVote 1.0	DEEUH1-08GI72AC1SB
Innodisk	USB EDC H2SE (16GB) for ExpressVote 2.1	DEEUH1-16GI72AC1SB
Delkin	USB Flash Drive (512MB, 1GB, 2GB, 4GB, 8GB)	N/A
Delkin	USB Embedded 2.0 Module Flash Drive	MY16TNK7A-RA042-D/ 16GB
Delkin	Compact Flash Memory Card (1GB)	N/A
Delkin	Compact Flash Memory Card Reader/Writer	6381
Delkin	CFAST Card (2GB, 4GB)	N/A
Lexar	CFAST Card Reader/Writer	LRWCR1TBNA
CardLogix	Smart Card	CLXSU128kC7/ AED C7
SCM Microsystems	Smart Card Writer	SCR3310
Avid	Headphones	86002
Zebra Technologies	QR code scanner (Integrated)	DS457-SR20009
Symbol	QR Code scanner (External)	DS9208
Dell	DS450 Report Printer	S2810dn
OKI	DS450 and DS850 Report Printer	B431DN, B431D, B432DN
OKI	DS450 and DS850 Audit Printer	Microline 420
APC	DS450 UPS	Back-UPS Pro 1500
APC	DS850 UPS	Back-UPS RS 1500, Pro 1500
Tripp Lite	DS450 Surge Protector	Spike Cube
Seiko Instruments	Thermal Printer	LTPD-347B
NCR/Nashua	Paper Roll	2320
Fujitsu	Thermal Printer	FTP-62GDSL001, FTP-63GMCL153

System Limitations

This table depicts the limits the system has been tested and certified to meet.

System Characteristic	Boundary or Limitation	Limiting Component
Max. precincts allowed in an election	9,900	Electionware
Max. ballot styles in an election	15,000	Electionware
Max. candidates allowed per election	10,000	Electionware
Max. contests allowed in an election	10,000	Electionware
Max. number of parties allowed	General election: 75 Primary election: 30 (including non-partisan)	Electionware
Max. Precinct Types/Groups	25	Electionware
Max. Contests allowed per ballot style	500 or # of positions on ballots	
Max. Reporting Groups in an election	14	Electionware
Max. candidates allowed per contest	230	Electionware
Max. "Vote For" per contest	230	Electionware
Max. ballots per batch	1,500	DS45/DS850

Component Limitations:

Electionware

1. Electionware capacities exceed the boundaries and limitations documented for ES&S voting equipment. For this reason, ballot tabulator limitations define the boundaries and capabilities of the Electionware system.
2. Electionware software field limits were calculated based on an average character width for ballot and report elements. Some uses and conditions, such as magnified ballot views or combining elements on printed media or ballot displays, may result in field limits (and associated warnings) lower than those listed. Check printed media and displays before finalizing the election.
3. The Electionware Export Ballot Images function is limited to 250 districts per export.
4. Electionware supports the language special characters listed in the System Overview, Attachment 1. Language special characters other than those listed may not appear properly when viewed on equipment displays or reports.
5. The Straight Party feature must not be used in conjunction with the Single or Multiple Target Cross Endorsement features.

6. The 'MasterFile.txt' and the 'Votes File.txt' do not support results for elections that contain multiple sheets or multiple ExpressVote cards per voter. These files can be produced using the Electionware > Reporting > Tools > Export Results menu option. This menu option is available when the Rules Profile is set to "Illinois".

Paper Ballot Limitations

1. The paper ballot code channel, which is the series of black boxes that appear between the timing track and ballot contents, limits the number of available ballot variations depending on how a jurisdiction uses this code to differentiate ballots. The code can be used to differentiate ballots using three different fields defined as: Sequence (available codes 1-16,300), Type (available codes 1-30) or Split (available codes 1-18).
2. If Sequence is used as a ballot style ID, it must be unique election-wide and the Split code will always be 1. In this case the practical style limit would be 16,300.
3. The ExpressVote activation card has a limited ballot ID based on the three different fields defined as: Sequence (available codes 1-16,300), Type (available codes 1-30) or Split (available codes 1-18).
4. Grid Portrait and Grid Landscape ballot types are New York specific and not for general use.

ExpressVote

1. ExpressVote capacities exceed all documented limitations for the ES&S election management, vote tabulation and reporting system. For this reason, Election Management System and ballot tabulator limitations define the boundaries and capabilities of the ExpressVote system as the maximum capacities of the ES&S ExpressVote are never approached during testing.

ExpressVote XL

1. ExpressVote XL capacities exceed all documented limitations for the ES&S election management, vote tabulation and reporting system. For this reason, Election Management System and ballot tabulator limitations define the boundaries and capabilities of the ExpressVote XL system as the maximum capacities of the ES&S ExpressVote XL are never approached during testing.
2. ExpressVote XL does not offer open primary support based on the ES&S definition of Open Primary, which is the ability to select a party and vote based on that party.
3. ExpressVote XL does not support Massachusetts Group Vote.
4. ExpressVote XL does not support Universal Primary Contest.
5. ExpressVote XL does not support Multiple Target Cross Endorsement.
6. ExpressVote XL does not support Reviewer or Judges Initials boxes.
7. ExpressVote XL does not support multi-card ballots.
8. In a General election, one ExpressVote XL screen can hold 32 party columns if set up as columns or 16 party rows if set up as rows.
9. ExpressVote XL does not support Team Write-In.

ExpressTouch

1. ExpressTouch capacities exceed all documented limitations for the ES&S election management, vote tabulation and reporting system. For this reason, Election Management System limitations define the boundaries and capabilities of the ExpressTouch system as the maximum capacities of the ES&S ExpressTouch are never approached during testing.

2. ExpressTouch does not offer open primary support, which is the ability to select a party and vote based on that party.
3. ExpressTouch does not support Massachusetts Group Vote.
4. ExpressTouch does not support Universal Primary Contest.
5. ExpressTouch does not support Multiple Target Cross Endorsement.
6. ExpressTouch does not support Team Write-In.

DS200

1. The ES&S DS200 configured for an early vote station does not support precinct level results reporting. An election summary report of tabulated vote totals is supported.
2. The DS200 storage limitation for write-in ballot images is 3,600 images. Each ballot image includes a single ballot face, or one side of one page.
3. Write-in image review requires a minimum 1GB of onboard RAM.
4. To successfully use the Write-In Report, ballots must span at least three vertical columns. If the column is greater than 1/3 of the ballot width (two columns or less), the write-in image will be too wide to print on the tabulator report tape.

Functionality

VVSG 1.0 Supported Functionality Declaration

Feature/Characteristic	Yes/No	Comment
Voter Verified Paper Audit Trails		
VVPAT	No	
Accessibility		
Forward Approach	Yes	
Parallel (Side) Approach	Yes	
Closed Primary		
Primary: Closed	Yes	
Open Primary		
Primary: Open Standard	Yes	Except ExpressTouch and ExpressVote XL
Primary: Open Blanket	No	
Partisan & Non-Partisan:		
Partisan & Non-Partisan: Vote for 1 of N race	Yes	
Partisan & Non-Partisan: Multi-member (“vote for N of M”) board races	Yes	
Partisan & Non-Partisan: “vote for 1” race with a single candidate and write-in voting	Yes	
Partisan & Non-Partisan “vote for 1” race with no declared candidates and write-in voting	Yes	
Write-In Voting:		
Write-in Voting: System default is a voting position identified for write-ins.	Yes	
Write-in Voting: Without selecting a write in position.	Yes	
Write-in: With No Declared Candidates	Yes	
Write-in: Identification of write-ins for resolution at central count	Yes	
Primary Presidential Delegation Nominations & Slates:		
Primary Presidential Delegation Nominations: Displayed delegate slates for each presidential party	No	

Feature/Characteristic	Yes/No	Comment
Slate & Group Voting: one selection votes the slate.	No	
Ballot Rotation:		
Rotation of Names within an Office; define all supported rotation methods for location on the ballot and vote tabulation/reporting	Yes	
Straight Party Voting:		
Straight Party: A single selection for partisan races in a general election	Yes	
Straight Party: Vote for each candidate individually	Yes	
Straight Party: Modify straight party selections with crossover votes	Yes	
Straight Party: A race without a candidate for one party	Yes	
Straight Party: N of M race (where "N">1)	Yes	
Straight Party: Excludes a partisan contest from the straight party selection	Yes	
Cross-Party Endorsement:		
Cross party endorsements, multiple parties endorse one candidate.	Yes	
Split Precincts:		
Split Precincts: Multiple ballot styles	Yes	
Split Precincts: P & M system support splits with correct contests and ballot identification of each split	Yes	
Split Precincts: DRE matches voter to all applicable races.	Yes	
Split Precincts: Reporting of voter counts (# of voters) to the precinct split level; Reporting of vote totals is to the precinct level	Yes	
Vote N of M:		
Vote for N of M: Counts each selected candidate, if the maximum is not exceeded.	Yes	
Vote for N of M: Invalidates all candidates in an overvote (paper)	Yes	
Recall Issues, with options:		
Recall Issues with Options: Simple Yes/No with separate race/election. (Vote Yes or No Question)	No	
Recall Issues with Options: Retain is the first option, Replacement candidate for the second or more options (Vote 1 of M)	No	
Recall Issues with Options: Two contests with access to a second contest conditional upon a specific vote in contest one. (Must vote Yes to vote in 2nd contest.)	No	
Recall Issues with Options: Two contests with access to a second contest conditional upon any vote in contest one. (Must vote Yes to vote in 2nd contest.)	No	
Cumulative Voting		
Cumulative Voting: Voters are permitted to cast, as many votes as there are seats to be filled for one or more candidates. Voters are not limited to giving only one vote to a candidate. Instead, they can put multiple votes on one or more candidate.	No	

Feature/Characteristic	Yes/No	Comment
Ranked Order Voting		
Ranked Order Voting: Voters can write in a ranked vote.	No	
Ranked Order Voting: A ballot stops being counting when all ranked choices have been eliminated	No	
Ranked Order Voting: A ballot with a skipped rank counts the vote for the next rank.	No	
Ranked Order Voting: Voters rank candidates in a contest in order of choice. A candidate receiving a majority of the first choice votes wins. If no candidate receives a majority of first choice votes, the last place candidate is deleted, each ballot cast for the deleted candidate counts for the second choice candidate listed on the ballot. The process of eliminating the last place candidate and recounting the ballots continues until one candidate receives a majority of the vote	No	
Ranked Order Voting: A ballot with two choices ranked the same, stops being counted at the point of two similarly ranked choices.	No	
Ranked Order Voting: The total number of votes for two or more candidates with the least votes is less than the votes of the candidate with the next highest number of votes, the candidates with the least votes are eliminated simultaneously and their votes transferred to the next-ranked continuing candidate.	No	
Provisional or Challenged Ballots		
Provisional/Challenged Ballots: A voted provisional ballots is identified but not included in the tabulation but can be added in the central count.	Yes	
Provisional/Challenged Ballots: A voted provisional ballots is included in the tabulation, but is identified and can be subtracted in the central count	Yes	
Provisional/Challenged Ballots: Provisional ballots maintain the secrecy of the ballot.	Yes	
Overvotes (must support for specific type of voting system)		
Overvotes: P & M: Overvote invalidates the vote. Define how overvotes are counted.	Yes	
Overvotes: DRE: Prevented from or requires correction of overvoting.	Yes	
Overvotes: If a system does not prevent overvotes, it must count them. Define how overvotes are counted.	Yes	
Overvotes: DRE systems that provide a method to data enter absentee votes must account for overvotes.	Yes	
Undervotes		
Undervotes: System counts undervotes cast for accounting purposes	Yes	
Blank Ballots		
Totally Blank Ballots: Any blank ballot alert is tested.	Yes	
Totally Blank Ballots: If blank ballots are not immediately processed, there must be a provision to recognize and accept them	Yes	
Totally Blank Ballots: If operators can access a blank ballot, there must be a provision for resolution.	Yes	
Networking		
Wide Area Network – Use of Modems	No	

Wide Area Network – Use of Wireless	No	
Local Area Network – Use of TCP/IP	No	
Local Area Network – Use of Wireless	No	
FIPS 140-2 validated cryptographic module	Yes	
Used as (if applicable):		
Precinct counting device	Yes	DS200, ExpressTouch, ExpressVote HW2.1, ExpressVote XL
Central counting device	Yes	DS450 and/or DS850

Baseline Certification Engineering Change Order's (ECO)

There are no ECOs associated with this certification.

Attachment B – Accessibility Examination Findings and Recommendations from EVS 6000/6021

(No additional accessibility examination was conducted on this release.)

A) Top problems and Recommendations as listed in the accessibility examiner's report

Top problems.pdf

B) All observations from Accessibility Examination

All observations.pdf

C) Recommendations for Deployment from Accessibility Examiner report

Recommendations for deployment.pdf

Top problems

The examination identified three problems that could reduce the ability of people with disabilities to vote independently and privately.

1. Automatic selection and deselection

What happened

- Voters were confused by the automatic selection and deselection that is part of straight party voting.
    - When you make a manual selection to override your straight party, all the straight party choices are deselected automatically. The XL does not completely announce the deselections. Deselects may not be visible onscreen, if happen on a screen.
    - If you want to vote for no one, you cannot deselect all candidates if there's an eligible candidate selected by straight party vote.
    - Touching a straight party candidate (for emphasis or deselection), deselected the other candidates.
- In some cases, this led voters to cast a ballot without knowing all of the candidates that had been selected. This problem is exacerbated by the inability of any of our voters or poll-workers to successfully validate the printed ballot on the XL.
- Voters marking choices manually, with no straight party selection, were *always* clear what was selected and deselected.

Why this is a problem

The system relies on voters both perceiving the change in selections and understanding why those changes happened.

The effect is that the voting system appears to act in inconsistent ways, forcing voters into time-consuming problem-solving that takes them away from their primary task of voting.

Depending on how easily they can use the technology or how confused they are about what is happening, some voters would have to ask for assistance. This is not only a failure to vote independently, but identifying and solving the problem requires revealing their votes to a poll worker or assistant.

This problem affected voters with a variety of disabilities.

Type of disability	Impact of the problem
Cognitive	Seemingly unpredictable and inconsistent machine response can be confusing and frustrating.
Low vision	Changes to selections may be made out of their view because they are made off-screen or because they are not focused on the part of the screen where the change happens.
Low literacy	Voters with low digital or reading literacy also have a narrow range of focus and can miss cues on different parts of the screen
Blind or very low vision	Because the audio does not announce the deselections, changes to candidates higher on the list are not identified unless the voter cycles back through the list. If they don't cycle back, they may never notice the problem.

Recommendations

Legally, the machines must comply with the Pennsylvania Method, but that interaction should happen in ways that fully inform the voter of what has happened, and how to express their preferences.

- Put voters in control and do not allow the system to make any automatic selections or deselections after straight-party voting selections are applied..
- Improve the feedback messages to tell voters what is happening – including number and names of the candidates being deselected.

- Provide feedback on the reason for the changes in selections and the interaction with straight-party choices.

2. Inconsistency in navigation

In both the visual and audio navigation, there were enough small problems of inconsistency or poor instructions to create a cumulative effect. This issue is most serious for voters using the audio ballot without the visual display.

Every participant had at least one problem, despite relatively high election knowledge and digital experience, suggesting that the issue would be more severe for voters without these personal resources to help them understand what it happening.

What happened

Small inconsistencies in the navigation patterns or the audio instructions forced participants to stop and figure out what was wrong or how to do something.

Many of these small issues caused them to need to ask for assistance – easy to do in the examination, but much harder in a polling place.

In some cases, their attempts to guess at a solution caused even more problems.

Example: reviewing and correcting a write-in

An example of this cascading of problems occurred when blind voters tried to write in the name of a candidate. Throughout the system, voters can push the left arrow key to review their previous selection. As a result, two voters used the left arrow to try to review what they'd typed in a write-in. When they pushed the key, they exited the write-in screen and lost the characters they had typed.

This problem was compounded by other challenges of using the tactile keypad for write-ins:

- Using the tactile keypad to enter text is a slow process requiring voters to scan through the alphabet one letter at a time to spell a name.
- When they were not sure of the letters that had been selected, or wanted to check their spelling, they could not find a way to do this.
- All of the participants knew that a misspelled write-in would not be counted, but could not figure out how to review what was typed.
- If they had not listened carefully to the full instructions or had not cycled through all 26 letters, they did not know that there was a backspace key.

Example: Overvote messages

Throughout the system, voters can push the right and up/down arrows to proceed forward. But when the user attempts a selection that would result in an overvote, the error message is shown on a new screen, without audio notification of the change of context. The only way to move forward after the message is using the *left* arrow.

The problem was hardest on people using the audio ballot:

- The instructions on the error message include general instructions for navigating within the contest, so it's not clear that the user must use the left (back) arrow to return to the contest.
- These instructions included using the up and down arrows to move through the contest.
- When voters tried using the arrows immediately a message announced that the up and down arrows did not work here, but then repeated the instructions to use the arrows to deselect a candidate before selecting a new one.

Example: Button labeling

Buttons for different actions in different screens sometimes have the same labels.

- On the XL, the “Cast” button on the review screen prints the ballot for review. The “Cast” button on subsequent screens actually casts ballot into the built-in box.
- The audio narration often doesn’t use the same words as the on-screen buttons. On the XL, it says “print” your ballot instead of “casting it.”

Why this is a problem

People who use assistive technology rely on quickly learning patterns for basic navigation. An example is this comment from a voter: “If it is true to what it did before, I should be able to push the arrow to move to the next issue.”

Breaking these patterns is a usability problem that is amplified for voters using the audio ballot or with cognitive limitations. In both cases, they have fewer resources to perceive and solve the problem.

These problems often happen in the middle of the ballot where assistance could also violate privacy.

Recommendations

Many of these problems were relatively easy to find during the expert review, and confirmed through observing voters.

- Examine all audio instructions on messages to be sure critical information is in an order that puts specific information for the current task or screen before general, repeated instructions.
- No destructive action should ever take place without explicit confirmation from the voter. In the example above, the system could save write-in entry until the voter leaves that contest so that moving back to the contest using the left-arrow is not destructive. It could also warn voters when partially completed write-in entries will be discarded.

Review the visual interface to make sure buttons that do similar things have the same label. Also use key words like “cast” and “print” consistently throughout the system. Better usability testing with voters with a range of

disabilities during system development would have prevented many of these problems.

3. Verification is possible, but challenging

The move to voting systems with paper ballots provides voters with an opportunity to verify their ballot. We wanted to know whether verification can be part of the normal course of voting for voters with disabilities on systems being examined.

What happened

In this examination, we tested systems with two different models for paper handling and verification.

Model 1. Voters can handle the printed ballot

In this model, tested on the ExpressVote, the system ejects the ballot after printing, so it can be cast in the ES&S scanner. This method requires voters to handle the ballot, but also makes it possible for voters to use personal technology such as magnifiers or text readers to read the paper ballot.

- All our participants were able to verify the ballot if they wanted to.
- 2 blind voters tried using personal text readers and were generally successful, though one with more difficulty.
- Voters with vision were able to read the small text with difficulty.

The ballot can be read back to the screen by reinserting it and reviewing (but not changing) selections.

- Some participants tried reviewing their ballots this way and were happy with it.
- 1 blind voter, who had struggled to enter a write-in and wanted to confirm what was on the ballot, found that the actual text of the write-in is not included in the review because it is not encoded in the paper ballot barcodes.

Although we were not able to test with voters with limited dexterity, we believe:

- Most would be able to move the ballot to a stable surface for examination
- The ballot requires some force to remove it from the system. We did not test the amount of force required, but some voters might require assistance.

Model 2. The ballot is presented behind glass

In this model, tested on the ExpressVote XL, the system prints the ballot, displays it under a glass panel, and then casts the ballot by automatically depositing the paper ballot in a container while it records the vote electronically. This means that voters do not have to handle the ballot, but also makes it impossible for voters to use personal technology such as magnifiers or text readers to read the paper ballot.

Some of the participants were surprised that they did not get the ballot back when they pressed "cast." As the ballot went into the XL ballot box, one voter said, "It didn't come out!"

- None of the participants could verify the ballot in the glass cage:
  - Blind voters had no access to the ballot to use personal technology
  - Low vision voters could not position the ballot so they could read the small text
  - Other voters had problems reading the ballot because of glare and because the sides of the ballot were obscured by the cage.
- Although it is possible to have the ballot ejected to handle it while verifying, the procedure is unclear and it requires voters to tell the system they want to "Quit" and call a poll worker.

Why this is a problem

The purpose of accessible voting options is to give people with disabilities the same opportunity to mark, verify and cast their ballot as other voters.

Recommendations

- Require the paper ballot to include an encoding of write-in text so it can be read back when the ballot is reinserted.
- Change the process for ejecting a ballot on the XL (or the auto-cast option on the ExpressVote) so that it can be done independently by the voter.
- Ensure that the systems with an auto-cast capability are set up so that they can work for people with no use of their hands.

All observations

Positives

Function	Observation	System	Severity
Keypads	The layout of the primary navigation keys was familiar to all participants who use tactile controls.	Both	Positives
Audio	The audio running when the voter approaches the system tells them how and where to insert the ballot making it possible for them to start the voting session independently. This included (on the Express Vote) giving instructions to correct the orientation of the ballot	EV	Positives
Audio	Several participants said the synthesized voices are clear and easy to hear, with enough volume.	Both	Positives
Audio	The range of speech speeds provided was adequate, though some of our voters indicated that they would prefer faster speech.	Both	Positives
Display	Blind voters liked the option to hide the visual display or not at any time. (This feature is not available on the XL.)	EV	Positive
Display	The XL screen can be physically adjusted to change the angle of the screen to make it easier to reach or remove glare.	XL	Positive
Audio / Display	One voter favorably compared the option for simultaneous, synchronized audio and visual display to the system she currently uses, where this is not an option. Note: Synchronized audio and video is required in VVSG 1.0+	Both	Positive

Function	Observation	System	Severity
Audio messages	Some of the messages were helpful and elicited comments. For example, after checking a vote by going from the review screen to the contest and then back to the review screen, one participant liked that the audio confirmed what screen it was on.	EV	Positives
Navigation	The “out-and-back” navigation from the review screen to a contest and back was helpful and made it easy to quickly correct a selection.	Both	Positives
Messages	A blind participant liked the message about not having seen all of the candidates in a contest, so that she didn’t miss anyone.	EV	Positives

Ambiguous issues

Function	Observation	System	Severity
Keypads	The XL keypad is used by poll workers to activate the ballot. Even though ballot activation buttons appear on screen, the poll worker has to use the keypad to continue. • The advantage is that every XL system will have a tactile keypad available and working, • The disadvantage is that this means it can be difficult to handle while giving it to a voter. A longer cord would make it easier to hand the keypad to a voter without having to pass it under the screen and around the support structure. There should be easy to reach racks to place the keypad in between uses, rather than balancing it on the top of the base of the machine.	XL	Set up
Keypads	Both systems have an audio jack that is positioned so a voter can easily plug in their own headset and can be found by feel. • On the XL, the jack is on the keypad	Both	Needs assistance

Function	Observation	System	Severity
	• On the EV, it is on the front of the device below the screen However, on both systems: • The labels are black text on a white strip and not tactilely discernable. • The jacks can easily be confused with the similarly labeled jack for the dual switch or other personal technology. A blind advocate participant suggested that a raised headset icon would be an easily recognized symbol to solve this problem		
Messages	Some of the participants thought a screen required them to take action when it didn't • Selecting a party. One poll worker asked if it was possible to vote without a straight party when they reached the straight party screen • The undervote warning screen led several voters to believe that they were forced to vote the full count. They did not listen long enough to know that they could go forward from that screen. • Trying to not vote for anyone, a participant tried putting in a blank write-in. They felt the process seems to be forcing a vote, commenting, "I guess you have to put something."	Both	Problem solving
Keypads	On the XL, voters felt that the keypad was "busy," containing too many keys. While the Braille labels were easily read their positioning was not always clearly related to the controls.	XL	Annoyance
Keypads	On the XL, the buttons may trigger twice, making them too "responsive." Voters with a mild tremor might, for example, move back two contests, not just one. A small latency in the key response coding would prevent this.	XL	Annoyance

Function	Observation	System	Severity
Messages	Both systems gave users a message if they had undervoted as they left a contest. This is a generic message which inserts the name of the contest, but not how many candidates can be or have already been selected. • The message itself was initially confusing, but then easily understood. • Once the message was understood, it quickly became mildly annoying. • The same message is repeated as the voter leaves the review screen. Some of the participants took this as a strong nudge to fully vote in every contest. However, the EV audio does announce when a multi-select contest is "fully voted," which participants who heard this message found helpful.	Both	Annoyance Or Problem solving
Display	We have not done a detailed analysis, but we noticed several places where button labels were not consistent between the two systems. This is not a problem for a voter using just one system, but adds to the complexity of creating voter education and poll worker materials across the state, or for voters who move between counties using different systems.	Both	Annoyance Or Problem solving

Problems

Function	Observation	System	Severity
Display	The EV screen cannot be physically adjusted to change the angle of the screen to make it easier to reach or remove glare. There is a stand on the back of the device, but it is not adjustable.	EV	Potential Show stopper

Function	Observation	System	Severity
Display	The visual cues for the location of the cursor (the indication of what's currently selected) are difficult to interpret, especially for people with low vision. • On the XL, the dotted-line perimeter was not visible at all for participants with low vision and difficult to see for others. • On the EV, using the same background color for the cursor location and selected candidates was confusing. Voters thought the item with focus was selected and would try to deselect it, resulting in the candidate being selected.	Both	Potential Show stopper
Keypads	The labels on the XL tactile keypad are black on black making them almost impossible for anyone to read.	XL	Need assistance
Display	On the XL, the transition between screens was very subtle and participants often changed screens without noticing. Having the contest title in the center of the screen and the contests at the far left added to the problem. A low-vision users said, "I saw some shaded areas here (on the left) but thought that these were from the previous vote. I thought the middle was where I was voting now." (The shaded area is actually the current contest."	XL	Problem solving
Display	In several places, the button labels are inconsistent within a system, especially error messages. These small inconsistencies are magnified for a voter who cannot see the screen, where the position of the button or any icons on them are additional cues.	Both	Annoyance or Problem solving
Keypads	Some of the Braille labels on the EV tactile keypad are abbreviated, making them difficult to	EV	Need assistance

Function	Observation	System	Severity
	understand: “TPO” for Tempo, the label on volume, and “PS” for pause		
Keypads	One participant (P5) was concerned that the controls on the EV tactile keypad are too small for some blind users with limited feeling in their fingers, for example from diabetic-related blindness.	EV	Need assistance
Keypads	Using the XL, a low vision voter tried to follow instructions to press the “square” button. Unfortunately, there are two, and he ended up in the keypad tutorial rather than having pressed select.	XL	Needs assistance or Problem solving
Keypads	The Home key works in different ways, depending on where the cursor is on the screen. • From the list of selections, it goes back to the contest header to begin reading again from the top of the page. • From the contest header, it goes back to the first (straight-party) contest. For the blind voter (the intended user of this button), there is no clear indication of where the cursor is currently located, so it is not possible to predict the action.	Both	Problem-solving
Keypads	There were some concerns about the number of the keys: • [P3] Thought the XL pad has too many keys • [P6] thought the EV pad had too many keys and was too small	Both	Annoyances
Keypads	The “Repeat” key only repeats the last action or audio instruction. Several participants wanted to use this to go back to the top of the contest.	Both	Annoyance
Keypads	There is a key to blank the screen on the [EV] but not the [XL].	EV	Annoyance

Function	Observation	System	Severity
Keypads	The Home button on the EV is used like the Info on the XL, so the label is not helpful.	EV	Annoyance
Keypads	Audio instructions are on the initial screen. If the voter decides that they would like audio after they get to the ballot, the audio is silent until the voter changes selections.	EV	Annoyance
Keypads	There is no feedback when the volume or tempo buttons are pressed. A sound or confirmation (such as “volume up” or “tempo faster”) would be helpful. On the XL, the volume keys announce “Volume up/down.”	EV	Annoyance
Keypads	When the audio is paused, a participant was confused when the audio did not begin again when she navigated to a new contest. “If I move to another candidate or contest, it should start speaking again without having to press Pause again (to restart it)”	EV	Annoyance
Keypads (Audio)	The audio includes instructions for the dual switch and sip-and-puff, even if no device is plugged into the jack. An ideal system would detect input device and adjust the audio to the combination of controls.	Both	Annoyance
Keypads (Audio)	The audio reads all instructions for using the keypads even if the voter is using the touch screen. An ideal system would detect this and adjust the audio to the combination of controls to avoid the lengthy instructions that are not needed.	Both	Annoyance
Ballot Text size	On the XL, selecting “Large Text” changes the screen to a contest-by-contest display, but does not make the text size very much larger. This forces low vision users who simply need slightly larger text into using the audio ballot.	XL	Showstopper

Function	Observation	System	Severity
	One participant with very low vision put his face so close to the screen that he accidentally made selections with his nose.		
Ballot Layout	Reading the judicial retention instructions and the referendum question, the line length is so long that participants had to swivel their head to visually track across a line of text.	XL	Annoyance
Ballot Layout	The layout of the contest on the very wide screen meant that the title of the contest (centered on the screen) and the number of selections was very far from the list of candidates(on the left margin).	XL	Annoyance
Ballot (Audio)	The audio on the XL does not announce the party of each candidate. This made it impossible to complete tasks based on party, including confirming straight party selections. "I'd assume that is the Democrat because I picked them for straight party." [P3]	XL	Show stopper
Ballot (Audio)	If a voter attempted to make too many selections on a vote-for-N-of-M contest (overvote), a message informs them of the problem. It was not clear to blind voters that they were on a separate message screen. The audio on the overvote message includes the general instructions for using the arrow keys, even though these keys are not active on the message. The message about how to return to the contest screen comes after the general instructions, where voters missed it They needed either extensive problems solving or support to get back to the contest.	XL Both?	Needs assistance
Ballot (Audio)	In the audio announcement of each contest, the information about how many can be selected is easy to miss, and the information about how many candidates have already been selected is	Both	Problem solving

Function	Observation	System	Severity
	either missing, or placed at the end of the standard instructions where none of the participants heard it. This is especially important if a straight party option was selected. Changing the order of the instructions would make it easier for blind voters to keep track of their progress		
Ballot (Audio)	After returning to the contest from the overvote message, participants were confused that the last candidate was not selected and had to puzzle their way through the problem	Both	Problem solving
Ballot (Audio)	There is no option to ask the system to spell out a candidate name. • This is not normally a problem, but could make it difficult to distinguish candidates with very similar-sounding names (Smith and Schmidt, for example). • This capability is a standard feature of screen readers, so voters who use that technology may expect it.	Both	Annoyance
Ballot	A candidate endorsed by both parties was only visually identified as being from one of them. The straight party logic, however, selected here for each of the two parties. On the full-face ballot, this was visually confusing because it showed a candidate selected in the "wrong" column.	XL	Problem solving
Ballot (Audio)	Listening to the list of candidates, participants often skipped to the next one as soon as they heard the name, sometimes missing the announcement that the candidate was selected. One voter suggested announcing "You selected" *before* the name of the candidate in these cases.	Both	Annoyance

Function	Observation	System	Severity
Ballot (Audio)	When the voter has reached the last choice, the audio announces this, but pressing the down-arrow does nothing. A participant suggested that it should repeat "Last choice" or "You have heard all of the choices."	XL	Annoyance
Ballot (Straight Party)	Several participants, including poll workers, hesitated at the screen for straight party, wondering if you had to select a party to continue. Better instructions or an option for "No straight party selection" would be helpful	EV XL (large)	Problem solving
Ballot (Straight Party)	The interaction with changing straight party selections was confusing in several ways: • Trying to select just one candidate from a group selected by straight party produced inconsistent results, depending on the exact configuration of the candidates. o If a participant tries to deselect a candidate, it resulted in that candidate being selected and others deselected. o If they tied to select a candidate from another party, all of the straight party selections were deselected, even if the new selection was within the number of options available. • Participants using the audio ballot did not always notice when candidates were deselected, especially if they were higher in the list when the deselection occurred. o When multiple candidates were deselected by this process, only the first was announced on the XL. • Participants using the audio ballot were surprised to hear that other candidates were deselected and only found that out when	Both	Problem solving Or Needs assistance

Function	Observation	System	Severity
	they reviewed the contest or were told they overvoted.		
Ballot (Straight Party)	Not being able to clear all selections on a contest with an available straight party option was very confusing. • One participant described it as having candidates "popping up" and was unable to figure out why this was so. • One participant did not understand why she was not able to deselect a candidate, not understanding that it was related to her straight party selection. • 2 participants created a write-in for "None" as a way of being able to clear all candidates and vote for no one. • When participants deselected all the straight party options, the resulting alert message was very confusing. Several participants did not figure out that the problem was related to straight party voting. o None of the participants wanted to go back, change their straight party choice and recreate their selections to vote for no one, as the message suggested. • On the XL, this would be a show-stopper for someone using the audio ballot because party affiliations were not read out. o One voter described her current voting machine as having a clear way to vote for none on each contest.	Both	Needs assistance Or Show stopper
Write-in	When trying to enter a write-in, participants paused and had to figure out how to actually select the write-in choice to enter a name, in many cases needing assistance. On the EV, the audio narration does not explain that you must push the select key to enter a write-in.	Both	Needs assistance

Function	Observation	System	Severity
Write-in	One participant did not see where the candidate name was written on the contest screen.	XL	Needs assistance
Write-in (Audio)	Using the tactile keypad and audio, it was not clear how to correct a misspelling because participants did not realize that there were keys for space, backspace and so on. The initial audio instructions don't mention the backspace and space keys.	Both	Needs assistance
Write-in (Audio)	The Info (XL) or Home (EV) button makes the system read what's been entered, but no participants found this even though they wanted it.	Both	Needs assistance
Write-in (Audio + Visual)	When returning to the write-in screen with an entry already made, there is no indication of where the cursor is placed, that is, where the next character will be entered.	Both	Needs assistance
Write-in (Audio)	Participants struggled to find the "Space" button (located after punctuation and backspace buttons in the scanning sequence).	Both	Problem solving
Write-in	On the ExpressVote, the buttons for leaving the write-in are visually opposite to the location of the keys on the keypads: • Accept: left on screen, right on keys • Cancel: right on screen, left on keys	EV	Annoyance
Write-in (Audio)	Participants struggled to find the backspace button to erase a letter. One tried using the left arrow, which took her back to the contest, and destroyed all the text she had already typed.	Both	Problem solving or Show stopper
Review screen	The judicial retention and ballot measures had uninformative headings: • The judicial retention contest did not list the name of the judge to be retained. • The ballot measure did not have a short identifier or title, nor show the full text.	Both	Problem solving

Function	Observation	System	Severity
Review screen	A participant with a cognitive disability was initially confused by the review screen. She had never seen something like this. But after looking at it, was able to explain it reasonably well.	XL	Problem solving
Review screen	Using the audio ballot, a participant went back to the contest to check who she had voted for in a contest, even though it was displayed (and read) on the review screen itself.	EV	Annoyance
Review screen	When voter returns to ballot measure from the review screen to change or confirm a vote, they are always returned to the top measure of the review screen, and have to "down arrow" through the ballot to get back to where they were. Participants assumed they would be returned to the ballot measure they had departed from.	XL	Annoyance
Review screen	Participants were surprised to get a message about undervoted contests after completing the review screen. For some, it made it feel that they were required to completely vote all contests.	Both	Annoyance Or Problem solving
Print, verify, cast	If you eject the ballot and then reinsert it to verify what has been printed, the content of the write-in is lost, because the text entered is not encoded in a barcode, and the system is not reading the text through OCR. • This means that it is not possible for a blind or low-vision voter to completely verify their ballot using just the voting system. • Two participants tried reading the ballot using personal technology. The one who used this technology found it easy. The other struggled, but was successful.	Both	Show stopper

Function	Observation	System	Severity
Print, verify, cast	Voters used to the Danaher Shouptronics expected to find a "Vote" button available to them at any time. • Using the XL in full-face mode means that there is no navigation between screens, so that there is a button to print and cast the ballot always available. • This is an issue that will require voter education.	EV	Problem solving
Print, verify, cast	On the XL, blind participants were not sure what was happening during the printing process. • They understood that something would print. • They heard the printer. • But they did not know where the ballot was or what to do next.	XL	Problem solving
Print, verify, cast	On the XL, it was not clear how to get to the print button. At this point in the process, participants wanted clarity and accuracy. • One participant thought the down arrow should get to the print button, but the correct control is the right arrow.	XL	Problem solving or Needs assistance
Print, verify, cast	On the XL, it was not clear how participants could get their ballot back so they could verify it. This concern was raised even when the XL was the first or only system they used, so it is not simply a comparison to the EV. • The process to review the printed ballot requires that the ballot be "cancelled" to eject it from the machine. It can then be read back in after verification, but there is no audio (or onscreen) description of this process. • One participant thought "Quit" was how to say she was done voting.	XL	Problem solving or Needs assistance Or Show stopper

Function	Observation	System	Severity
	• Another could not figure it out, and ended up casting their ballot without verifying. • There is no indication in the audio that this is an option for blind or low vision voters who don't want to "cancel" their ballot, but just review it manually.		
Print, verify, cast	None of the participants were able to verify their paper ballot on the XL. • The ballot is partially obscured by the cover. • The ballot is behind glass making it harder to see. • The text is too small. • Several participants never saw the ballot to verify.	XL	Show stopper
Print, verify, cast	On the ExpressVote, most participants simply followed the instructions to complete the printing and verifying process, but a few were confused because it wasn't clear that the ballot would be returned to them.	EV	Problem solving
Scanner	There are no audio instructions to help a blind or low-vision voter insert and cast their ballot	DS200	Needs assistance
Scanner	There is no way for a blind or low vision voter to read any of the messages on the scanner. This is a low-frequency problem when using the EV because there are no overvotes possible on the ballot, and the scanner was programmed to ignore undervotes. However, it is possible to cast a blank ballot.	DS200	Needs assistance
Scanner	There is no audio equivalent to the final screen to communicate that the ballot has been cast. Blind participants heard the ballot drop into the box, but in a noisy polling place or when there is a pile of ballots already in the box this sound would not be available.	DS200	Needs assistance

Recommendations for deployment

The participants – and examiners – saw the systems being tested for the first time during the examination. Many voters will also try using a new system for the first time in the voting booth, so our test was realistic for Pennsylvania voters.

The problems we encountered also suggest ideas for how election officials can support voters and poll workers as they introduce the new system and design their processes and procedures.

The recommendations here are based on observations of how both poll workers and voters used the system and direct suggestions they made.

Advance training and hands-on practice

The need for an introduction and a chance to try out the system before Election Day was the strongest recommendation from every poll worker participant. As an election judge said, when we asked what he would tell his poll workers, "Go to the training!"

Poll workers felt strongly that any new system – particularly these digital interfaces – would be intimidating to voters and fellow poll workers who were not used to computers. They recommended:

- Longer training sessions for poll workers to give them more time to familiarize themselves with a new system.
- Opportunities for hands-on experience, including scenarios for different situations they might have to handle.
- An aggressive voter education program to give voters a chance to try out the new system.
- Outreach to voters with disabilities, including those who regularly vote with assistance to let them know about the capabilities of a new system that might help them.

- Instructions or a practice system in the polling place, especially in districts with many older people.

Training to support voters with disabilities

Poll workers may not be familiar with how to help people with disabilities. Most of the poll worker participants said that they had no blind or disabled voters in their polling places, although one pointed out that the features on these systems might enable their “assisted voters” to try voting independently.

In addition to a good training module on ways to help voters with disabilities, the training should focus on how to give instructions before and during a voting session to avoid compromising the privacy. For example:

- A “what if” troubleshooting guide could include specific questions to ask and prompts that poll workers can use to help a voter with problem solving without looking at the screen.
- Give poll workers guidance on where to stand while supporting voters. For example, standing behind the ExpressVote and facing the voter would make it clear that they are not looking at the screen.
- Using the procedures for initiating a voting session, including the screens to select a language or acknowledge that assistive technology has been activated, to make sure that the voter has found the basic navigation keys on the keypad. On the ExpressVote, there is a screen with a diagram of the keys that the poll worker can review with the voter (reading the instructions to be sure they are consistent and accurate).

Poll worker procedures

Poll workers procedures can also help bridge any information gaps for voters, with instructions embedded in the voting process.

- Tell voters how to insert their ballot: identify the corner notch and the location of the slot, and tell them the ballot is inserted directly into the machine, not just slid forward.
- Remind voters to check both the review screen and their paper ballot before casting.
- Tell voters that if they make a mistake, they can get a new ballot.
- Instruct voters to insert their ballot with the corner notch on the bottom right so others can't see their selections. The ballot can be inserted into the scanner in any orientation.

Support for voters using the tactile keypad or dual switch and audio ballot might include:

- A keypad they can try out before entering the voting booth.
- Instructions for how to use the keypad in both Braille and large print. The illustration on the ExpressVote help screen could be the basis for these instructions.

As a voter approaches the voting station, poll workers can help voters adjust the voting system or attach personal assistive technology:

- Help voters get positioned at the voting system so they can reach all controls. The XL screen can be adjusted to change its angle for a closer approach, adapting to standing or sitting postures, and avoiding glare.
- Provide assistance plugging in personal headsets or switches with verbal instructions or by doing it for the voter.
    - A voter with a disability is likely to know how to plug in their personal headset or switch, but they will not know the location of the jacks on the machine.

- Make sure voters are oriented and know where all parts of the voting system are, including the privacy shields. The ExpressVote includes a dedicated key on the tactile keypad to blank the screen.
- Remind voters how to cast their ballot and how to know when they are done.

Voting booth setup

Voters with disabilities may have assistive technology or personal notes that they need to place within reach. They may also need room to place the printed ballot on a flat surface to use personal technology such as magnifiers or text readers to verify it.

- work well with the printed ballot layout

For the ExpressVote, the path to the scanner should be as easy as possible, ideally a straight line with no obstructions. The path should include ample room to turn a wheelchair if the machine is positioned with the screen facing the wall. The ADA standards suggest a minimum of 60x60 inches for this.

Attachment C – Implementation Attestation

Implementation attestation.pdf

Voting System Implementation Attestation

System Name: _____

County: _____

Date Installed/Upgraded: _____

The below hardware/software was installed and verified on the system implemented:

System Component	Software or Firmware Version	Hardware Version	Model	Comments
Electionware				(Please specify the implementation, single device (desktop/laptop), Client/server
ES&S Event Log Service				
Removable Media Service				
ExpressVote HW 2.1				
ExpressVote Previewer (2.1)				
DS200				
DS450				
DS850				
ExpressVote XL				

ExpressLink				
Toolbox				

Further to the key hardware/software components listed above, any of the COTS software installed on the voting system adheres to the EAC certificate of conformance for the EVS 6030 system. Any ancillary components like switches, ballot boxes, charging carts sold on this contract are EAC certified components of the EVS 6030 electronic voting system. (Attach a list of items sold on this contract.)

ES&S also has validated that the systems have been installed and hardened following the EAC certified system hardening instructions and no software other than the voting system software has been installed on any of the components.

Vendor Representative Signature: _____

Vendor Representative Name: _____ **Title:** _____

Telephone: _____ **Email:** _____

County Representative Signature: _____

County Representative Name: _____ **Title:** _____

Attachment D – Minimum Training Requirements

ES&S must provide training and training materials as set forth below prior to the first use of the voting system in a primary or general election.

a) A demonstration of and training on the setup and operation of the Voting System to the purchasing county's board of elections' members and staff and the county's precinct election officials. Periodic re-training, and training of new personnel, should be considered as part of the training program.

b) A training session on the Voting System's election management system for the purchasing county's board of elections' members and no less than two and no more than six staff members chosen by the board of elections. The training sessions must afford the board members and its staff the opportunity to learn how to setup and program an election, and if applicable design and layout ballots independently of the Supplier's assistance and support.

c) A training session on the following subjects for the purchasing county's board of elections' members and no less than two and no more than six staff members chosen by the board of elections:

i. programming of all voting units and ancillary devices;

ii. tabulating results during the unofficial and official canvass;

iii. ensuring accuracy and integrity of results;

iv. preparing polling places and setting up the system for election day operation;

v. training on accessibility options of the voting system;

vi. election day operating procedures;

vii. auditing procedures;

viii. conducting a recount;

ix. preserving records;

x. printing, designing, and formatting election reports;

xi. troubleshooting common issues;

xii. safeguarding and preventing tampering and unauthorized access to all parts of the Voting System; and

xiii. Post-election care, maintenance and storage of all components, including electronic media.

d) Any and all system manuals necessary to allow a purchasing county to operate the Voting System independently of the Supplier's assistance and support.

e) Training materials for a purchasing county board of elections to use when training its precinct election officials on how to setup, operate, and close down the Voting System on Election Day.

Attachment E – Source Code Escrow Obligations for ES&S

The Supplier must maintain an escrow agreement covering all source codes of the Voting System and/or EPB for a period of ten years from the date of delivery to and acceptance by a purchasing county board of elections. The Pennsylvania Secretary of the Commonwealth shall have the right to access the source codes in escrow. The Supplier must pay all costs associated with 1) placing the codes in escrow; and 2) verifying that the Supplier has placed the codes in escrow (note: the escrow agent conducts this verification and charges a separate fee for this service).

a. Source code. Simultaneously with delivery of the Voting System and/or EPB software to purchasing Members, the Supplier shall deliver a true, accurate and complete copy of all source codes relating to the software to an escrow agent.
b. Escrow. To the extent that Voting System and/or EPB software and/or any perpetually-licensed software include application software or other materials generally licensed by the Supplier, Supplier agrees to place in escrow with an escrow agent copies of the most current version of the source code for the applicable software that is included as a part of the Services, including all updates, improvements, and enhancements thereof from time to time developed by Supplier.
c. Escrow agreement. An escrow agreement must be executed by the parties, with terms acceptable to the Commonwealth prior to deposit of any source code into escrow.
d. Obtaining source code. Supplier agrees that upon the occurrence of any event or circumstance which demonstrates with reasonable certainty the inability or unwillingness of Supplier to fulfill its obligations to Commonwealth under this Contract, Commonwealth shall be able to obtain the source code of the then-current source codes related to Voting Systems software, and/or any Supplier Property placed in escrow from the escrow agent.