COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF STATE

REPORT CONCERNING THE EXAMINATION RESULTS OF DOMINION VOTING SYSTEMS DEMOCRACY SUITE 5.17 WITH IMAGECAST ® X BALLOT MARKING DEVICE (ICX-BMD), IMAGECAST PRECINCT OPTICAL SCANNER (ICP), IMAGECAST PRECINCT 2 OPTICAL SCANNER (ICP2), IMAGECAST CENTRAL STATION (ICC), AND DEMOCRACY SUITE EMS (EMS)



Issued By:

Al Schmidt Secretary of the Commonwealth August 7, 2024

EXAMINATION RESULTS OF DOMINION VOTING SYSTEMS DEMOCRACY SUITE 5.17 WITH IMAGECAST ® X BALLOT MARKING DEVICE (ICX-BMD), IMAGECAST PRECINCT OPTICAL SCANNER (ICP), IMAGECAST PRECINCT 2 OPTICAL SCANNER (ICP2), IMAGECAST CENTRAL STATION (ICC), AND DEMOCRACY SUITE ELECTION MANAGEMENT SYSTEM (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 his opinion, the electronic voting system can be safely used by voters and meets all applicable requirements of the Election Code.

Upon the request of Dominion Voting Systems Inc. (Dominion), the Department of State's Bureau of Elections (Department) scheduled an examination of the Democracy Suite 5.17 voting system for January 16, 2024. The voting system presented for certification in Pennsylvania included the Democracy Suite Election Management System (EMS) election management software used in conjunction with the following components:

- ImageCast X (ICX) Ballot Marking Device (BMD), a ballot marking device with Commercial off-the-shelf (COTS) printer;
- ImageCast Precinct Scanner (ICP), a precinct optical scan ballot tabulator that scans, validates, and tabulates hand-marked paper ballots and ballots produced on the ICX ballot marking device;
- ImageCast Precinct 2 Scanner (ICP2), a precinct optical scan ballot tabulator that scans, validates, and tabulates hand-marked paper ballots and ballots produced on the BMD; and,
- 4) ImageCast Central Station (ICC), a ballot scanning and tabulating system that can be configured with COTS high-speed Canon scanners for central count tabulation.

The 5.17 release of Democracy Suite included security updates, an additional precinct

scanner capable of tabulating ballots at higher speeds (ICP2), and ICX enhancements to allow for the printing of uniform ballots that appear similar to hand marked paper ballots.

The Secretary appointed SLI Global Solutions (SLI) as professional consultants to conduct the examination. The examination process included a public demonstration, functional examination, and security testing. Department consulted with accessibility examiner Whitney Quesenbery to discuss pertinent changes to accessibility from the previously certified releases, considering the minimal changes to form factor or accessibility.

The functional examination was performed in Room 114A of the Commonwealth Keystone Building, 400 North Street, Harrisburg, Pennsylvania. Mike Santos, Voting System Test Lab (VSTL) Director, Benjamin Robertson, Senior Test Engineer, and Michael Harvey, Test Engineer II, (Functional Examiners) of SLI Global Solutions, conducted the functional examination of the system pursuant to Section 1105-A(a) of the Election Code, 25 P.S. § 3031.5(a). The examinations commenced on January 16, 2024, and lasted approximately three days.

In attendance during the examination were the following additional persons:

- Sindhu Ramachandran, Chief of the Division of Election Security and Technology, representing the Secretary of the Commonwealth;
- Casey Brady, Voting Systems Analyst, representing the Secretary of the Commonwealth;
- Robert Giles, VP of Certification and Compliance, representing Dominion Voting Systems;
- Frank Dutton, PA Customer Success Manager, representing Dominion Voting Systems;
- Mark Bekstrand, PA Sales Manager, representing Dominion Voting Systems; and,
- Devin Surface, Senior QA Analyst, representing Dominion Voting Systems.

Additional staff members from the Department also attended the examination. The functional examination was open to the public and the public demonstration portion of the examination was recorded by Commonwealth Media Services staff and placed on the Department's website (https://www.pa.gov/en/agencies/dos/resources/voting-and-elections-

resources/voting-systems.html). Security testing of the Democracy Suite 5.17 system was performed at SLI facilities located at 4720 Independence Street, Wheat Ridge, Colorado. Security testing was completed prior to the functional examination. Mike Santos, VSTL Director, and Jesse Peterson, Security Specialist, at SLI Global Solutions, served as the Security Examiners for the Democracy Suite 5.17 security testing.

II. THE DEMOCRACY SUITE 5.17 VOTING SYSTEM

Democracy Suite 5.17 components considered for use in Pennsylvania provide a paperbased optical scan voting system that provides end-to-end election support; from defining an election to generating final reports. The following is a description of the Democracy Suite 5.17 components summarized from the System Overview section of the Functional Examiner's Test Report (PDV-24004-FTR-03) and the Democracy Suite System Overview document submitted by Dominion as part of the Technical Data Package (TDP).

A. Democracy Suite Election Management System (EMS)

Democracy Suite is an election management system that consists of an interconnected set of applications responsible for all pre-voting activities for defining and managing elections. Included in this are ballot layout, ballot design, and ballot production for all paper and screenbased ballots. All hardware components are unmodified Commercial off-the-Shelf (COTS) that are connected via a wired, closed, and isolated network not connected to any other systems or to the Internet. The election management system (EMS) consists of the following end-user (client) and back-end (server) applications and is used for the following tasks:

- Create and import jurisdiction data;
- lay out, proof, and produce both paper and accessible ballots in supported languages;
- and create and modify other tabulators and ballot marking device products within the Democracy Suite ecosystem;
- Record and/or synthesize audio files for accessible voting; and
- Results tabulation, reporting, and publishing.

Election department staff can design ballots, proof their design (including accessible ballots), lay out and review one or all ballot styles, generate PDFs for ballot-printing companies

and ballot-on-demand printers, and generate the election definition files that program the other components.

B. ImageCast X

The ImageCast X system is an at-polls ballot marking device designed to ensure access for all voters. The ImageCast X solution consists exclusively of COTS available hardware and operating system. Voters are afforded the ability to select their choices independently and privately on the touchscreen, review and correct their selections as necessary, and print a machine-marked ballot that matches their selections. These machine-marked ballots can be scanned by the ImageCast Precinct, ImageCast Precinct 2, or ImageCast Central tabulators.

C. ImageCast Precinct and ImageCast Precinct 2

The ImageCast Precinct (ICP) and ImageCast Precinct 2 (ICP2) are precinct-based ballot scanners that process both hand-marked paper ballots and ballots printed by the ImageCast X accessible marking device. Both are designed to provide ballot scanning, ballot review and tabulation at a polling place.

D. ImageCast Central

The ImageCast Central (ICC) is a high-speed tabulator used for centrally scanning ballots. The ICC is built using COTS available hardware combined with proprietary ballot processing software.

E. Manufacturer Software/Firmware

The **Democracy Suite 5.17** voting system consists of the following software and firmware components:

| Application | Version |
|---------------------------------------|-----------|
| EMS Election Event Designer (EED) | 5.17.17.1 |
| EMS Results Tally and Reporting (RTR) | 5.17.17.1 |
| EMS Application Server | 5.17.17.1 |
| EMS File System Service (FSS) | 5.17.17.1 |
| EMS Audio Studio (AS) | 5.17.17.1 |
| EMS Data Center Manager (DCM) | 5.17.17.1 |

| EMS Election Data Translator (EDT) | 5.17.17.1 |
|------------------------------------|-----------|
| ImageCast Voter Activation (ICVA) | 5.17.17.1 |
| EMS Adjudication | 5.17.17.1 |
| EMS Adjudication Service | 5.17.14.1 |
| Smart Card Helper Service | 5.17.17.1 |
| ImageCast Precinct (ICP) | 5.17.15.3 |
| ImageCast Precinct 2 (ICP2) | 5.17.15.1 |
| ImageCast Central (ICC) | 5.17.15.1 |
| ImageCast X (ICX) | 5.17.17.1 |

F. COTS Software/Firmware

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

G. Hardware

Please refer to Attachment A of this report for the EAC certification scope document, which lists all software and hardware components of the EAC certified system.

III. EXAMINATION APPROACH, PROCEDURES AND RESULTS

A. Examination Approach

To ascertain whether Democracy Suite 5.17 can be safely used by voters at elections in the Commonwealth and whether it meets all the requirements of the Code, the Examiner developed test protocols for the examination. The Examination was broadly divided into three categories; a Functional Examination, Security Testing, and an Accessibility Examination.

B. Functional Examination

The test protocols separated the requirements of Article XI-A of the Code, Sections 1101-A to 1122-A, 25 P.S. §§ 3031.1 - 3031.22, into six main areas of test execution:

- 1) Source Code Review
- 2) Documentation Review

- 3) System Level Testing
- 4) Security Analysis
- 5) Privacy Analysis
- 6) Usability Analysis

<u>Source Code Review</u> was performed by the Functional Examiner prior to the date of the functional examination to probe for any vulnerabilities found that would warrant additional scrutiny during the security examination.

<u>Documentation Review</u> was performed to verify that Democracy Suite 5.17 is in compliance with all pertinent portions of the Pennsylvania Election Code. During the documentation review, the Functional Examiner confirmed the system to be compliant with the following requirements of the Pennsylvania Election Code:

- Section 1105-A(a), 25 P.S. § 3031.5(a), requiring that an electronic voting system has been examined and approved by a federally recognized ITA (Independent Testing Authority);
- Section 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;
- Section 1107-A(13), 25 P.S. § 3031.7(13), requiring an electronic voting system to correctly tabulate every vote;
- Section 1107-A(14), 25 P.S. § 3031.7(14), requiring an electronic voting system to be safely transportable; and
- Section 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.

System Level Testing was divided into two separate sub-tests; one for a primary election and a general election. Each election sub-test began with creating an election definition in the Election Management Software, and then creating all election media needed to populate all tabulators and ballot marking devices to be used in each election. Ballots were marked by hand and through use of the ImageCast X ballot marking device, and tabulated on the ImageCast Precinct, ImageCast Precinct 2, and ImageCast Central. The results reports were validated against the expected results of the voted ballots. All components of Democracy Suite 5.17 were tested to verify compliance with all pertinent requirements of the Pennsylvania Election Code. The test cases were developed to evaluate the system's compliance with the following provisions of the Election Code:

- Section 1101-A, 25 P.S. § 3031.1, requiring an electronic voting system to provide for a permanent physical record of all votes cast;
- Section 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;
- Section 1107-A(4), 25 P.S. § 3031.7(4), requiring an electronic voting system to permit a voter to vote for candidates of all different parties, and write-in candidates;
- Section 1107-A(5), 25 P.S. § 3031.7(5), requiring an electronic voting system to permit a voter to enter write-in votes;
- Section 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 prevents a voter from casting votes the voter is not entitled to vote on;
- Section 1107-A(7), 25 P.S. § 3031.7(7), requiring an electronic voting system to prevent over-votes;
- Section 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;
- Section 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 prevents them from voting in other parties' primaries, while also permitting voters to vote for any nonpartisan nomination or ballot question they are qualified to vote on; and
- Section 1107-A(10), 25 P.S. § 3031.7(10), requiring an electronic voting system that registers votes electronically to permit voters to change their votes up until taking the final step to register the vote, and for systems that use paper ballots or ballot cards, permits a voter to get a new ballot in the case of a spoiled ballot, and to mark and cancel the spoiled ballot;
- Parts of Section 1107-A(16), 25 P.S. § 3031.7(16), requiring an electronic voting

system which provides for district-level tabulation to include (i) a public counter to register how many ballots are submitted to be counted; (iv) will not tabulate an overvote, with an option to notify a voter of an over-vote if used during voting hours; and (v) generates a printed record that counters are set to zero before voting commences; and

Parts of Section 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 at public testing, in addition to the requirements being validated in the documentation review phase by reviewing EAC certification reports.

The collection of test cases for the <u>Security Analysis</u> were used to verify that Democracy Suite 5.17 meets or exceeds applicable security requirements in the Pennsylvania Election Code and the Pennsylvania Voting System Security standard. The test cases incorporate voting system security provisions implemented to counter unauthorized access to, deletion or modification of any data, audit trail data, or modification or elimination of security mechanisms. Vendor documentation was also reviewed to ensure it provided sufficient detail to securely operate the voting system. This testing included review of the security of each individual component of the system as well as review of the system holistically to account for new vulnerabilities that could arise due to interaction between components.

The <u>Privacy Analysis</u> 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. This analysis consisted of documentation review and physical inspection of tabulators and ballot marking devices in a facsimile of a polling place setup to check for adequate visual and audio secrecy of the vote, as well as compliance with anonymity requirements.

The Usability Analysis evaluated the compliance of the voting system with Sections

Section 1107-A(14) and (15), 25 P.S. § 3031.7(14) & (15). The results from the tests were used by the Examiner to supplement his conclusions from the documentation review phase.

C. Security Testing

The Security testing provided a means to assess the required security properties of the voting system under examination and ascertain compliance with PA Election Code requirements, including 25 P.S. §§ 3031.7(11), (12), (16) and (17). The security tests were based on the PA Voting System Security Standard, published as Attachment E to the Directive for Electronic Voting Systems. The Security Examiner conducted tests that covered the following areas of testing - documentation review, design, software security, network capabilities, audit logging, physical security, and penetration testing.

D. Accessibility Examination

The Center for Civic Design (CCD) served as the accessibility examiner. Led by Whitney Quesenberry, it reviewed the changes between the previously certified version and Democracy Suite 5.17 and reviewed the video of the public demonstration portion of the examination to understand the voter facing changes. Ms. Quesenbery also provided her insights which will be included in the Examination Results portion of this report as a supplement to the initial finding from the examination of Democracy Suite 5.5A.

The Department of State, in consultation with the Accessibility Examiner, found that the applicable conclusions taken from the Democracy Suite 5.5A Accessibility Examination can be extended to Democracy Suite 5.17, since there were only minor hardware or software changes to any accessibility features. The only new equipment not included in any Accessibility Examination is the ImageCast Precinct 2 (ICP2), which has the same form factor and voter-facing functionality as the ImageCast Precinct (ICP), only containing upgraded internals for faster scanning and a full-color interface screen. The only change in relation to the ImageCast X (ICX) was the addition of the ability to create uniform ballots that very closely resemble handmarked paper ballots, instead of printing a distinct ballot that uses QR codes readable by the ImageCast Precinct. To this end, the applicable conclusions pertaining to the ICP can also be applied to the ICP2. The Accessibility Examiner reviewed the changes and issued findings which will be included as a supplement to the Democracy Suite 5.5A findings.

The accessibility examination was designed to provide insights about each voting system's usability and accessibility especially for voters with disabilities, as well as how effectively the system could be deployed by poll workers and voters. The Accessibility Examination included a team of three examiners with accessibility, usability, and election process experience, collectively referred as Accessibility Examiner. The examination process was divided into three parts:

- Expert review by the Accessibility Examiner, using scenarios based on personas of people with disabilities from National Institute of Standards and Technology (NIST) and their professional experience.
- Voters with disabilities used the system voting a reasonable length PA ballot and completed a questionnaire about their experience. The Accessibility Examiner observed and made notes.
- Election officials and poll workers tested the accessibility features to evaluate how they would be activated during an election. They commented on the system based on their experience.

The testing team determined the test ballot parameters and constructed a typical PA ballot, with a mix of contest types and variation in the number of candidates to be voted for each contest. The ballot contained 14 contests: 1 straight party contest, 1 vote for a pair (President/Vice President), 7 vote for one, 2 vote for not more than three, 1 vote for not more than five, 1 referendum contest and 1 retention contest. The facilitator instructed voters on the vote selections to be made, so that results could be compared between each session and different examinations.

III. EXAMINATION PROCESS AND PROCEDURES

The procedures and processes used during the examination of Democracy Suite 5.17 are listed in the sections below. The final recommendations contained later in this report are based on combined analyses of the results and applicable conclusions from all examinations.

A. Functional Examination Procedures

The public demonstration and functional examination portions of the testing commenced on January 6, 2024, in Room 114/OA of the Keystone Building at 400 North Street, Harrisburg

PA 17120, adjacent to the Capitol Complex. Members of the public were allowed and encouraged as observers for the duration of the examination, and public notice of the date and time of the examination and the public demonstration was provided in advance on the Department of State website. The execution of all testing tasks took approximately 3 days. The Functional Examiner performed System Level Testing, physical Security/Penetration Testing, and Privacy and Usability Analysis during the examination. The Documentation and Source Code Review portions of the examination were completed prior to the public examination at SLI test lab facilities in Wheat Ridge, Colorado.

Dominion supplied all required equipment, including any software or firmware to be tested during the examination. All software and firmware required to perform the examination was received directly from the Voting System Test Laboratories (VSTL) that tested the voting system during certification through the Election Assistance Commission. All trusted builds of the software and firmware of each device were installed using the appropriate media and methodologies for installation. The hash codes for all components of the system were captured by the Functional Examiner with assistance from a Dominion representative by using the process listed in the manufacturer's Technical Data Package (TDP). 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 or continuing with the System Level Testing portion of the examination.

The Functional Examiner created the election definition using EMS – EED and transport media was created to populate the devices under examination with the election. The polling place was set up using ICP, ICP2 and ICX - BMD. A primary and general election were then run using polling place devices and central scanners. Ballots were tabulated at the polling place using ICP, ICP2 and ICC using Canon ImageFormula DR-G2140 scanners. Results were then tabulated using EMS and validated against expected results.

B. Security Examination Procedures

The Security Testing was done at SLI lab facilities in Wheat Ridge, Colorado. The Security Examiner received the hardware devices from Dominion and the software and firmware were obtained from the Voting System Test Lab (VSTL) which tested the system for EAC certification testing. The Examiner installed the Trusted Build prior to the evaluation using the appropriate media for installation. Security Testing is comprised of a series of test cases which are utilized for verifying that a voting system will correspond to applicable security requirements within the Pennsylvania Election Code and PA Security Standards. The Security Examiner evaluated each component of the Democracy Suite 5.17 system and the system as a whole for interactions between components. These test cases covered areas of documentation review, design, software security, network capabilities, audit logging, physical security of the voting systems.

The requirements associated to each area of testing were applied to the Democracy Suite 5.17 system in the following manner. The Security Examiner reviewed the EAC testing reports of the system and executed tests for a cross section of Voluntary Voting System Guidelines (VVSG) 1.0 requirements to reconfirm compliance. The Security Examiner then designed tests that included in depth verification and validation of reports, audit logs and physical and logical access controls for each of the components of the voting system. The physical security examination included security seals, lock/key combinations, measures for collection of voting in the event of an extended power outage, ballot box and system access points. Tests were done to ensure that election results, media used, reports and audit logs were protected from attempts to decrypt, manipulate, and corrupt election data. The Security Examiner also created a vulnerability assessment and performed penetration testing of the Democracy Suite 5.17 system.

C. Accessibility Examination Procedures

As noted in the examination approach section of this document, the accessibility examination for Democracy Suite 5.17 included an examiner review of the pertinent changes between the previously certified version Democracy Suite 5.5A since a full accessibility examination was done when examining the Democracy Suite 5.5. Details of the accessibility examination done for Democracy Suite 5.5 is listed in the following paragraphs.

The accessibility examination portion for Democracy Suite 5.5 commenced on October 15, 2018, at Room G24A/B of the Commonwealth Capitol Complex - Finance Building. The examination lasted approximately three days followed by a debrief meeting on October 18, 2018, with DOS and CCD to discuss initial findings. The examination included expert review by the Accessibility Examiner, sessions with four poll worker groups, and sessions with six voters with disabilities using different accessible devices for voting. The voter sessions each took

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approximately an hour. The poll worker sessions took approximately one hour to 90 minutes each. Dominion supplied the hardware and supplies for the Accessibility Examination. The equipment was prepared for the examination by loading the required election definition using transport media. This test examined the Dominion Voting ImageCast X (ICX) touch screen ballot marking device with COTS printer HP LaserJet Pro Printer M402dne and the ImageCast Precinct Optical Scanner (ICP).

The typical accessible voting experience involves the voter making selections on the ICX to mark their ballot, printing their ballot using a separate printer, and then scanning their printed ballot on the ICP or ICP2 to cast the ballot. The Accessibility Examiner identified the accessibility features of each component as listed below:

1. ICX accessibility features:

- ADA compliant voting booth.
- Touch screen, in portrait orientation.
- Audio ballot with two voices: a prerendered, tactile keypad instructions voice and a ballot content, text-to-speech voice.
- Tactile keypad with different-shaped, braille encoded buttons.
- Binary input/Dual switch jack (on tactile keypad).
- Audio output jack.
- Dual switch "jellybean" buttons.
- Sip-and-puff device, mountable to the table with adjustable arm.

2. Voter settings:

- Language choice.
- Audio volume and tempo changes.
- Text Size (default, "Big").
- Screen contrast options: color, white background with black text, and black background with white text.
- Screen blank, while using the audio only.

3. The following are the changes to ICX as part of Democracy Suite 5.17 release:

- ICX is capable of producing a uniform ballot that is very similar in appearance to hand-marked paper ballots.
- ICX has added support for Provisional Voting with ICX BMD.
- Number of columns a contest should occupy on the ICX screen is now configurable.
- ICX has added ability for text size selected on the ICX screen to be printed on QR ballot or not.

4. ICP and ICP2 scanner accessibility features

• The ICP and ICP2 scanners have no notable accessibility features.

The machine features listed above are not exhaustive. For more information about Dominion Democracy Suite 5.17, refer to the technical specifications provided by the vendor.

5. Expert Review by Accessibility Examiner

The Accessibility Examiner used the same ballot and instructions to be used for voter and poll worker review, for their expert review, so they would be familiar with the interaction voters would experience.

Sessions with voters

Each voter session took about an hour. They included:

- An opening interview about their previous voting experience and the types of assistive technologies they use in daily life and in voting.
- A very basic orientation to the system with opportunities for voters to ask questions about any assistive technologies available.
- Set-up of the machine using the provided assistive access features based on the needs of the individual voter. Where a blind voter would typically use the provided or personal headset to listen to the audio instructions, the tests used an external speaker so that the testers could inquire about the voters understanding of the instructions.

- Voting a ballot following facilitator-guided voting instructions, and facilitator help only where necessary. Voters were encouraged to give feedback about their experiences, both positive and negative, as they went through the ballot. The Accessibility Examiner and the voters discussed any feedback and questions that occurred during the voting sessions and re-evaluated any findings as necessary.
- A closing interview including a questionnaire about their voting experience and reactions to the system.

Sessions with poll worker groups

Each poll worker session took approximately an hour and a half, depending on the group size and provided the most activity variability. Each session included:

- A brief orientation to the voting systems and the accessibility features, similar to a poll worker training.
- An opportunity for the poll workers to review vendor-provided instructions before trying the system. They marked ballots and experimented with the accessibility features.
- An opportunity for the poll workers to interact with two to three different accessneeds scenarios, depending on the size of the group and available time. Each scenario involved an examiner role-playing as a voter with an unspecified disability. In some scenarios, the voter didn't immediately identify their disability. Since this was not intended to test the poll-worker's ability to determine appropriate accommodations, each simulated voter provided information about the accommodations they needed in general language. This sometimes required the poll worker to ask the voter what additional assistance she or he might need. Then the poll worker activated the necessary accessibility features for the voter. Note: due to lack of time, the final poll worker group did not participate in the examiner role-plays.
- The Accessibility Examiner took notes about aspects of the system that worked well and problems they encountered during all three phases of the examination.

The issues were then categorized based on their impact on a voter's ability to vote independently and privately.

- Positives things that voters mentioned as meeting or exceeding their expectations.
- Annoyances things voters mentioned as problems, but which did not significantly slow their progress in marking their ballot.
- Problem solving instances where voters hesitated and had to figure out how to complete an action or task, but were able to do so on their own, by exploring the system or relying on past experience with technology.
- Needs assistance problems that could only be solved with help, such as instructions or assistance from a poll worker.
- Likely to prevent independent voting for voters with some disabilities- problems that will prevent successful independent and private voting for voters with some disabilities, even with good knowledge about how to use the system and accessibility features.

The Accessibility Examiner then compiled the applicable findings including categorizations from the examination into a report submitted to the Secretary.

IV. EXAMINATION RESULTS

On January 30th, 2024, the Functional Examiner issued his draft report for the testing of Democracy Suite 5.17 with the recommendation that the system was in compliance with all pertinent sections of the Pennsylvania Election Code. The Examiner's report for Democracy Suite 5.17 (Test Report – PDV-24004-FTR-02) included details of the test cases, execution, and successful completion. The following Section contains a summary of all results of the examination as explained in fuller detail in the Examiner's Report.

A. Functional Examination Results

1. Source Code Review

Source Code Review for Democracy Suite 5.17 was performed, in conjunction with the EAC source code review, prior to the public examination to determine if any vulnerability was

found within the source code that would warrant additional examination. The Functional Examiner reported that the code review was completed with no malicious software, cryptographic software, process control or password management vulnerabilities being found. The Examiner concluded that no deficiencies were found during source code review.

2. Documentation Review

The Documentation Review testing performed by the Functional Examiner demonstrated that the Democracy Suite 5.17 meets the relevant requirements of the Pennsylvania Election Code. The Examiner reviewed the "Test Report for EAC 2005 VVSG Certification Testing Dominion Voting Systems Democracy Suite (D-Suite) Version 5.17 Voting System."

Documentation Review was performed to verify that the portions of the Pennsylvania Election Code which reference documentation detail, are sufficiently met by the Dominion Democracy Suite 5.17 documentation. The review of the EAC test reports by the Functional Examiner and the EAC certifications submitted by Dominion 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, as meeting the applicable performance and test standards established by the federal government.

Accuracy testing performed during EAC certification testing provided confirmation of system accuracy to ascertain compliance to Section 1107-A(13) of the Pennsylvania Election Code, 25 P.S. § 3031.7(13).

3. System Level Testing

As referenced in the examination approach, System Level Testing was administered through two separate tests consisting of a closed primary election and general election. The ballots used for testing those elections had contests and ballot layouts consistent with voting variations supported in Pennsylvania.

A closed primary election was run utilizing following equipment: ICX ballot marking device, ICP precinct scanner, ICP2 precinct scanner, ICC central count location high speed scanner using a Canon DR-G2140. All equipment was set up to be analogous to use cases for Pennsylvania elections during Election Day.

The closed primary election consisted of the following parameters: ballot for both

Democratic and Republican parties for each of three precincts. The three precincts consisted of Precinct 1, Precinct 2, and Precinct 3. The Republican ballots for each precinct consisted of 16 contests: 14 partisan contests and 2 referendums, 8 "Vote for One", 1 "Vote for no more than Two", 3 "Vote for no more than Three", 1 "Vote for no more than Four" and 1 "Vote for no more than Fifteen". The Democratic ballots for each precinct consisted of 16 contests: 14 partisan contests and 2 referendums, 8 "Vote for One", 1 "Vote for no more than Fifteen". The Democratic ballots for each precinct consisted of 16 contests: 14 partisan contests and 2 referendums, 8 "Vote for One", 1 "Vote for no more than Two", 3 "Vote for no more than Three", 1 "Vote for no more than Two", 3 "Vote for no more than Three", 1 "Vote for no more than Four" and 1 "Vote for no more than Fifteen". Referendum contests were added to test the generation and computation of non-partisan ballots, which each contained two contests. The Functional Examiner validated compliance of the system to Sections 1101-A and 1107-A(2), (5)-(11), & (13) and 25 P.S. §§ 3031.1, 3031.7(2), (5)-(11), (13), & (16)-(17). All test cases passed without anomalies.

The primary election was conducted in the following manner:

- 1. The Examiner used the Democracy Suite 5.17 Election Event Designer software to create the election definition files for the primary election.
- 2. Media was created to load the election definition files onto the devices that were under examination.
- Paper ballots were manually marked by hand, and uniform and QR code ballots were marked using the ICX ballot marking device.
- 4. All created ballots, including hand marked, ICX BMD (uniform and QR code)), were tabulated using the ICP.
- 5. All created ballots, including hand marked, ICX BMD (uniform and QR code)), were tabulated using the ICP2.
- All created ballots, including hand marked, ICX BMD (uniform and QR code)), were tabulated using the ICC connected to a Canon DR-G2140 COTS scanner.

Each ballot created was tabulated a total of three times. Tabulation results for hand marked and ICX produced ballots (uniform and QR code) from the ICP, ICP2 and ICC, were then processed into the EMS, write-in votes were adjudicated, and reports were generated with results for the election. The result reports for the primary election were confirmed to match the expected results of the voted ballots.

A general election was run utilizing following equipment: ICX ballot marking device,

ICP precinct scanner, ICP2 precinct scanner, ICC central count location high speed scanner using a Canon DR-G2140. All equipment was set up to be analogous to use cases for Pennsylvania elections during Election Day.

The general election consisted of the following parameters: ballots contained candidates for each of four parties: Republican, Democratic, Green, and Libertarians for each of three precincts. The three precincts consisted of Precinct 1, a split Precinct 2 consisting of splits 2A and 2B, and Precinct 3. The ballots for each precinct consisted of 17 contests: 15 partisan contests consisting of 11 "Vote for One", 1 "Vote for no more than Two", 5 "Vote for no more than Three", 1 "Vote for no more than Four" and 1 "Vote for no more than Fifteen". Additionally, there were two referendums on a separate ballot style. The Functional Examiner examined the compliance of the system to Sections 1101-A and 1107-A(2)-(8), (10)-(11) & (13), and 25 P.S. §§ 3031.1, 3031.7(2), (4)-(8), (10)-(11), (13), & (16)-(17). All test cases passed without anomalies.

The general election was conducted in the following manner:

- 1. The Examiner used the Democracy Suite 5.17 Election Event Designer software to create the election definition files for the general election.
- 2. Media was created to load the election definition files onto the devices that were under examination.
- Paper ballots were manually marked by hand, and uniform and QR code ballots were marked using the ICX ballot marking device.
- 4. All created ballots, including hand marked, ICX BMD (uniform and QR code)), were tabulated using the ICP.
- 5. All created ballots, including hand marked, ICX BMD (uniform and QR code)), were tabulated using the ICP2.
- 6. All created ballots, including hand marked, ICX BMD (uniform and QR code)), were tabulated using the ICC connected to a Canon DR-G2140 COTS scanner.

Each ballot created was tabulated a total of three times. Tabulation results for hand marked and ICX produced ballots (uniform and QR code) from the ICP, ICP2 and ICC, were then processed into the EMS, write-in votes were adjudicated, and reports were generated with results for the election. The result reports for the general election were confirmed to match the

expected results of the voted ballots.

4. Security Analysis

The Functional Examiner designed the methodology for security and penetration testing by reviewing each pertinent requirement for this testing individually, and then created test cases to address the requirement either during the course of a documentation review, a functional examination, or both. To verify compliance with 25 P.S. § 3031.7(12), which requires that a voting device "provides acceptable ballot security procedures and impoundment of ballots to prevent tampering with or substitution of any ballots or ballot cards," the following setup was implemented.

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

5. Privacy Analysis

The Functional Examiner reviewed and inspected the privacy aspects of the Democracy Suite 5.17 system to ascertain compliance with Section 1107-A(1) of the Election Code, 25 P.S. § 3031.7(1). The Functional Examiner determined that the components of the system used during the examination comply with 25 P.S. § 3031.7(1) by review of system documentation and physical inspection. Central scanners were physically examined by the 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 any way meaningful to a voter's secrecy of selections being compromised.

6. Usability Analysis

The Functional Examiner determined that Democracy Suite 5.17 successfully demonstrated compliance with the pertinent usability requirements of Sections 1107-A (14) of the Election Code, 25 P.S. § 3031.7(14) & (15), by reviewing appropriate EAC certification

reports and vendor documentation.

The Functional Examiner also noted that the paper ballots will allow recounts as required by Sections 1117-A, 25 P.S. § 3031.17. 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, use and maintenance aspects of a voting system:

After all the testing activities, the examiners and Department concluded that the Democracy Suite 5.17 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.

B. Security Testing Results

During the security testing of Democracy Suite 5.17, a cross section of the VVSG 2005 requirements were re-tested, as part of a due diligence measure to ensure that the EAC certification testing of Democracy Suite 5.17 was comprehensive. These tests included detailed validation and verification of reports and audit logs generated by the system under to verify and validate that all pertinent confidentiality requirements had been met.

An in-depth examination of Election-specific results, media, reports, and audit logs was performed, which included attempts to manipulate, decrypt, and correct election data to change or influence the final results of an election. Alongside this, the central count network for transmissions between tabulation devices, clients, and servers were reviewed in detail for any vulnerability, and the system's cryptographic elements were tested to verify election system file and transmission confidentiality.

During the penetration testing of Democracy Suite 5.17, applicable vendor documentation was reviewed for application of solution as we as recommendations for securing the system as well as setup, deployment, management, and maintenance of the voting system solution. Testing efforts were conducted with an emphasis on bypassing currently in place security mitigation techniques, included circumnavigation of physical security measures. This testing was conducted against election systems that were configured and secured in the same manner that they would be in a live election scenario, with all security seals and relevant locks

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engaged. The inability to simulate actual live situational dependencies including central count and polling place security measures as well as election officials / poll workers reduced the ability to test the system in a fully live environment and identify the effectiveness of vendor recommended security practices.

All initial penetration efforts were performed with attackers having no access to insider information, including usernames/passwords, access codes, advanced networking knowledge, and fully enabled security measures. Recommendations from vendor documentation on security were followed to the best of the Examiner's abilities. All initial penetration attempts against voter facing devices were given reasonable time and effort constraints to simulate actual polling place conditions; attackers were limited on time and what they could carry unobtrusively in their pockets.

Penetration attempts were also performed in scenarios like storage or in transportation where there is potential for extended periods of time for physical manipulation of security measures and included larger varieties of tools, solvent solutions, portable computer devices and disassembly or removal of parts from voting system devices.

The examiner concludes in their Security/Penetration Test report: "Examiner recommends that the system fulfills the security requirements for acceptance. A successful election run with Dominion Voting Systems hardware and software solutions requires a concerted effort between the state and the vendor to provide a robust election infrastructure that allows individual voters to successfully cast their vote. The amount of mitigation controls offered by Dominion Voting Systems gives the ability to substantially reduce the overall attack surface of the system under test. Dominion offers enhanced physical security recommendations and controls, as well as the ability to utilize full disk encryption for all devices and workstations."

The Security/Penetration report included the following caveats for certification:

The jurisdiction must implement and deploy the Dominion Voting Systems D-Suite
 17 voting system utilizing recommendations outlined in the system documentation.
 Including but not limited to:

a. Processes for managing / monitoring of tamper evident seals.

b. Maintaining a chain of custody for electronic voting devices and election materials.

c. Key control of all election equipment and locations where election equipment is stored.

d. Appropriate levels of training for election officials in the setup and running of elections utilizing Dominion Voting Systems voting system solution to maintain election integrity.

e. Verification of devices for certified software installation before, during and after as applicable.

f. Management of Physical infrastructure as able utilizing State / jurisdiction processes and procedures taking into account vendor recommendations where applicable.

g. Full disk encryption is currently implemented and fully functional.

h. Ensuring all Locking mechanisms of all elements of the voting solution are engaged, including workstation case lock mechanisms.

The voting system as tested has sufficient security practices and measures in place to successfully configure and complete an election. The state/jurisdiction is responsible for taking the vendor recommendations into consideration as well as the states voting practices to ensure a secure successful implementation of the electronic voting system.
 Successful use of the Dominion Voting Systems voting platform is reliant upon properly trained election officials, as well as following all processes and procedures set forth by the voting vendor to ensure properly configured and secured equipment for use in a live election environment. The Examiner determine that there are specific areas that require additional attention.

a. Physically securing of the voting devices while in transit, storage, or in use at their respective locations is imperative. Unmonitored physical access to devices may lead to compromise.

b. Processes and procedures involving management, monitoring and verification of Seals, locks/keys, before during and after the election.

c. Verification that all devices are unmodified before, during and after use as applicable.

C. Accessibility Examination Results

The tests included examiner review, and sessions with voters and poll workers. A summary of the test details and findings is discussed in this section.

1. Democracy Suite 5.5A

The Accessibility Examiner conducted a review of Democracy Suite 5.5A system under examination prior to sessions with voters and poll workers. The Accessibility Examination team included both accessibility and usability expertise to ensure background and knowledge of the issues for accessible voting. The Accessibility Examiner had experience working with people with a wide variety of disabilities and their impact on daily life, knowledge of the range and use of assistive technologies that voters with disabilities might rely on for access, experience conducting usability evaluations with voters and strong knowledge of best practices and design principles for digital technology and voting systems. The expert review gave the examiners a chance to make sure they understand how the system and accessibility features works and to note anything they want to watch for during other testing.

Voter Sessions

The following voter population was represented in the test sessions:

- 4 blind from birth.
- 1 late onset blindness.
- 1 dexterity/limited use of hands.
- Age Ranges: 35 thru 70. All but one (a 70-year-old) were in the 35–60-year-old age range.
- Counties: Allegheny, Dauphin, Lebanon, Philadelphia, or York

Voters had a range of voting experiences. The Accessibility Examiner noted that the test population included a limited range of disabilities and the top problems with the ICX and ICP machines largely focused on issues a low or no vision voter would experience.

Poll worker Sessions

Poll workers were invited to come in teams. We had a total of fourteen participants across five sessions, which represented poll workers in Perry and Dauphin counties. The poll worker groups:

- Had between five and twenty-six years of experience.
- Had at least one election judge.
- Were experienced with the Danaher ELECTronic 1242 and the ES&S. iVotronic systems.
- Had mostly limited experience serving voters with disabilities.

Unique facts about the poll worker groups:

- Three poll workers had blind family members.
- One poll worker was blind.
- One poll worker was a retired user interface designer.

The Accessibility Examiner noted that poll workers with a wider range of voting system experience and different sized communities would have provided a better sample size for the test.

The Accessibility Examiner compiled the applicable findings from the examiner review, voter sessions and poll worker sessions into positives, annoyances, problem solving, needs assistance and likely to prevent independent voting for voters with some disabilities. The Accessibility Examiner included recommendations for improving the accessible voting experience with each of the top five accessibility issues identified. The report also included recommendations on how election officials can support voters and poll workers when the new system is fielded. This section presents a summary of the report. Attachment B of this document lists these issues and recommendations in fuller detail and also describes all the observations from the Accessibility Examination.

The Accessibility Examiner noted in the summary section of the report that the Dominion systems are an advance in independence and privacy for Pennsylvania voters with disabilities, and identified several positive aspects of the system including the following:

- Voters could vote privately and independently.
- Access features were easily learned by voters and poll workers, and poll workers reported the features would help their voters.
- Sufficient default text size for all sighted voters and the ability to increase to a larger font, if desired.

- Visual interface is clean and generally intuitive.
- Printed ballots could easily be read by app-based screen readers.

The top five accessibility issues identified by Accessibility Examiner and voters are summarized in the following section. The Department further evaluated each of the applicable findings and recommendations from the Accessibility Examiner and included the fielding recommendations as conditions for certification of the system3. The Department also discussed the applicable findings from the Accessibility testing, specifically the ones that were marked as "Likely to prevent independent voting for voters with some disabilities" to ensure that appropriate fielding recommendations would alleviate the concerns for most voters.

Top 5 Accessibility Issues:

Privacy and independence restrictions -

- Poll workers must create a special voter card and initialize the assistive devices for voters. This means voters have to disclose disabilities to poll workers or poll workers have to guess voter's abilities.
- The large ICX touchscreen and placement inside the voting booth may make it possible for other voters and people in the polling location to see how the voter is voting, unless the county mitigates this risk when configuring the polling place.

Assistive technologies quality, instructions, and feedback -

- For the ICX audio, one voice provides voting instructions and the other announces ballot content. These appeared to use different technologies. Initially, there was a dramatic volume difference between the two, but the vendor was able to correct this problem. The rate of speech is different for the two voices, and the content voice is difficult to understand at very slow or high speeds because of how the audio playback managed the speed.
- The tactile keypad has duplicated buttons and a help button that is not helpful.
- The voting instructions are persistent and repetitive, with poor phrasing that makes it difficult for voters to understand. Lastly, the content of the instructions is too wordy, confusing, and ultimately unhelpful. Voters found it easier to ignore the instructions.

Write-in process

- The write-in process was difficult for the blind voters, and each required some facilitator aid to successfully finish.
- For voters using the audio assistance, there are no instructions to help a voter edit and verify their write-in.

Silent/Hidden selection and deselection

- The implementation of the straight party option made candidate selection and deselection confusing for some voters.
- When candidates overrode their straight party vote in a longer contest, candidates could be deselected off screen and out of the voter's view, without any system alert.
- Overvote protections on the system greys out the remaining options once the maximum number of selections are reached. This may cause the voter using the audio ballot to not hear all of the options in a contest.

Paper ballot handling

- The scanner bed is very shallow and cannot support the entire ballot, and if the ballot is not inserted properly, the scanner will return it to the voter. Since the scanner bed is not full size, the ballot may fall on the floor.
- There are no audible cues to assist blind voters, and the scanner screen is not easy to see.
- Contest alerts used on the paper ballots are not used or worded differently on the touchscreen device.
- The Accessibility Examiner noted that paper ballot is printed on cardstock and can be read by personal assistive devices. It was noted that the system uses a COTS printer for printing the ballots and the voters need not handle blank ballots before making the choices. The implementation reduces the verifiability for voters using assistive devices, since the ballot cannot be reinserted to be "read back". Three out of the five blind voters were able to use app-based print readers to read the ballot back to them.
- There are no audible cues on the ICP to assist blind voters, and the scanner screen is not easy to see.

The Accessibility Examiner noted that both test voters and poll workers stressed the need for a strong education program to introduce the new systems, including opportunities for hands on training or practice as a new system is rolled out. The examination team also stressed the need for well thought out deployment of any new voting machines (recommendations listed in Attachment B) and effective poll worker training.

2. Democracy Suite 5.17

After discussion between the Department and Accessibility Examiner, the determination was made that the applicable findings from the accessibility examination of Democracy Suite 5.5A are still relevant. The Accessibility Examiner deemed the additions of added support for provisional voting on the ImageCast X and configurable contest columns to be beneficial for accessibility and provided details on pitfalls to watch out for when configuring the new features of the ImageCast X for use in an election. Counties must follow the Conditions for Certification to maintain voter accessibility. The Accessibility Examiner's findings for both Democracy Suite 5.5A and 5.17 are both included as Attachment B.

v. **OBSERVATIONS**

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

- 1. Dominion Democracy Suite 5.17 does not support cumulative voting
- 2. The ImageCast X Ballot Marking Device could effectively be used by all voters for a jurisdiction, not restricting their use to only voters using assistive devices.
- **3.** The use of activation cards for voter access will create a lot of components requiring careful tracking and management to ensure chain of custody on Election Day. Creating a large number of cards would make it difficult to keep track of card inventory. If jurisdictions choose to create cards on demand, it will necessitate an additional system at the polling place.
- 4. The ImageCast X BMD uses a COTS printer to print the marked ballots. The printer

settings need to be appropriately adjusted for the printed ballots to be read by the ImageCast Precinct or Central.

The ICX can accommodate 4 to 5 voters using assistive devices or around 19 voters per hour when used as the primary voting system depending on the size of the ballot. The ICP precinct scanner can serve 30 voters per hour depending on the length of the ballot. The ICP2 precinct scanner can serve up to 90 voters per hour depending on the length of the ballot.

All testing of Democracy Suite 5.17 was performed using executables verified by hash validation to be from the EAC Trusted Build, in association with the appropriate hardware version as declared for Democracy Suite 5.17.

System level testing verified that the system as an aggregate is capable of conducting a full election, from creation of the election definition to creation of media used to conduct inperson and central count polling activities, and cumulation and publishing of the election's final results. The following requirements 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 deals with non-functional testing aspects of acquisition, use and maintenance aspects of a voting, that a jurisdiction would be tasked with following: 25 P.S. § 3031.1, 3031.2, 3031.3, 3031.4, 3031.5, 3031.6, 3031.8, 3031.9, 3031.10, 3031.11, 3031.12, 3031.13, 3031.14, 3031.15, 3031.17, 3031.18, 3031.19, 3031.20, 3031.21 and 3031.22.

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

After all testing activities, the examiners and Department concluded that Democracy Suite 5.17 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.

VI. CONDITIONS FOR CERTIFICATION

Based on the results of the examination in January 2024 and the reported findings of the Examiners as set forth in their reports, the Secretary of the Commonwealth certifies Democracy Suite 5.17 for sale and use in Commonwealth elections subject to the following conditions:

The Secretary's certification for Democracy Suite 5.17 is predicated on the EAC final

certification decision dated 3/16/2023. The final EAC certification report is appended to this certification report as Attachment A.

- A. Pennsylvania counties using the Democracy Suite 5.17 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 September 25th, 2023, 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 ICX 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)). The ICX BMD screens have large size and high-resolution displays and are very clear and can be viewed at wide angles without distortion. Jurisdictions must make a note of this while setting up polling places and purchase privacy booths or orient the ICX screen away from the center of the voting area to protect the privacy of the person using it.
- B. Equipment Reporting by jurisdictions. Reported field issues or anomalies that occur in Pennsylvania or elsewhere with any piece of equipment deployed in the Commonwealth of Pennsylvania must be relayed to the Department of State by each jurisdiction using the Democracy Suite 5.17 as laid out in the Directive Regarding the Uniform Reporting of Voting System Malfunctions to the Department of State issued September 22, 2023.
- C. No components of the Democracy Suite 5.17 shall be connected to any modem or network interface, including the Internet, at any time, except when a standalone local area wired network configuration 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 Democracy Suite 5.17, including wireless LAN cards, network adapters, etc. must be uninstalled or disabled prior to delivery or upon delivery of the voting equipment to a County Board of Elections.

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- D. Because Democracy Suite 5.17 is a paper-based system, counties using the Democracy Suite 5.17 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 via a manual count of the voter marked paper ballots exclusively. Counties must include in the sample ballots 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 September 25th, 2023, and any future revisions or directives that may apply to audits of electronic voting systems.
- E. All jurisdictions implementing the Democracy Suite 5.17 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. Jurisdictions must include audio ballots and accessible devices during L&A 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.
- F. Democracy Suite 5.17 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 ICX as an ADA compliant device in configuring a precinct polling place. Jurisdictions must also take into consideration the ICP and ICP2 scanning speed, ballot box and Transport Media capacities on polling place components when deciding on the number of voting booths.
- G. All jurisdictions implementing the Democracy Suite 5.17 must implement administrative safeguards and proper chain of custody to facilitate the safety and

security of electronic systems pursuant to the Guidance on electronic Voting System Preparation and Security, October 2020.

- H. Jurisdictions implementing the Democracy Suite 5.17 with the Central Count Tabulator 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.
- I. All jurisdictions implementing Democracy Suite 5.17 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 to avoid any password compromise. The passwords and permissions management must at a minimum comply to the password requirements outlined in NIST 800-63. This publication can be accessed at https://pages.nist.gov/800-63-3.html.
- J. Jurisdictions implementing Democracy Suite 5.17 must ensure strict adherence to strong physical and administrative controls with respect to servers. It is imperative that root passwords (OS and database) are protected and only given to those in roles with a need to know. Jurisdictions must ensure proper operating system account creation based on roles and limit it to the minimum required access required to perform the assigned responsibility.
- K. All jurisdictions implementing Democracy Suite 5.17 must configure the polling place components of the voting system to notify voters when they attempt to cast overvotes. 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).

- L. All jurisdictions implementing Democracy Suite 5.17 must work with Dominion to ensure that only the certified system configuration is installed on purchase or anytime 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 added as Attachment C to this document.
- M. Dominion must work with the jurisdictions implementing Democracy Suite 5.17 to ensure that the system has been hardened for a secure implementation.
 Jurisdictions must implement processes to ensure that all components of the voting system have been hardened per the instructions in the TDP.
- N. Jurisdictions can make use of the adjudication functionality to adjudicate write-ins and evaluate questionable ballots, contests, or selections to determine voter intent. Any decisions made during review of the ballot must be agreed upon by a team of at least two reviewers authorized by the election official. The election official can also 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.
- O. Jurisdictions implementing Democracy Suite 5.17 must work with Dominion 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.
- P. Jurisdictions using the services of Dominion or a third-party vendor for election preparation activities must work with Dominion or the vendor to ensure that systems used for ballot definition activities are considered part of the voting

system and 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 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.

- Q. Jurisdictions must implement processes and procedures involving management, monitoring and verification of seals, locks/keys, before, during and after the election.
- R. Jurisdictions must not use individual voter access cards for activating the ICX Ballot Marking device. This is to avoid lost, stolen or misplaced cards with the activator chip, which would be a potential vulnerability. Jurisdictions using poll worker cards for ICX activation must ensure that poll workers are trained to maintain strict chain of custody of the activation cards.
- S. Dominion must ensure that any implementations in Pennsylvania counties must appropriately indicate that the ICX BMD is printing the ballot and the final messaging on the ICX must instruct the voter on how to complete the voting process. Any references to "casting the ballot" must not be present. The changes must be done during implementation by Dominion support personnel and verified by county election officials.
- T. Jurisdictions must have appropriate instructions on the ICX BMD to ensure that the voter reviews the entire ballot before printing the ballot.
- U. Jurisdictions must work with Dominion to ensure that the entire audio ballot including audio rates and volumes on the audio ballot are tested before deploying to polling places. Jurisdictions must also ensure that poll worker training includes potential situations and questions from voters using the audio ballot. This is specifically important for Dominion Democracy Suite 5.17. Jurisdictions must note that the general instructions and ballot instructions are configured separately and could have different volume setting and audio rates.

- V. Jurisdictions must work with Dominion during the ballot definition to ensure that voters using assistive devices have clear instructions for the write-in process. The onscreen instructions must be adjusted to have the audio ballot explain the process. The audio instructions must include instructions on how to navigate and find the write-in keyboard.
- W. Jurisdictions must work with Dominion 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:
 - i. The audio ballot must fully inform the voter what has happened on the system and how to select/deselect their choices;
 - ii. The feedback messages must explain to voters what is happening, including the number and names of candidates being deselected; and
 - iii. The audio ballot must provide feedback on the reason for the changes in any selections and the interaction with straight-party choices.
- X. Dominion and jurisdictions must ensure that the COTS printer used for ICX BMD is configured that the printer settings cannot be changed by the voter at the polling place. The configuration must ensure that the printer settings can only be modified by authorized personnel.
- Y. The electronic voting system must be physically secured 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.
- Z. Jurisdictions must implement processes and procedures involving management, monitoring and verification of seals, locks/keys, before, during and after the election.
- AA. 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 Dominion 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 that can be removed by authorized personnel when the port is needed.

- BB. Jurisdictions using standalone installation of the EMS server on portable devices must protect the laptops to prevent lost or stolen device.
- CC. 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 and reported in a timely manner.
- DD. Jurisdictions implementing Democracy Suite 5.17 must ensure that the USB devices and any other removable or transportable media used for election activities is maintained with strict chain of custody. There must be a process to manage the removable/transportable media inventory to avoid misplaced and lost media. The devices must either be replaced or reformated before use in each election. Appropriate steps must be taken to ensure that the format is a full reformat of the USB devices.
- EE. Jurisdictions implementing Democracy Suite 5.17 must work with Dominion to ensure appropriate levels of training for election officials is planned on implementation. Counties must ensure that the trainings adhere to the "Minimum Training Requirements" specified in Attachment D of this document.
- FF. Jurisdictions implementing Democracy Suite 5.17 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 poll worker education to assist voters with disabilities. Refer to Attachment B, listing detailed recommendations for deployment noted by the Accessibility Examiner.
- GG. Jurisdictions implementing Democracy Suite 5.17 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 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.

- The path between ICX and the ICP 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.
- The cords for tactile keypads, headphones and BMD printer need to be placed so that they don't interfere with the printed ballot and the voter's ability to find and take the ballot.

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

- HH. Jurisdictions implementing Democracy Suite 5.17 must ensure that the iButton used for activating administrative access on ICP is managed with strict chain of custody. The iButton pass codes must be modified at a minimum for every election. If an iButton pass code requires change after the initial assignment, appropriate EMS options must be selected to ensure that only the latest assigned iButton pass code is active.
- II. Dominion 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 publicly available social media platform. The videos must have audio instructions and must be closed captioned.
 - i. A video (in an electronic format) for voters that demonstrates how to cast a vote using the Voting System
 - ii. 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.
 - iii. 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.

- iv. A "quick reference guide" with images that demonstrates to voters how to cast 49 a vote. Must be provided in additional languages for any jurisdictions required to meet thresholds in the Voting Rights Act.
- JJ. Dominion must adhere to the following reporting requirements and submit the following to the Secretary:
 - 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;
 - ii. Ownership, Financing, Employees, Hosting Location. Any changes of information on the Dominion'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, Dominion 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 Dominion or a third-party; and
- KK. Dominion must adhere to the "Source Code and Escrow Items Obligations" specified in Attachment E of this document.
- LL. Dominion must work with jurisdictions to ensure that the system is configured to comply with all applicable requirements of PA Election Code delineated in Article XI-A of the Pennsylvania Election Code, sections 1101-A to 1122-A, 25 P.S. §§ 3031.1 – 3031.22.
- MM. Jurisdictions implementing the Democracy Suite 5.17 and Dominion must work together to implement 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. § 3031.5(a)-(b). Dominion must

ensure that future releases of the voting system with enhanced security and accessibility features are presented for approval to the Secretary.

- NN. Dominion must work with counties and Department to ensure that the system can integrate with the Pennsylvania Department of State's Election Night Reporting (ENR) system.
- OO. In addition, pursuant to the Directive Concerning the Use, Implementation and Operation of Electronic Voting Systems by the County Boards of Elections issued on September 25, 2023, and section 1105-A(d) of the Pennsylvania Election Code, 25 P.S. § 3031.5(d), this certification and approval is valid only for Democracy Suite 5.17. If the vendor or a County Board of Elections makes any changes to the Democracy Suite 5.17 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 Democracy Suite 5.17 Voting System in the Commonwealth of Pennsylvania.
- PP. Jurisdictions implementing Democracy Suite 5.17 must review the Secretary's certification report for Democracy Suite 5.5A issued on January 17th, 2019, for a detailed review of the accessibility examination approach, process and procedures and results. The accessibility examination of this release was limited to only an expert review of prior examinations, and any applicable findings from the initial examination remain the same for the Democracy Suite 5.17 voting system.
- QQ. Jurisdictions implementing Democracy Suite 5.17 must ensure that personnel responsible for secure operations of the system components are familiar with the entire technical data package. Security topics are found in different sections of the TDP.
- RR. Jurisdictions implementing Democracy Suite 5.17 should disable the initial ballot preview screen that is presented to voters before they make selections on the ImageCast X to avoid gaps in accessibility related to lack of instructions.

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VII. RECOMMENDATIONS

- A. All jurisdictions implementing Democracy Suite 5.17 should take appropriate steps to ensure that voter education is part of the implementation plan.
- B. All jurisdictions implementing the Democracy Suite 5.17 should ensure that precinct election officials and poll workers receive appropriate training and are comfortable using the system.
- C. All jurisdictions considering purchase of the Democracy Suite 5.17 should review the System Limits as mentioned in the EAC certification scope.
- D. The Secretary recommends that Dominion and counties work with the Department on any changes to their voting equipment including, but not limited to, purchase and upgrades.
- E. Secretary recommends in-house ballot definition activities at county location whenever possible. If an external vendor location is used the county should implement checks and balances to ensure that election data including ballot definition files and audit logs stored on devices outside of the county is protected from unauthorized access.
- F. Secretary recommends configuring the election with only one contest being displayed on each screen presented to the voter on ICX. This is to ensure that all screens presented to the voter are similar and voters don't need to adapt to the situation that there may be multiple contests displayed on a screen.

VIII. CONCLUSION

As a result of the examination, and after consultation with the Department's staff and the Examiners, the Secretary of the Commonwealth concludes that Democracy Suite 5.17 can be safely used by voters at elections as provided in the Pennsylvania Election Code and that it meets all of the requirements set forth in the Code, provided the voting system is implemented with the conditions listed in Section IV of this report. Accordingly, the Secretary certifies Democracy Suite 5.17 for use in this Commonwealth.

IX. Attachment A - EAC Certification Scope





United States Election Assistance Commission

Certificate of Conformance

Dominion Voting Systems Democracy Suite 5.17

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: Democracy Suite

Model or Version: 5.17

Name of VSTL: Pro V&V

EAC Certification Number: DVS-DemSuite5.17

& Ji

VVSG 2005 VER.

CERTIFIED

Steven M. Frid Executive Director

Date Issued: March, 16 2023

Scope of Certification Attached

Manufacturer: System Name: Certificate: Dominion Voting Systems (DVS) Democracy Suite 5.17 DVS-DemSuite5.17 Laboratory: Pro V&V Standard: VVSG 1.0 Date: 3/15/23



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 D-Suite 5.17 Voting System is a paper-based optical scan voting consisting of the following major components: The Election Management System (EMS), the ImageCast Central (ICC), the ImageCast Precinct (ICP and ICP2), the ImageCast Evolution (ICE), and the ImageCast X ballot marking device (BMD). The D-Suite 5.17 Voting System configuration is a modification from the EAC approved D-Suite 5.5-D system configuration.

System Modifications:

The list below includes changes between this Democracy Suite 5.17 system and the baseline of the Democracy Suite 5.5-D Voting System:

GENERAL SYSTEM CHANGES

- System and security updates to Democracy Suite:
 - Upgrade to Windows Server 2019 and SQL Server 2019.
 - New tool for performing automated hardening procedure of all Windows-based components.
 - \circ $\;$ Additional encryption of election databases on ICE, ICP2 and ICX $\;$
 - ICX Smart Card Mutual Authentication and Secure Messaging
- Added support for Provisional Voting with ICX-BMD and QR ballots.
- Added support for ICX BMD to produce a Uniform Ballot.
- Added additional election-specific information to the barcode on paper ballots.
- Added support for Batch and Summary Cards in EED and ICC.
- Added ability in EED to configure the number of columns a contest should occupy on the ICX screen.
- Improved pseudo random number algorithm.
- Added ability to export server certificates for previously imported encrypted projects.

EMS

- System and security updates to the EMS system:
 - Expanding the use of Trusted Certificates
 - Additional Software Encryption of the SQL Database
 - Blocked auto-play for all external media.
- Modified UI for managing tabulators.
- Election Event Designer updates:
 - Added support for creating watermark images for paper ballot header, footer, and stubs.
 - Added information about status of election files in the Tabulator list to indicate whether election media has been programmed or needs to be re-programmed.
 - Improvement to election file generation
- Results Tally & Reporting updates:
 - Updated reporting module.
 - Added option to redact low turnout by precinct and/or counting group from CVR export for Primary elections.

ADJ

- Added an option to prevent adjudicators from adjudicating contests which do not meet selected out-stack conditions for the project.
- New Adjudication Activity Log Report and Export.
- Added ability to perform Database Back-ups and Maintenance Procedure.

ICC

- Add a configuration setting to force save both sides of the ballot for single sided ballots.
- Poll ID field extended from 6 characters in length to 10.
- Added a Status/Interrupt Report
- Update application to support HiPro Firmware version 1.0.1074

ICE

• Ability to display instructional text or contest heading on ICE Screen

ICP2

- Introduced option to specify a different passcode for the Poll Close action.
- Added a warning during poll-closing procedure reminding the Poll Worker to ensure that the Auxiliary Bin is empty.
- Added monitoring of the printer sensor to ensure the printer head is in the correct place.
- Prevented the Calibration Buttons from lighting up after the Poll has opened.

ICX

- System and Security updates to the ICX product:
 - Upgrade to Android version 8.1
 - Obfuscation of Source Code
 - Added tabulator serial number to the result files.
 - Support for Poll Worker and Technician Card expiration date
 - Additional USB models added to list of accepted devices.
- Added support for following BMD Printers:
 - o Avision AP3061
 - o HP M404dn
 - o HP 4001dn
- Ability to choose if the text size selected on the screen is printed on the BMD QR ballot or not.
- Allow Poll Worker to cast a fleeing voter ballot.
- New Firmware version 169 for VVPAT V1 and V1C
- Updates to printed content for VVPAT:
 - Option to not print Total Ballots Cast in report footer.
 - \circ $\;$ Option to print Party information for Primaries.
 - Precinct ID changed to Precinct Name
- Reduced amount of paper used when printing on VVPAT.
- Removed ability to print Zero Report after ballots have been cast in VVPAT BMD mode.

Language capability:

This section provides information describing the languages supported by the various components of the system.

| Language | ICE | ICP | ICP2 | ICX |
|---------------|---------------------|------------|------|-----|
| Alaska Native | Yes, if using Latin | Yes | No | No |
| | alphabet | | | |
| Apache | Audio only | Audio only | No | No |
| Bengali | Yes | Yes | Yes | Yes |
| Chinese | Yes | Yes | Yes | Yes |
| English | Yes | Yes | Yes | Yes |
| Eskimo | Yes, if using Latin | Yes | No | No |
| | alphabet | | | |
| Filipino | Yes, if using Latin | Yes | Yes | No |
| | alphabet | | | |
| French | Yes | Yes | No | Yes |
| Hindi | Yes | Audio only | Yes | Yes |
| Japanese | Yes | Yes | Yes | Yes |
| Jicarilla | Audio only | Audio only | No | No |
| Keres | Audio only | Audio only | No | No |
| Khmer | Yes | Audio only | No | No |
| Korean | Yes | Yes | Yes | Yes |
| Navajo | Audio only | Audio only | No | No |
| Seminole | Audio only | Audio only | No | No |
| Spanish | Yes | Yes | Yes | Yes |
| Tagalog | No | No | No | Yes |
| Thai | Yes | Audio only | Yes | Yes |
| Тоwa | Audio only | Audio only | No | No |
| Ute | Audio only | Audio only | No | No |
| Vietnamese | Yes | Yes | Yes | Yes |
| Yuman | Audio only | Audio only | No | No |



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 | Operating System or COTS | Comments |
|---------------------------------------|---------------------------------|--------------------------|----------|
| EMS Election Event Designer (EED) | 5.17.17.1 | Windows 10 Pro | EMS |
| EMS Results Tally and Reporting (RTR) | 5.17.17.1 | Windows 10 Pro | EMS |
| EMS Application Server | 5.17.17.1 | Windows Server 19 | EMS |
| | | Windows 10 Pro | |
| EMS File System Service (FSS) | 5.17.17.1 | Window 10 Pro | EMS |
| EMS Audio Studio (AS) | 5.17.17.1 | Windows 10 Pro | EMS |
| EMS Data Center Manager (DCM) | 5.17.17.1 | Windows Server 19 | EMS |
| | | Windows 10 Pro | |
| EMS Election Data Translator (EDT) | 5.17.17.1 | Windows 10 Pro | EMS |
| ImageCast Voter Activation (ICVA) | 5.17.17.1 | Windows 10 Pro | EMS |
| EMS Adjudication (ADJ) | 5.17.14.1 | Windows 10 Pro | EMS |
| File System Server | 5.17.17.1 | Windows Server 19 | EMS |
| | | Windows 10 Pro | |
| Database Server | 5.17.17.1 | Windows Server 19 | EMS |
| | | Windows 10 Pro | |
| EMS Logger | 5.17.17.1 | Windows Server 19 | EMS |
| | | Windows 10 Pro | |
| NAS Server | 5.17.17.1 | Windows Server 19 | EMS |
| | | Windows 10 Pro | |
| EMS Adjudication Services | 5.17.14.1 | Windows Server 19 | EMS |
| | | Windows 10 Pro | |
| Smart Card Helper Service (SCHS) | 5.17.17.1 | Windows 10 Pro | EMS |
| Election Firmware | 5.17.15.3 | uClinux | ICP |
| ICP2 Application | 5.17.15.1 | Linux | ICP2 |
| ICE Application | 5.17.15.1 | Ubuntu Linux | ICE |
| ImageCast Central Application | 5.17.15.1 | Windows 10 Pro | ICC |
| ICX Application | 5.17.17.1 | Android 8.1.0-2.2.4 | ICX |

Voting System Software Components:

Voting System Platform:

| System Component | Version | Operating System or COTS | Comments |
|---------------------------|-----------------|-----------------------------|----------------------|
| Microsoft Windows Server | 2019 | Unmodified COTS | EMS Server SW |
| | | | Component |
| Microsoft Windows | 10 Professional | Unmodified COTS | EMS Client/Server SW |
| | | | Component |
| .NET Framework | 3.5 | Unmodified COTS | EMS Client/Server SW |
| | | | Component |
| .NET Framework | 4.8 | Unmodified COTS | EMS Client/Server SW |
| | | | Component |
| Microsoft Visual C++ 2015 | 2015 | Unmodified COTS | EMS Client/Server SW |
| Redistributable | | | Component |
| Microsoft Visual C++ 2013 | 2013 | Unmodified COTS | EMS Client/Server SW |
| Redistributable | | | Component |

| System Component | Version | Operating System or COTS | Comments |
|----------------------------------|------------------------|-----------------------------|-----------------------|
| Java SE Runtime Environment | 6.0 Update 20 or later | Unmodified COTS | EMS Client/Server SW |
| Microsoft SOL Server 2019 | 2010 Standard SP2 | Linmodified COTS | EMS Client/Sonver SW/ |
| Standard SP2 | 2019 Standard 3F2 | onnouned CO13 | Component |
| Microsoft SOL Server 2019 | 2019 Express | Unmodified COTS | EMS Client/Server SW/ |
| Express with Advanced Services | 2019 Express | onnouned cors | Component |
| Censtral Voices | 623 | Unmodified COTS | EMS Client/Server SW |
| cepstral voices | 0.2.5 | onnouned cors | Component |
| Arial Narrow Fonts | 2 37a | Linmodified COTS | EMS Client/Server SW |
| | 2.374 | onniounicu cons | Component |
| Dallas 1-Wire Device Driver | 4 05 | Unmodified COTS | EMS Client/Server SW |
| | 4.05 | onnounce cors | Component |
| Adobe Reader DC | AcrobatDC | Unmodified COTS | EMS Client/Server SW |
| Adobe Redder De | A CIOBALD C | onniounicu cons | Component |
| Microsoft Access Database Engine | 2010 | Unmodified COTS | EMS Client/Server SW |
| | | | Component |
| Open XML SDK 2.0 for Microsoft | 2.0 | Unmodified COTS | EMS Client/Server SW |
| Office | | | Component |
| Infragistics NetAdvantage Win | 2011Vol. 1 | Unmodified COTS | EMS SW Platform |
| Forms | | enniounicu coro | |
| Infragistics NetAdvantage Win | 2013 Vol. 1 | Unmodified COTS | EMS SW Platform |
| Ultimate | | | |
| Infragistics NetAdvantage WPF | 2012 Vol. 1 | Unmodified COTS | EMS SW Platform |
| TX Text Control Library for .NET | 16.0 | Unmodified COTS | EMS SW Platform |
| SOX | 14.3.1 | Unmodified COTS | EMS SW Platform |
| NLog | 1.0.0.505 | Unmodified COTS | EMS SW Platform |
| iTextSharp | 5.0.5 | Unmodified COTS | EMS SW Platform |
| CLR Security | 2.3 | Unmodified COTS | EMS SW Platform |
| ICSharpCode SharpZipLib | 0.86.0 | Unmodified COTS | EMS SW Platform |
| ISONewspaper | 30.4 | Unmodified COTS | EMS SW Platform |
| OpenSSL | 1.0.2K | Unmodified COTS | EMS SW Platform |
| OpenSSL FIPS Object Module | 2.0.14 | Unmodified COTS | EMS SW Platform |
| SQLite | 1.0.116 | Unmodified COTS | EMS SW Platform |
| Lame | 3.99.4 | Unmodified COTS | EMS SW Platform |
| Speex | 1.0.4 | Unmodified COTS | EMS SW Platform |
| Ghostscript | 9.54 | Unmodified COTS | EMS SW Platform |
| One Wire API for .NET | 4.0.2.0 | Unmodified COTS | EMS SW Platform |
| Microsoft Expression Drawing; | 3.0.0 | Unmodified COTS | EMS SW Platform |
| MS Prism | 4.0.0 | Unmodified COTS | EMS SW Platform |
| MS Prism Unity Extensions | 4.0.0 | Unmodified COTS | EMS SW Platform |
| MS Build Community Tasks | 1.4 | Unmodified COTS | EMS SW Platform |
| MS Build Extension Pack | 4.0.8.0 | Unmodified COTS | EMS SW Platform |
| Enterprise Library | 5.0 | Unmodified COTS | EMS SW Platform |
| Entity Framework | 6.1.3 | Unmodified COTS | EMS SW Platform |
| NASM Assembler | 2.12.02 | Unmodified COTS | EMS SW Platform |
| newtonsoft.ison | 13.01 | Unmodified COTS | EMS SW Platform |
| Nlog | 1.0.0.505 | Unmodified COTS | EMS SW Platform |
| Ogg Vorbis decoder - oggdec | 1.10.1 | Unmodified COTS | EMS SW Platform |
| Ogg Vorbis encoder - oggenc2 | 2.88 | Unmodified COTS | EMS SW Platform |
| PDFPrintingNet | 4820 | Unmodified COTS | EMS SW Platform |
| Prism Myym | 1 1 1 | | EMC CM/ Dlatform |
| 1 113111.1010 0111 | 1.1.1 | onnouned CO13 | EIVIS SVV Platform |

| System Component | Version | Operating System or COTS | Comments |
|----------------------------------|---------------------------|-----------------------------|-----------------|
| Sox | 14.3.1 | Unmodified COTS | EMS SW Platform |
| SQLSysClrTypes.msi | Microsoft System CLR | Unmodified COTS | EMS SW Platform |
| | Types for SQL Server 2014 | | |
| SSH.Net | 2014.4.6.Beta2 | Unmodified COTS | EMS SW Platform |
| Strawberry Perl | 5.24.1.1 | Unmodified COTS | EMS SW Platform |
| System Windows.Interactivity. | 2.0.20525 | Unmodified COTS | EMS SW Platform |
| WPF | | | |
| Toggle Switch Control Library | 1.1.1 | Unmodified COTS | EMS SW Platform |
| TreeViewEx | 0.1.0.0 | Unmodified COTS | EMS SW Platform |
| twaindsm-2.3.0.win.bin.zip | 2.3.0 | Unmodified COTS | EMS SW Platform |
| TX Text Control 16.0.NET | 16.0 | Unmodified COTS | EMS SW Platform |
| Visual Studio 2019 Professional | 2019 Professional | Unmodified COTS | EMS SW Platform |
| Wix | 3.11 | Unmodified COTS | EMS SW Platform |
| Wix toolset Visual Studio | 3.11.2 | Unmodified COTS | EMS SW Platform |
| Extension | | - | |
| Spreadsheetlight | 3.4.3 | Unmodified COTS | EMS SW Platform |
| Open SSL | 1.0.2K | Unmodified COTS | ICP |
| OpenSSL FIPS Object Module | 2.0.10 | Unmodified COTS | ICP |
| Colilo | 200400221 | Unmodified COTS | ICP |
| uClinux tools | 20040603 | Unmodified COTS | ІСР |
| | 20070130 | Modified COTS | ІСР |
| Kernel (Linux) | 2.6.30.9-dvs-36 | Modified COTS | ICE |
| U-Boot | 1.3.4 | Modified COTS | ICE |
| BusyBox | 1.20.2 | Unmodified COTS | ICE |
| e2fsprogs | 1.42.4 | Unmodified COTS | ICE |
| Expat XML Parser | 2.1.0 | Unmodified COTS | ICE |
| Fontconfig | 2.9.0 | Unmodified COTS | ICE |
| Freetype | 2.4.9 | Unmodified COTS | ICE |
| I ² C Tools for Linux | 3.1.0 | Unmodified COTS | ICE |
| JPEG library | 8d | Unmodified COTS | ICE |
| libogg | 1.3.0 | Unmodified COTS | ICE |
| libPNG | 1.5.10 | Unmodified COTS | ICE |
| libusb | 1.0.8 | Unmodified COTS | ICE |
| libusb-compat | 0.1.3 | Unmodified COTS | ICE |
| openssl | 1.0.2k | Unmodified COTS | ICE |
| openssl-fips | 2.0.10 | Unmodified COTS | ICE |
| PPP | 2.4.5 | Unmodified COTS | ICE |
| quazip | 0.7.6 | Unmodified COTS | ICE |
| Qt Everywhere Linux | 4.7.3 | Unmodified COTS | ICE |
| skell | 1.19 | Unmodified COTS | ICE |
| SoundTouch | 1.6.0 | Unmodified COTS | ICE |
| speex | 1.2rc1 | Unmodified COTS | ICE |
| SQLite | 3.7.13 | Unmodified COTS | ICE |
| Sysfs Utilities | 2.1.0 | Unmodified COTS | ICE |
| TIFF library | 4.0.1 | Unmodified COTS | ICE |
| timezone | 2012b | Unmodified COTS | ICE |
| USB ModeSwitch | 1.2.4 | Unmodified COTS | ICE |
| zlib | 1.2.7 | Unmodified COTS | ICE |
| Kernel | 4.9.11 | Modified COTS | ICP2 |
| U-Boot | 2017.03 | Modified COTS | ICP2 |

| System Component | Version | Operating System or COTS | Comments |
|--|--------------------------------|-----------------------------|-----------------------------------|
| Logback | 1.1.1-12 | Unmodified COTS | ICX SW |
| Speex | 1.2rc1 | Unmodified COTS | ICX SW |
| GreenDAO | 2.2.1 | Unmodified COTS | ICX SW |
| GSON | 2.8.4 | Unmodified COTS | ICX SW |
| Zxing Core | 3.4.0 | Modified COTS | ICX SW |
| SoundTouch | 1.9.2 | Modified COTS | ICX SW |
| Android | 8.1 | Modified COTS | ICX SW |
| OGG | 1.3.2 | Unmodified COTS | ICX SW |
| SLF4J | 1.7.29 | Unmodified COTS | ICX SW |
| USB Serial | 3.2 | Unmodified COTS | ICX SW |
| OpenSSL FIPS Object Module | 2.0.10 | Unmodified COTS | ICX SW Build Library |
| OpenSSL | 1.0.2K | Unmodified COTS | ICC SW Build Library |
| OpenSSL FIPS Object Module | 2.0.14 | Unmodified COTS | ICC SW Build Library |
| 1-Wire Driver (x86) | 4.05 | Unmodified COTS | ICC Runtime SW |
| 1-Wire Driver (x64) | 4.05 | Unmodified COTS | ICC Runtime SW |
| Canon DR-G1130 TWAIN Driver | 1.2 SP6 | Unmodified COTS | ICC Runtime SW |
| Canon DR-G2140 TWAIN Driver | 1.1.11807.24001 SP2 | Unmodified COTS | ICC Runtime SW |
| Canon M160ii | M160II_DRIT_V12S P6 | Unmodified COTS | ICC Runtime SW |
| Canon DR-M260 TWAIN Driver, | 1.1.11803.19001 SP2 | Unmodified COTS | ICC Runtime SW |
| InoTec HiPro 821 TWAIN Driver | 1.3.0.4 | Unmodified COTS | ICC Runtime SW |
| Visual C++ 2015 Redistributable (x86) | 2015 | Unmodified COTS | ICC Runtime SW |
| Microsoft Windows 10 Professional x64 | 10 | Unmodified COTS | ICC Runtime SW |
| Strawberry Perl | 5.24.1.1 | Unmodified COTS | ICC Runtime SW |
| Visual Studio 2019 Professional | 2019 | Unmodified COTS | ICC Runtime SW |
| Machine Configuration File (MCF) | 5.17.15.1_20220920 | Proprietary | ICX Configuration File |
| Device Configuration File (DCF) | 5.17.9.1_20220916 | Proprietary | ICP and ICC Configuration File |
| ICE Machine Behavior Settings | 5.17.8.1_EAC_5.17_20220 727 | Proprietary | ICE Configuration |
| ICP2 Machine Behavior Settings | 5.17.8.1_EAC_5.17_20220 727 | Proprietary | ICP2 Configuration |

Hardware Components:

| System Component | Hardware Version | Proprietary or COTS | Comments |
|-----------------------------|-------------------------------|------------------------|-----------------------|
| ImageCast Precinct (ICP) | PCOS-320C | Proprietary | Precinct Scanner |
| ImageCast Precinct (ICP) | PCOS-320A | Proprietary | Precinct Scanner |
| ImageCast 2 Precinct (ICP2) | PCOS-330A | Proprietary | Precinct Scanner |
| ImageCast Evolution (ICE) | PCOS-410A | Proprietary | Precinct Scanner |
| ICP Ballot Box | BOX-330A | Proprietary | Ballot Box |
| ICP Ballot Box | ElectionSource IM-COLLAPSIBLE | Proprietary | Ballot Box |
| ICE Ballot Box | BOX-410A | Proprietary | Ballot Box |
| ICE Ballot Box | BOX-420A | Proprietary | Ballot Box |
| ICP2 Ballot Box | BOX-350A | Proprietary | Ballot Box |
| ICP2 Ballot Box | ElectionSource IM-COLLAPSIBLE | Proprietary | Ballot Box |
| ICX UPS Inline EMI Filter | 1.0 | Proprietary | EMI Filter |
| ICX Tablet (Classic) | aValue 15" Tablet (SID-15V) | COTS | Ballot Marking Device |
| ICX Tablet (Classic) | aValue 21" Tablet (SID-21V) | COTS | Ballot Marking Device |

| System Component | Hardware Version | Proprietary or COTS | Comments |
|----------------------------|---------------------------------------|------------------------|--------------------------|
| ICX Tablet (Prime) | aValue 21" Tablet (HID-21V) (Steel or | COTS | Ballot Marking Device or |
| | Aluminum chassis) | | Direct Recording |
| | | | Electronic |
| Thermal Printer (VVPAT) | KFI VRP3 V1 and V1C | COTS | Voter-verifiable paper |
| | | | audit trail (VVPAT) |
| Server | Dell PowerEdge R630 | COTS | Standard Server |
| Server | Dell PowerEdge R640 | COTS | Standard Server |
| ICC Workstation HW | Dell Optiplex 5270 All in One | COTS | |
| ICC Workstation HW | Dell OptiPlex 7440 All in One | COTS | |
| ICC Workstation HW | Dell OptiPlex 3050 All in One | COTS | |
| ICC Workstation HW | Dell OptiPlex 9030 All in One | COTS | |
| ICC Workstation HW | Dell OptiPlex 9020 All in One | COTS | |
| ICC Workstation HW | Dell OptiPlex 9010 All in One | COTS | |
| ICC Workstation HW | Dell Precision 3450 XE | COTS | |
| ICC Workstation HW | Dell Precision 3460 XE | COTS | |
| ICC Workstation HW | Dell Precision 3440 XE | COTS | |
| ICC Scanner | Canon imageFormula DR-G1130 | COTS | Central Count Scanner |
| ICC Scanner | Canon imageFormula DR-M160 II | COTS | Central Count Scanner |
| ICC Scanner | Canon imageFormula DR-M260 | COTS | Central Count Scanner |
| ICC Scanner | Canon imageFormula DR-G2140 | COTS | Central Count Scanner |
| ICC Scanner | InoTec HiPro 821 | COTS | Central Count Scanner |
| ICC Scanner | Dell Optiplex 7070 | COTS | |
| ICC Scanner | Dell Optiplex 7060 | COTS | |
| ICC Scanner | Dell Optiplex 7050 | COTS | |
| ICC Scanner | Dell Optiplex XE3 | COTS | |
| ICC Scanner | Dell Optiplex XE4 | COTS | |
| ICC Scanner Monitor | Lenovo 100XPAR1US | COTS | |
| ICC Scanner Monitor | Dell 2418HT Monitor | COTS | |
| ICC Scanner Monitor | Lenovo 11GCPAR1US | COTS | |
| ICC Scanner Monitor | Planar PCT2235 | COTS | |
| Client Workstation HW and | Dell Precision 3430 | COTS | |
| Express Server | | 0010 | |
| Client Workstation HW and | Dell Precision 3431 | COTS | |
| Express Server | | | |
| Client Workstation HW and | Dell Precision T3420 | COTS | |
| Express Server | | | |
| Client Workstation HW and | Dell Precision 3440 XE | COTS | |
| Express Server | | | |
| Client Workstation HW and | Dell Precision 3450 XE | COTS | |
| Express Server | | | |
| Client Workstation HW and | Dell Precision 3460 XE | COTS | |
| Express Server | | | |
| Client Workstation HW and | Dell Precision T1700 | COTS | |
| Express Server | | | |
| Client Workstation HW and | Dell Precision T3420 | COTS | |
| Express Server | | | |
| ImageCast Voter Activation | Dell Latitude 3330 | COTS | |
| (ICVA) | | | |
| ImageCast Voter Activation | Dell Latitude 3420 | COTS | |
| (ICVA) | | | |
| ImageCast Voter Activation | Dell Latitude 3410 (SSD) | COTS | |
| (ICVA) | | | |

| ImageCast Voter Activation (ICVA) Dell Latitude 3410 (HDD) COTS ImageCast Voter Activation (ICVA) Dell Latitude 3400 COTS |
|---|
| ImageCast Voter Activation Dell Latitude 3400 COTS (ICVA) Dell Latitude 3422 COTS |
| |
| ImageCast Voter Activation Dell Latitude 3490 COTS (ICVA) |
| ImageCast Voter Activation Dell Latitude e3480 COTS (ICVA) COTS COTS |
| ImageCast Voter Activation Dell Latitude e3470 COTS (ICVA) |
| ImageCast Voter Activation Dell Latitude e7450 COTS (ICVA) |
| ICX Printer and Report HP LaserJet Pro Printer M402dn COTS Printer |
| ICX Printer HP LaserJet Pro Printer M402dne COTS |
| ICX Printer HP LaserJet Printer M501dn COTS |
| ICX Printer HP LaserJet Printer 4001dn COTS |
| ICX Printer HP LaserJet Printer M404dn COTS |
| ICX Printer Avision Ap3061 COTS |
| ICE Dual Monitor AOC e1649FWU COTS |
| ICE Dual Monitor Display Logic LM15.6-USB-DV.B COTS |
| Monitor Dell Monitor P2422H COTS |
| Monitor Dell Monitor P2419H COTS |
| Monitor Dell P2417H COTS |
| iButton Programmer Maxim iButton Programmer COTS DS9490R# with DS1402-RP8+ |
| iBUtton Dallas Maxim DS1963S-F5+ COTS |
| UPS Tripp Lite SMART1500RMXL2U COTS |
| UPS APC SMT1500C Smart-UPS COTS |
| UPS APC SMT1500 Smart-UPS COTS |
| UPS APC BR1000G COTS |
| UPS CyberPower PR1500LCD COTS |
| UPS CyberPower PR1500LCD-VTVM COTS |
| Network Switch Dell X1008 COTS |
| Network Switch Dell X1026 COTS |
| Network Switch Cisco 8-port Switch (CBS350-8T-E-2G) COTS |
| Network Switch Cisco 24-port Switch (CBS350-24T-4G) COTS |
| Sip and Puff Enabling Devices #972 COTS |
| Headphones Cyber Acoustics ACM-70 and 70B COTS |
| 4-way Joystick Controller S26 Modified COTS |
| Rocker (Paddle) Switch Enabling Device #971 COTS |
| Rocker (Paddle) Switch AbleNet 10033400 (2x) COTS |
| Rocker (Paddle) SwitchHosa Technology YMM-261COTSCable(for use with AbleNet switches) |
| CF Card Dual-Slot Reader Lexar USB 3.0 COTS |
| CF Card Reader Hoodman Steel USB 3.0 102015 COTS |

| System Component | Hardware Version | Proprietary or COTS | Comments |
|------------------------------------|--|------------------------|----------|
| CF Card Reader | Kingston FCR-HS4 | COTS | |
| CF Card | Centon C4-CM-CF-16.4 | COTS | |
| CF Card | RiTek RDCF8G-233XMCB2-i | COTS | |
| CF Card | SanDisk SDCFHS-008G | COTS | |
| SDHC Memory Card | Centon C4-ET-SDU-16.1 | COTS | |
| SDHC Memory Card | Centon S4-ET-SDU3-8.1 | COTS | |
| SDHC Memory Card | Centon S4-CM-SDHU1-8G-002 | COTS | |
| SDHC Memory Card | Centon C4-CM-SDU1-8.2 | COTS | |
| CF Card | SanDisk SDCFHS-004G | COTS | |
| USB Memory Device | Apricorn AEGIS Secure Key 3NX PN: ASK3-NX-128GB | COTS | |
| USB Memory Device | Apricorn AEGIS Secure Key 3NX PN: ASK3-NX-32GB | COTS | |
| USB Memory Device | Centon (BiCS4) PN: C4-CT-U3P2-16.3 | COTS | |
| USB Memory Device | Centon S4-CM-U3P2-16.1 | COTS | |
| USB Memory Device | Apacer EH353-M APHA016GAG0CG- 3TM | COTS | |
| USB Memory Device | Centon (BiCS4) PN: C4-CT-U3P2-8.3 | COTS | |
| USB Memory Device | Centon S4-CM-U3P2-8.1 | COTS | |
| USB Memory Device | Apacer EH353-M APHA008GAG0CG- 3TM | COTS | |
| USB Memory Device | o USB Memory Device (4GB): Verbatim 97087 | COTS | |
| ATI - Serial | ATI handset | Proprietary | |
| ATI- USB | ATI-USB handset | Proprietary | |
| ACS PC-Linked Smart Card Reader | ACR38U | COTS | |
| ACS PC-Linked Smart Card Reader | ACR39U | COTS | |
| Smart Card Reader | HID Global Omnikey 3121 | COTS | |

System Limitations

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

| Characteristic | Limiting Component | Limit | Component |
|------------------------------------|-----------------------|-------------|---------------------------|
| Ballot positions | Ballot | 462**/292* | 22 in. Ballot |
| Precincts in an election | EMS | 1000; 250 | Memory, Standard; Express |
| Contests in an election | EMS | 1000; 250 | Memory, Standard; Express |
| Candidates/Counters in an election | EMS | 10000; 2500 | Memory, Standard; Express |
| Candidates/Counters in a precinct | Ballot | 462**/240* | 22 in. Ballot |
| Candidates/Counters in a tabulator | Tabulators | 10000; 2500 | Memory, Standard; Express |
| Ballot Styles in an election | Tabulators | 3000; 750 | Memory, Standard; Express |
| Ballot IDs in a tabulator | ICP | 200 | Memory, Both EMS |
| Contests in a ballot style | ICX BMD Ballot | 156**/38* | 14 in. Ballot, Both EMS |
| Candidates in a contest | Ballot | 231**/240* | 22 in. Ballot, Both EMS |
| Ballot styles in a precinct | Tabulators | 5 | Memory, Both EMS |
| Number of political parties | Tabulators | 30 | Memory, Both EMS |
| "Vote for" in a contest | Ballot | 30**/24* | 22 in. Ballot, Both EMS |
| Supported languages in an election | Tabulators | 5 | Memory, Both EMS |

* Reflects the system limit for a ballot printed in landscape.

** Reflects the system limit for a ballot printed in portrait.

Functionality

VVSG Supported Functionality Declaration

| Feature/Characteristic | Yes/No | Comment |
|--|--------|---------|
| Voter Verified Paper Audit Trails | | |
| VVPAT | YES | |
| Accessibility | | |
| Forward Approach | YES | |
| Parallel (Side) Approach | YES | |
| Closed Primary | | |
| Primary: Closed | YES | |
| Open Primary | | |
| Primary: Open supported) | YES | |
| Partisan & Non-Partisan: | | |
| Partisan & Non-Partisan: Vote for 1 of N race | YES | |
| Partisan & Non-Partisan: Multi-member ("vote for N of M") | YES | |
| board races | | |
| Partisan & Non-Partisan: "vote for 1" race with a single | YES | |
| candidate and write-in voting | | |
| Partisan & Non-Partisan "vote for 1" race with no declared | YES | |
| candidates and write-in voting | | |
| Write-In Voting: | | |
| Write-in Voting: System default is a voting position identified | YES | |
| for write-ins. | | |
| Write-in Voting: Without selecting a write in position. | NO | |
| Write-in: With No Declared Candidates | YES | |
| Write-in: Identification of write-ins for resolution at central | YES | |
| count | | |
| Primary Presidential Delegation Nominations & Slates: | | |
| Primary Presidential Delegation Nominations: Displayed | YES | |
| delegate slates for each presidential party | | |
| Slate & Group Voting: one selection votes the slate. | YES | |
| Ballot Rotation: | | |
| Rotation of Names within an Office; define all supported | YES | |
| rotation methods for location on the ballot and vote | | |
| tabulation/reporting | | |
| Straight Party Voting: | | |
| Straight Party: A single selection for partisan races in a general | YES | |
| election | | |
| Straight Party: Vote for each candidate individually | YES | |
| Straight Party: Modify straight party selections with crossover | YES | |
| votes | | |
| 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 | YES | |
| party selection | | |
| Cross-Party Endorsement: | | |

| Feature/Characteristic | Yes/No | Comment |
|---|--------|---------|
| Cross party endorsements, multiple parties endorse one | NO | |
| candidate. | | |
| Split Precincts: | | |
| Split Precincts: Multiple ballot styles | YES | |
| Split Precincts: P & M system support splits with correct YES | | |
| contests and ballot identification of each split | | |
| 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 | | |
| Vote N of M: | | |
| Vote for N of M: Counts each selected candidate, if the | YES | |
| maximum is not exceeded. | | |
| Vote for N of M: Invalidates all candidates in an overvote | YES | |
| (paper) | | |
| Recall Issues, with options: | | |
| Recall Issues with Options: Simple Yes/No with separate | YES | |
| race/election. (Vote Yes or No Question) | | |
| Recall Issues with Options: Retain is the first option, | NO | |
| Replacement candidate for the second or more options (Vote | | |
| 1 of M) | | |
| Recall Issues with Options: Two contests with access to a | NO | |
| second contest conditional upon a specific vote in contest | | |
| one. (Must vote Yes to vote in 2nd contest.) | | |
| Recall Issues with Options: Two contests with access to a | NO | |
| second contest conditional upon any vote in contest one. | | |
| (Must vote Yes to vote in 2nd contest.) | | |
| Cumulative Voting | | |
| Cumulative Voting: Voters are permitted to cast, as many | NO | |
| 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. | | |
| Ranked Order Voting | | |
| Ranked Order Voting: Voters can write in a ranked vote. | NO | |
| Ranked Order Voting: A ballot stops being counting when all | NO | |
| ranked choices have been eliminated | | |
| Ranked Order Voting: A ballot with a skipped rank counts the | NO | |
| vote for the next rank. | | |

| Feature/Characteristic | Yes/No | Comment |
|---|--------|-------------------------|
| Ranked Order Voting: Voters rank candidates in a contest in | NO | |
| 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 | | |
| Ranked Order Voting: A ballot with two choices ranked the | NO | |
| same, stops being counted at the point of two similarly ranked | | |
| choices. | | |
| Ranked Order Voting: The total number of votes for two or | NO | |
| 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. | | |
| Provisional or Challenged Ballots | | |
| Provisional/Challenged Ballots: A voted provisional ballots is | YES | |
| identified but not included in the tabulation but can be added | | |
| in the central count. | | |
| Provisional/Challenged Ballots: A voted provisional ballots is | NO | |
| included in the tabulation, but is identified and can be | | |
| subtracted in the central count | | |
| Provisional/Challenged Ballots: Provisional ballots maintain | YES | |
| the secrecy of the ballot. | | |
| Overvotes | | |
| Overvotes: Overvote invalidates the vote. | YES | |
| Overvotes – DRE / BMD: Prevented from or requires | YES | |
| correction of overvoting. | | |
| Overvotes: If a system does not prevent overvotes, define | YES | If allowed via voter |
| how overvotes are counted. | | override, overvotes are |
| | | tallied separately. |
| Undervotes | | |
| Undervotes: System counts undervotes cast for accounting | YES | |
| purposes | | |
| Blank Ballots | | |
| Totally Blank Ballots: Any blank ballot causes an alert. | YES | Precinct voters receive |
| | | a warning; both |
| | | precinct and central |
| | | scanners will warn on |
| | | blank ballots. |

| Feature/Characteristic | Yes/No | Comment |
|--|--------|-------------------------|
| Totally Blank Ballots: If blank ballots are not immediately | YES | Blank ballots are |
| processed, there must be a provision to recognize and accept | | flagged. These ballots |
| them | | can be manually |
| | | examined and then be |
| | | scanned and accepted |
| | | as blank; or precinct |
| | | voter can override and |
| | | accept. |
| Totally Blank Ballots: If operators can access a blank ballot, | YES | Operators can examine |
| there must be a provision for resolution. | | a blank ballot, re-mark |
| | | if needed and allowed, |
| | | and then re-scan it. |
| Networking | | |
| Wide Area Network – Use of Modems | NO | |
| Wide Area Network – Use of Wireless | NO | |
| Local Area Network – Use of TCP/IP | YES | Client/server only |
| Local Area Network – Use of Infrared | NO | |
| Local Area Network – Use of Wireless | NO | |
| Used as (if applicable): | | |
| Precinct counting device | YES | ImageCast Precinct |
| | | ImageCast Precinct 2 |
| | | ImageCast Evolution |
| Central counting device | YES | ImageCast Central |

Baseline Certification Engineering Change Orders (ECO)

| ECO # | Description |
|--------|---|
| 100706 | Adjusted resistor value for paper sensor LED output |
| 100718 | Added Dell Precision 3440 XE EMS Express Server |
| 100719 | Added Dell Precision 3440 XE EMS-ADJ Workstation |
| 100720 | Added Dell Precision 3440 XE ICC Canon Workstation |
| 100721 | Added Dell Optiplex XE3 ICC HiPro Workstation |
| 100741 | Added Dell Latitude 3410 ICVA Workstation |
| 100755 | Added Cisco 24-port Switch (CBS350-24T-4G) Network Switch |
| 100756 | Added Cisco 8-port Switch (CBS350-8T-E-2G) Network Switch |
| 100762 | Added alternate supplier for the ICP2 LCD-Touch Panel assembly |
| 100763 | Added termination resistors to unused lines on the ICE Main Controller Board |
| 100769 | Added Dell Latitude 3410 with 512GB SSD Drive for ICVA Workstation |
| 100772 | Added Dell Latitude 3420 ICVA Workstation |
| 100802 | Added new ICP2 printer door that captures the printer platen roller onto the door |
| 100803 | Added new ICE DDR Memory Module |
| 100812 | Added alternate supplier for the ICE LCD-Touch Panel assembly |
| 100819 | Added new ICP2 Printer Controller Chip vendor |
| 100826 | ICP Provisional Flag Modification (5.5-B) |
| 100827 | ICP Provisional Flag Modification (5.5-C) |
| 100829 | Added Dell Precision 3450 XE EMS Express Server |
| 100830 | Added Dell Precision 3450 XE EMS-ADJ Client Workstation |
| 100831 | Added Dell Precision 3450 XE ICC Canon Workstation |
| 100832 | Added Lenovo 11GCPAR1US Touchscreen monitor for HiPro |
| 100833 | ICX Prime BIOS 1.40C Update |
| 100843 | Removal of ICP2 Ethernet Port |
| 100845 | Removal of ICE Ethernet Port |
| 100849 | Added New Centon 8GB SDHC Card - BiCS4 |
| 100850 | Added New Centon 8GB microSD Memory Card -BiCS4 |
| 100864 | Added new EMS Monitor – P2422H |
| 100791 | Added new ICE Battery Pack |
| 100898 | Removal of ICE Smartcard Reader |
| 100891 | Added Dell Precision 3460 XE EMS Express Server |
| 100903 | Added Dell Precision 3460 XE EMS-ADJ Client Workstation |
| 100904 | Added Dell Precision 3460 XE ICC Canon Workstation |

X. Attachment B- Recommendations from Accessibility Examiner





Top problems

The following discusses the problems that surfaced during the expert examinations and voter/poll worker observations with the Dominion Voting ICX ballot marking system.

Testing identified five problems that could reduce the ability of people with disabilities to vote independently and privately on the ICX voting machine.

1. Privacy and Independence

What Happened?

The ICX voting system, as it was configured during certification testing, presents two impediments to voters with disabilities voting privately and independently.

- **Machine set up.** The ICX has a 27-inch, portrait oriented diagonal display, which is very large and produces very clear print. Also, as with most modern displays, the screen can be viewed at wide angles without distortion. Also, the machine and printer take up a sizable operating footprint. Which means in most voting booths, the screen will sit near the front of the booth in order to fit.
- Voter check-in and disclosure. With the ICX system, voters receive a voter "smart card" from the check-in table that contains all the information the machine needs to pull up the correct ballot. There are many ways a county could implement this system, but it was clear that a card would need to be created for each voter in advance or on demand. There were two types of voter cards: standard and accessibility devices enabled. The second type of card must be inserted by a poll worker to activate the accessibility device options screen, where the preferred device, such as the tactile keypad, switch input, or audible output is chosen. Then, the preferred device is given to the voter.
- Accommodation screen. The accommodation selection screen is available only once in the voting process, so it is not possible to try

different accommodations to see which would work best. And, once the voter has begun voting, they cannot change the type of accommodation without canceling the ballot and starting again.

- Really only two options. The accommodation screen presents four choices: Audio-Tactile Interface (ATI), Paddles, Sip and Puff, or Audio/Visual mode. While this suggests that there are four modes of interaction, there are, in fact, only two. The ATI, Paddles, and Sip and Puff selections produce identical behavior. The Paddles and Sip and Puff choices, from the point of view of the voting machine, are identical, as would be any user-provided switch input. In all three methods, the machines "listens" for input from the switches and provides auditory feedback. In the fourth choice, Audio/Visual mode, the system provides auditory navigation and feedback, but does not listen for switch input.
- Active touchscreen, all the time. In all four modes, the touch-screen remains active. When the voter touches a control for the first time, its purpose and content is announced, but not selected. A second touch selects the control and activates it (if a button). On second touch, the content of the choice is repeated aloud, which allows a voter with low-vision to explore the screen by touching various controls and hearing their function without accidentally making choices.

This behavior for various switch and audio modes is not well implemented. A person who elects to use the switch input will not touch the screen for control, as that is beyond their capability (hence the use of the switch interface). However, if a switch user needs assistance from another person, the doubletouch function means the poll worker or aide must touch each choice twice. In these cases, the two-step selection is an unnecessary burden. Since the switch user (blind or sighted) would be using a personal listening device such as the provided headphones or personal headset, the selected choice being read prior to the selection would not be apparent to the person helping, and learning the two-step selection could be difficult.

Why is this a problem?

The poll worker setup and required voter disclosure are problems for three reasons.

- **Bright and clear.** Anyone within 10 feet of a booth, including in nearby booths, can observe the selections of any voter.
- Voters cannot independently choose and initiate their preferred voting method. For a voter to have access to the assistive devices they must declare their need at sign-in, and receive a different activation card than that provided to nondisabled voters. In some cases, such as blindness or mobility impairment, the disability is overt, and there is no loss of confidentiality. When such a voter enters the polling place, their need for accommodation is readily apparent, and there is no additional exposure from requesting an accommodations card (and generally the assistance of a poll worker in setting up the machine).

Because a poll worker must initiate the accommodations, and then walk away, there's no method where the voter could do this by themselves and then test the different devices.

• Social stigma and privacy. There are other types of disability that are not readily apparent, and those living with these limitations would also benefit from the available accommodations. For example, voters with low literacy or cognitive impairment would benefit from the audio/visual assistive option, but might not understand that the accessibility options can help them vote more effectively, or they may not wish to reveal their status to the poll workers and the community. The ICX voting machine requires this disclosure to activate the accommodations.

Recommendations

The recommendation for the physical privacy concern is relatively straightforward. Counties will need to think about how a polling location is set up. Keeping the open side of the voting booth close to a wall and ensuring adequate clearance around the voting machine can help. Also, exploring different voting booth manufacturers and types. One that is deeper and allowed the machine to be pushed back into the booth could provide enough side-to-side privacy.

A county choosing this machine will have to do at least two things *before* Election Day to ensure poll workers and voters are successful.

- **Poll Worker accessibility training.** Counties can create a poll worker accessibility training component that gives poll workers tools to effectively help voters with disabilities. Counties that already have this type of program can evaluate it against this machine's requirements. Such training programs could include ways to identify voters who may need assistance, how to appropriately ask a voter if they need assistance, and how to assist a voter once identified.
- Voter education and demonstrations. Officials can create voters with disabilities education and demonstration events around the county. Here, voters can learn how to use the new machine, and the county can demonstrate all the machine's accessibility features. While demonstrating them, officials can give examples of who could benefit from using each assistive device, and especially include examples of voters most would not immediately identify as having a disability. For example, an older voter with sight problems might benefit from the additional audio instructions. Or a diabetic with neuropathy in their hands may prefer to use the dual-switch paddles. Both examples of voters may not have known the options and devices were available before.

A strong two-pronged training and education program will help poll workers be more comfortable with assisting voters with disabilities. Having who know all of the accessibility options and well-trained poll workers will make voters feel more comfortable asking for assistance on Election Day.

2. Audio Quality, Instructions, and Feedback

The ICX voting machine had a number of problems with the audio quality, instructions, and feedback.

What happened?

The ICX machine uses two distinct voices for its audio interface.

- **Instructions.** One voice, used for instructions, appears to be prerecorded synthesized voice that will remain constant across elections. This voice is well articulated and clear, but was considered "harsh," "not good," and "rinky-dink" by voters who were more experienced with the state-of-the-art voices provided on their personal devices. The pacing and phrasing of this voice meant it was difficult to know when a sentence started and ended. For a brief announcement, this voice would be acceptable, but the long-term use was a problem (see below).
- **Ballot content.** The second voice uses text-to-speech and reads the content of the ballot. Unlike the pre-recorded voice, this voice is "live," somewhat "fuzzier," and less harsh than the instructional voice.

As delivered, these two voices had five problems, one of which was corrected before the voters arrived.

- Volume difference. The first, correctable, issue was that the voices started at quite different volumes. When the instructional voice was set to a comfortable level, the content voice was nearly inaudible. This problem was fixed by an adjustment by the manufacturer, but should have been tested before delivery.
- **Rate of speech and voice quality.** The system allowed voters to change the rate of speech, which is common for audio assistive devices. The range of speech rates was very different between the two voices. The instructional voice could be slowed by as much as 50%, and accelerated by approximately 200%. The content voice, by contrast, could be sped up by about 600%. An increase in the rate of the instructional voice from 100 words per minute to 110 words per

minute might result in a change of the content voice from 100 wpm to 200 words per minute. After the initial orientation to the machine, voters were more interested in the information provided by the content voice. These two voices need to respond similarly to the settings.

Audio and tactile keypad. At the top of the keypad, there are controls to adjust the rate and volume of the auditory feedback. These buttons are convex on top to indicate increasing, or concave to indicate decreasing the assigned function. Below this are five buttons: a right-left pair, the select button, and an up-down pair. At the bottom of the keypad is a "Help" button that reaches from side to side.

On the lower edge of the keypad are ports for headphones or access switches. These ports are physically identical (3.5mm phono jacks), and have nearly invisible raised labels (black on black). There is no Braille marking on the ports.

The tactile keypad's navigation buttons do not have a unique function in this voting system.

- The yellow, left and right buttons and the blue, up and down buttons do exactly the same thing. During the ATI instructions, this was not stated. The instructions described the yellow-and blue-buttons as having different functions. At each step, the buttons were described by color, shape, and function: "the yellow, left-arrow button to move left," or "the blue up-arrow button to move up."
- The single exception to this was the select button. In the Help instructions, this was identified as the "red, x-shaped select button." However, throughout the audio narration on the machine, this was only described as the "red select button." Several blind voters commented, "Why do I care what color it is?" When it was explained that a person with low vision might use this interface, and might be able to use the color as an aid, they were accepting, but the select button, being used so

often, should have been identified, using this logic, as x-shaped rather than simply "red."

- **Persistence and repetition.** The phrasing of audio commands should place the most important information first. This allows the voter to attend when the narration of interest, and think about other things when it is not.
 - The same instructions played every time a voter pressed a button in the same contest area. The instructions only changed when they moved to a new contest area or page. Also, if the voter paused to think about the next action, the instructions would immediately start to play again. Voters stopped thinking about voting to listen to the voice to ensure no new information was available. After voters figured out the pattern, they stopped listening to the instructions altogether.
- **Instructions content.** The content instructions are also long, confusing, or unhelpful.
 - The audio instructions for the Dominion system repeatedly said "Use the yellow, right-arrow button or the blue down arrow button to move to the next item." This long text was confusing. More efficient wording might simply ignore one set of buttons, for example, "To move to the next item, use the blue down-arrow button."
 - The introduction to the write-in screen says that you can writein a candidate of your choice, but does not provide guidance on how to do that. This disturbed even the sighted voters, but every blind voter had to be cued to move beyond the box announced as "Write-in candidate, blank" to find the keyboard.

Sometimes the voting instructions on the screen are poorly worded.

 The screen to select a straight party vote, the instructions say "You may select the party of your choice by selecting the party of your choice."

Why is this a problem?

To some extent, the audio instructions and content feature of the Dominion system may suffer from an "uncanny valley" where it is close enough to good to be annoying, though it is actually better than the feedback from some of the other machines we have evaluated.

Blind users typically want their text-to-speech voices to speak at rates above 400 words per minute, so that they can listen at the same rate sighted people can read. Many blind individuals read at speeds in excess of 600 words per minute, and up to 1000 words per minute (the limit of current technology). People with cognitive limitations such as auditory processing disorders may need the voice to speak more slowly, to give them time to understand it.

Voices designed for screen reading do not necessarily sound like human voices, but remain understandable over a wide range of speeds. To accomplish this, the components of voice that carry information are identified, and the filler sounds between those components are stretched or shortened to change the overall speech rate without loss of intelligibility. People who routinely listen to synthetic voices expect this.

The voices used in the Dominion voting machine are not this sophisticated. To increase speech rate, it appears that they simply slice sections from the sound stream. To slow the voice down, they insert silence at intervals in the sound stream. This approach is "effective" for compressions and stretches of 10 to 20%, as the human brain can fill in the blanks fairly effectively. However, the Dominion system attempts to use this technique with slowing to as little as 50% of the speech rate, and increasing rate by several hundred percent.

The use of two audio voices for instructions and ballot content in and of itself is not a problem (in fact, it meets the VVSG requirement that they be different). But Dominion's implementation of the voices is a problem for at least two reasons.

• **Election Day Ready.** The ICX seems to have a lot of configuration points, which could be a good thing for counties. However, when many of the settings, like the disparate volumes between instructions and content speech, are not usable out-of-the-box, some counties

may not know that they need to make those changes for an option to be usable.

• **Cognitive overhead.** Voters had to concentrate excessively to understand what was being said. At the lower three speed settings, the instructional voice was noticeably broken up, and at the highest two settings the gaps made it impossible to process what was being said.

When voters have to interpret poorly written instructions, it means they are not thinking about voting. This is made harder for voters using the audio when the quality, rate, and phrasing mean they are spending more time figuring out how to use the machine than they are on which candidate is best for the contest.

Recommendations

Counties choosing this machine can ensure that they:

- Test the audio rates and volumes before deployment to make sure they are usable for both blind voters and others who might use the audio.
- Train poll workers well on the potential issues and questions voters might have about using the audio while voting.
- Provide community demonstrations so voters can practice with the machine. Voting on Election Day may be smoother if they know what to expect.

Also, if the audio style and content is configurable, counties should ask the vendor to do the following:

• Use better voices. Many of the blind voters demonstrated the voices they use on their personal assistive devices, and explained why they were better. Much better voices than those on the tested system are available for purchase or license. The vendor could provide a synthetic voice that is designed for high compression levels such as those used in commercial screen readers or cell phones.

• Include verbosity control and contextual help. The blind voters all indicated that they would prefer some verbosity control on the audio instructions, or changing the level and wordiness of the help as needed. In the initial orientation, the full names could be used. Once the voter is oriented, though, this could be contracted to "Use the arrows to move forward or back." If the voter got confused, the Help button on the ATI could be configured to provide more detailed instructions about the current screen.

3. The Write-In Process

The write-in screen and process presented two problems for voters using the audio assistance.

What happened?

When visually choosing to write in a candidate on the ICX, the voter enters the write-in screen and is presented with a text box, where the write-in name will appear, editing buttons ("Clear all" and "Delete"). Below this is an onscreen keyboard in alphabetical order to enter the name of the chosen candidate. At the bottom of the screen is a button to confirm the write-in and return to the ballot. This all makes sense for a sighted voter because the layout is clear.

No instructions. There were very few instructions for sighted voters, but the layout of the screen made use self-explanatory for everyone in this test. The audio had no additional instructions beyond "Please enter your write in candidate." Then when the voter navigated to the next option, they only heard the voice say the text box was empty. Voters became caught in this area for a long time. The "Help" button on the tactile keypad only gave voters instructions on how to use the tactile keypad.

All of the blind voters needed facilitator assistance to successfully write in a candidate. Each voter had trouble moving beyond the writein name box. But once they advanced to, and heard, "A," they rapidly and generally accurately typed the name of the write-in candidate. At intervals, the users *could* navigate to the write-in name box to hear
their entry spelled back to them, then return to typing. None of our blind voters discovered this capability.

- **Editing Problems.** The Dominion ICX had implementation problems with editing a name once it had been entered and using the audio assistance.
 - Deleting. The only option for editing an error in name entry is to delete letters or the entire name and start from scratch. For sighted voters, this makes sense visually. They can see the letters disappearing and can easily see what letters remain. For blind voters using the audio, each letter is announced when typed, but when deleted, the key announces only "Delete," and not what has been deleted.
 - Repeating too soon. If the voter stops to consider what they are doing while editing a name, the ICX repeats the last audio instruction given. While this is not ordinarily more than an annoyance, in text entry it can be challenging. If the name being written in has a double letter, and the user pauses to think about the spelling of the name, the system will repeat the last instruction, "You selected 'M'." If this occurs as the user presses the select key to double the "M," it is not clear whether a second "M" has been typed, or if the audio has just repeated the previous letter. The user must navigate to the name box to hear the name spelled out to find out how many letter "Ms" have been typed. (This process is not described in the audio instructions, and must be discovered by the voter.)
 - Does not voice the "Space." The "space" character between names is not voiced. A blind voter may have forgotten to enter a space, but would not know.
 - No reentry. True for all voters: If a voter has entered a write-in name, returns to the ballot, and then realizes that the name was misspelled, touching the write-in option again clears the text in the box.

Why is this a problem?

While it is arguable that the write-in process has very little impact in most contests, all of our voters and poll workers were very interested in the usability of the write-in process. And all functions of a voting machine should work effectively for each voter. It does not always have to be the same method, but the outcome should be the same. Not being able to effectively edit a write-in name is a major problem for two reasons.

- An entry the voter thought was cast correctly because there were no audible mistakes might still be voided because of inaudible errors.
- Limited instructions combined with editing problems can lead to voter confusion. Even if they can figure out a method to get the system to voice what is actually in the text box, it takes an inordinate amount of mental resources. Resources that some voters cannot spare and should be reserved to deciding who to vote for.

Recommendation

We recommend the following changes to the write-in system:

- Adjust the on-screen instructions so that the audio reads it.
- Include audio instructions how to navigate to find the keyboard.
- Rework how the system voices deleted characters and the frequency it repeats them.
- Include any and all spaces and special characters in the text box when reading the entry to the voter.

4. Silent/Hidden selection and deselection

What happened?

There were three elements of silent and/or hidden selection and de-selection on the ICX that voters found confusing. In most cases, voters were able to mark their ballot as instructed through trial and error, but in others, they did not notice changes made by the system and might vote in a way that does not match their intent.

• Destructive candidate deselection when changing a straight party contest

After making a straight party choice, if voters wanted to vote for additional candidates from another party or "scratch" and change party for that contest, the system automatically deselects all of the other premarked candidates. In a contest with a short list of candidates, this behavior, dictated by the PA Method, caused confusion, but with persistence voters were able to select the candidates specified in the instructions. When the voters were asked to vote for just one of the three automatically selected candidates, they universally attempted to deselect an unwanted candidate by pressing on that candidate's name. Because of the interpretation of the PA Method, this resulted in confirming the vote for that candidate, instead of deselecting that candidate, as the voters stated they had expected. The voters were, in this case where the changes were evident, able to correct the error and vote as instructed. (Please see more about candidate selection in the next section)

- When the contest was long, candidates were often de-selected on a different screen, with no notification from the system. For sighted voters, this automatic change resulted in candidates who had been selected not being voted for as intended by the voter. For audio users, no deselection is voiced at any time.
- Overvoting protections do not protect audio users. Once a voter selects the maximum number of candidates in a contest, the system greys out the remaining options. This is a strong protective feature and intuitive for a sighted voter. The sighted voter is able to scan through the remaining candidates and find others who s/he might prefer, and change selections. However, when using the audio assistance, this way of handling overvote protection removes the ability for the system to read the remaining candidates, so a voter may not hear all of the options.

Why is this a problem?

The system relies on voters perceiving the change in selections and understanding why those changes have happened. This is a problem because:

- All voters should have control of all selections.
- Off-screen actions force all voters into problem solving. This is worse for voters using the audio format or a dual switch because navigation is more difficult.
- Voters with cognitive disabilities may be unable to understand what has happened when the interface is unpredictable and/or inconsistent.
- If a voter has to ask for assistance in the middle of the ballot, their privacy and independence are compromised.
- Ultimately, voters may vote in a way they had not intended.

Recommendations

While the machines must comply with the "Pennsylvania Method" of straight party voting, there are ways to fully inform the voter of selection and deselection changes. For example:

- Create meaningful audio feedback messages and confirmation processes to tell voters what is happening—including the number and names of the candidates being deselected. No selection or deselection should ever take place without explicit action or confirmation from the voter. Language should be included like: "If you do X, these voters will be deselected" or "Are you sure you want to...."
- Be consistent and toggle all selections on and off when touched or selected with the tactile keypad, including selections made when the straight party option is active. This is consistent with how selection and deselection works in general and is not destructive.

5. Paper ballot handling

One of the goals of the voting machine upgrade is to allow all voters to vote independently and privately, including verifying their ballot. All paper ballots introduce barriers for voters with low-vision, no-vision, and with limited dexterity.

Most voters appreciated the printed ballot, which allowed a second chance to review the vote before casting. The implementation of the printing and paper-handling of these paper ballots had some issues that limited the ability of voters to use them effectively.

Reading the paper ballot

For the Dominion ICX ballot marking system, the ballot is printed using a separate, off-the-shelf printer on 8.5 x 11-inch cardstock. The cardstock is stored inside the printer next to the tablet. This means that voters do not have to handle a blank ballot before making choices.

It also means that there is no feature to allow a voter to "read back" the ballot by reinserting the printed, completed ballot into the voting system. Three of our five blind voters were able to use app-based print readers on their phone to take a picture of the ballot and read it back to them. This is only an option for voters with this technology. There is no built-in option for all voters.

The paper ballot included alerts and language that was not used on the touchscreen. For example, undervoted contests are called out with "UNDER_VOTE_BY_N" where N is the number of positions still available. The ballot review screen does not do this, which means it is not announced to visually impaired voters using the audio assistance.

Interacting with the ICP ballot scanner

The scanner had both positives and negatives. In general, the ballot scanner does not produce any major accessible voting barriers.

Only one feature stood out and could be considered a positive for voters with disabilities.

• Voters may insert the ballot in any orientation. This provides another layer of privacy and limits the potential failures. However, this was not clear to any of the voters or poll workers. Each asked how to insert it.

The most serious problems are:

- The scanner bed is very shallow so the entire ballot does not fit on it. Only the top third of the page can be rested on the scanner. Voters with no/low use of their hands would rely on assistance for feeding the ballot into the scanner. And the supplied privacy sleeve was of little help because it was not designed for use with these ballots. Some of the test participants commented on these issues.
- There are no audible cues. The scanner did not include robust features to alert voters that their ballot has been cast successfully.
- If the ballot is not perfectly aligned as the scanner begins to grab it, the scanner will spit it back out. If the voter is not ready for this, the ballot will fall to the floor. This is a problem for all voters but potentially very embarrassing and frustrating for those with disabilities.
- There are subtle visual cues from a small screen that notify voters that the scanner is ready, reading a ballot, and finished scanning. These were not available for voters with low or no vision. Also, the quality of the screen is poor. If the voter or poll worker is not directly over the screen, it is difficult or impossible to read.

While the voter does not spend as much time interacting with the ballot scanner as the touchscreen machine, there are barriers for voters with disabilities that can limit voter privacy and independence. If a voter must ask a poll worker for ballot scanning assistance, this increases the likelihood that the poll worker will see how the individual voted.

Recommendations

For the printed ballot layout

• Make the alerts and language on the ballot and touch screen consistent.

For the scanner

- Increase the length of the scanner bed so that the full ballot can sit on it before inserting it into the machine. This will help low mobility and dexterity voters and will catch the ballot if it is inserted incorrectly.
- Make the cues more obvious that the ballot is cast. Large print words or simple images to indicate the scanning steps on the screen, and a stronger visual cue can show that the ballot scanned successfully. Adding a subtle audio cue that the ballot scanned properly would help blind or low vision voters confirm their ballot was cast.
- Train poll worker to assist voters in ways that do not compromise the voter's privacy. This might include having standard instructions for poll workers to use to guide a voter in casting their own ballot, or narrating the poll worker's actions so that the voter understands what the poll worker is doing.

Other issues for deployment

A few other issues produced consistent enough observations to call them out in some detail.

Alerts

Both the poll workers and the voters were uncomfortable with the language of the on-screen warnings.

In general, they felt that warnings were appropriate for conditions that might invalidate a ballot, where "alerts" would be appropriate for acceptable conditions that could be changed.

- "If left blank, this contest will have implicit choice selections for party [straight party choice]." One of the most egregious involves any contest that is left blank, but the voter selected a straight party. In this case, the system provides an alert that says "If left blank, this contest will have implicit choice selections for party [straight party choice]." The system does not have an immediate way to straight party vote and abstain from a contest, which is a problem in and of itself. But the high-level language in the alert confused most voters and poll workers. And all said that the message needed to change.
- "Your ballot is valid, but there are warnings." If a voter does not select a straight party, the review screen first indicates that "Your ballot is valid, but there are warnings." Then, the straight party contest alert indicates that "This contest is blank." The wording of this alert suggests that the straight party selection is a ballot contest rather than a convenience, and that selection is mandatory. In either case, the language is unnecessarily harsh and coercive.
- **"This contest is undervoted!"** If a voter does not select all of the available candidates in a contest, they receive a warning that the contest is undervoted. "Undervoted" is not a clear language term, and is potentially confusing to voters. The warning also suggests that full voting is required.

The language of on-screen or audio "warnings" should be informative, not coercive, and should be in plain language. Where possible, counties should work with the vendor to reconfigure or rewrite these warnings.

Poll Worker Concerns

Poll workers were very excited about the ability of the scanner to tabulate absentee ballots. However, they had some concerns about the touchscreen and general process.

- **Power needs and cords.** Several poll workers commented that the machine included the ballot marking tablet and a separate printer. They were concerned about the power requirements this would present in some of their polling places. Combined with the wires for the headphones and access switches, they felt that the number of cables would be a burden to manage in the polling site.
- Lots of pieces. The poll workers were concerned about managing the "parts" of the process. This machine uses activation cards to select the appropriate primary ballot by party, and uses different cards for "normal" versus "accommodated" voting. In polling places that serve more than one precinct, each might have a different ballot. This suggests the need for many types of cards, or new system entirely to manage at the voter check-in area. The scanner also has compact flash cards and security keys. They did not like the idea of complicating the voting process with additional things.
- **Casting the ballot and traffic management.** Poll workers were also worried that the voter must carry the ballot from the voting machine to the scanner and ensuring they actually fed the ballot into the scanner. This has been a common concern from poll workers who do not currently use paper ballots. However, this concern was justified in this instance because of the language on the print ballot screen.
 - When you press the "Print" button at the end of voting, the machine produces a new window with an alert. It has a message "Some warning detected on your ballot. You cannot make any more changes after casting the ballot." Then there are two buttons labeled: "Cast your ballot" and "Review your

choices." To make it worse, the final screen says "Thank you for voting! Your ballot is successfully cast." This language choice is misleading and incorrect. The touchscreen device just creates the ballot and printer prints it. The ballot is not "cast" until it has been scanned by the tabulator.

- Poll workers became worried that voters may misinterpret these screens and just walk away. Since many voters desire a receipt for voting (to validate time off from work or credit for school), they might think that they had indeed cast their ballot (because the machine said they had), and the printed copy is their receipt.
- The poll workers were anxious about traffic management to assure that the ballots and cards all came to the scanner. They suggested that a message on screen when the ballot was printed would help. It could instruct voters to take their ballot and activation card to the scanner to cast their ballot.
- The poll workers were uneasy about the comfort level of the older voters with change in the process. They all agreed that having the machines available in public spaces (libraries) prior to the election to allow voters to try them would be important.
- There was some apprehension about the use of compact flash cards to record tallies. These are small, and may be difficult to manage from some workers with limited dexterity.

Candidate Selection

The Dominion software uses two levels of candidate selection, which interact in two different ways from the point of view of the voter.

• **Soft Selection vs Hard Selection.** The first level of selection might be called "soft-selection." When a voter selects a straight party ballot, the candidates from that party are soft-selected and pre-marked throughout the ballot. This will count as a vote unless modified by action of the voter, as discussed in the "implicit" alert area above.

If a voter touches the screen to select a candidate without a straight party choice, this direct action creates a "hard selection." If a softselected candidate is touched by the voter, this converts the softselection to a hard selection.

• **Cannot leave a straight party contest blank.** Once a voter selects a straight party, the machine will not allow a voter to abstain from any contest. As mentioned in the "Alerts" section, the machine informs the voter that a blank contest will be marked as straight party—even if the voter leaves the names unselected. As one voter discovered on her own, she could effectively abstain from the contest by submitting a blank write-in entry. This is not an appropriate work around.

To the voter, soft-selected and hard-selected votes look the same. This is logically sound, but has unexpected repercussions.

- **Destructive behavior.** If a voter decides that they want to remove a straight party selected candidate in a "Vote for N" contest, they will try to deselect that candidate by touching or selecting that candidate. Instead of deselecting the soft-selected candidate, it converts it to a hard selection. This was not what the voter intended, so naturally the voter touches the selection again. This results in deselecting the candidate, and also deselecting all of the other straight party votes in that contest. This unexpected destructive behavior confused sighted voters.
- Soft-selection cue. All of our blind voters, when instructed to vote for an in-party candidate, reselected that candidate, making the selection a hard selection. This suggests that the cue that the candidate had already been soft-selected was not adequate to alert the voter, and might result in unintended cancellation of other in-party candidates.

There were additional candidate selection issues that confused voters.

• Number of available candidates vs number of selected candidates. In contests where the voter is allowed to select multiple candidates from the presented roster, there is no indication of the number of candidates available. Nor, after selecting one or more

candidates, is there indication of how many candidates have been selected.

When the roster of candidates is longer than a single screen, or for all blind voters, it is not clear how many candidates are available. This could be remedied by messages that say "Vote for 5 of the 23 candidates" and "You have voted for three of the allowed five votes." When the voter has selected fewer than the allowed number of candidates, they are presented with a warning that they have "undervoted" the contest. It was not clear to our voters what "undervoted" meant, and the language of the warning suggested that this was not a valid vote, and that all five candidates must be selected to be appropriate.

Not all of the issues in this section have clear workarounds or immediate vendor-provided solutions. Counties should have extensive poll worker trainings and many opportunities for voter education to ensure all poll workers and voters know how to successfully cast each vote at the polls.

Reviewing and verifying the ballot

Voters with disabilities will also need voter education on how the ballot review and verification process works for the combination of presentation and interaction mode they are using. This is particularly important because of the use of straight party voting in Pennsylvania

In this voting system, it is possible for a voter to select a straight party option, go directly to the review screen, and then directly to print without any notification from the ballot marking device that they have undervoted any nonpartisan contests or ballot questions.

A blind or low-vision voter who cannot easily verify the printed ballot might never learn that they skipped contests, especially if the precinct ballot scanners are not programmed to report undervotes.

One solution to this would be for the audio at the beginning of the review to announce if there are undervoted contests (and perhaps how many there are).

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.

Advanced 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.

Poll workers felt strongly that any new system – particularly those with 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.
- Have voting machine hands-on demonstrations at disability events so that voters can get to know the machines, practice voting, and be prepared for what they may need on Election Day.

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

Training for poll workers 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 their 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 ICX 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 ICX, the setting and preferences buttons are at the top of the screen at all times. The poll worker can review these with the voter (reading the instructions to be sure they are consistent and accurate).

Poll worker procedures

Poll worker 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 that the ballot must be placed in the center of the scan bed, 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 that their ballot can be inserted into the scanner in any orientation. Using the privacy sleeve is the most secure. However, inserting the ballot upside down, with the print toward the floor, is sufficient.

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 Braille, audio, and large print.
- Test all assistive aids with local voters.

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 ICX screen can be adjusted to change its angle for a closer approach, adapting to standing or sitting postures, and avoiding glare.
- Provide help 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. On the ICX, the tactile keypad includes two 3.5mm jacks that seems appropriate to insert a headset. One is marked in very small letters that it is for audio. However, the other jack is where the dual switch connects. Counties should ensure poll workers explain the two jacks to voters, at a bare minimum.
- Make sure voters are oriented and know where all parts of the voting system are, including the privacy shields. The ICX includes options to blank the screen during the audio ballot, but then poll workers could bring back the visual mode if the voter has a question.
- Remind voters how to cast their ballot and how to know when they are finished.

Polling place setup

Ensure all polling locations have at least one accessible voting booth with a chair that is easily removed if a voter uses a mobility device.

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 when using simple personal technology, such as magnifiers or text readers to verify it.

For all voting machines, the path to the touch screen and 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.

Use assistive technology to support blind and low-vision voters in verifying their ballot, for example, a magnification unit or a simple OCR scanner.

Voting booth setup for this system

Two issues were identified specifically for this system during the examination and usability testing related to how the system and attached devices are placed. The system fits very tightly in the accessible voting booth supplied by the vendor for the exam.

- Cable management for assistive devices. The tactile keypad is normally stored behind the screen, connected on a semi-permanent cord. The headphone is plugged in on the right-side front of the tactile keypad. The printer could be set up to the right or left.
 <u>Recommendation</u>: The cords need to be placed so that they don't interfere with the printed ballot or the voter's ability to find and take it.
- **Privacy.** The screen for this system sits close to the front of the booth. It is easy to read the crisp, clear screen display over the shoulder of someone sitting down, or from the side, especially when large text is used.

<u>Recommendation</u>: Position the booth so the voter's back is to a wall, so no one can walk behind them, and with sufficient space to the left and right that people cannot "peek" from the side. However, be sure that there is a good path for a manual or motorized wheel chair to get to the voting booth easily (see above).

All observations

Voter comments and reviewer observations about each machine are described below. For each are, the observations are organized by the machine function then by the severity.

Positives

| Function | Observation | System | Severity |
|---------------------------|---|--------|----------|
| General | Blind voter/poll worker - "Once I understand the system, I can whiz!" | ICX | Positive |
| Display and Navigation | Large, clear, easy to read screen. The screen angle can be changed to three angles: flat, slight incline, and almost vertical. | ICX | Positive |
| | Default font large enough for most sighted voters. | ICX | Positive |
| | The system prevents overvotes by greying out the remaining options once the voter has selected the maximum number of candidates in a contest. | ICX | Positive |
| | Alerts are generally well formatted and in appropriate places. The wording in the alerts is not good, however. (See Problems section below) | ICX | Positive |
| | The ballot review button is always visible and functional. Voters don't have to review the entire contest or ballot to navigate to the review screen. Likewise, the print ballot button is always available from the review screen. | ICX | Positive |
| | Large "scroll down/up" buttons at the top and bottom that span the width of the screen. | ICX | Positive |
| | Straight party vote indicator that allows you to turn on and off straight party votes at any point. | ICX | Positive |

| Function | Observation | System | Severity |
|---------------------------------|--|---------|----------|
| Display and Navigation | Ballot review screen is generally well formatted. Alerts are present in each contest where necessary. In blank or undervoted contests, a "No selection made" label is present for each potential vote for number. | ICX | Positive |
| Assistive Technology (AT) | Voter - "The disability functions are the best features." | ICX | Positive |
| | AT includes an audio mode that leaves the screen enabled. The first screen touch reads the selection, and then the same item touched a second time selects it. | ICX | Positive |
| | If the voter chooses the assistive technology, the touch screen is still active for those who may want to use both. | | |
| | Poll worker commented that these machines would help counties find accessible locations for the machines. | | |
| Write-In Screen | Once a blind voter found the on-screen keyboard, they were able to enter the candidate name quickly. | ICX | Positive |
| | After completing the write-in, one blind voter said, "That was easy." | ICX | Positive |
| Printed Ballot & Scanner | While sighted voters (and poll workers) generally did not want to check the printed ballot, blind voters generally did. The use of card stock made the ballot easy to handle. The card reader at the base of the screen created a make-shift easel. Voters could rest the ballot against the machine and use personal AT devices to verify their ballot. | ICX/ICP | Positive |
| | read the printed ballot to the voters successfully who attempted it. | | |

| Function | Observation | System | Severity |
|--------------------------------|--|--------|----------|
| Printed Ballot & Scanner | After the ballot printed, one voter responded "Neat!" | ICX | Positive |

Problems

| Function | Observation | System | Severity |
|----------------------------------|---|---------|-----------------|
| Setup for Voters | Concern about the power requirements (marker and printer use separate power cords) and confused cables for tactile keypad, speaker, switches, and headphones with power cords. Counties will need to ensure polling locations have enough outlets available, and they will need to think of strategies to contain the cords. | ICX/ICP | Annoyance |
| | This machine has a lot of additional parts: memory cards, voter cards, access keys. | ICX/ICP | Annoyance |
| | "Seems like a lot of parts to the process. Our voters will get confused." | ICX/ICP | Annoyance |
| | Poll workers were concerned if their county did not switch to an electronic poll book, then they would have to have another system to create voter cards on demand. | ICX/ICP | Annoyance |
| | Poll workers felt that early hands-on exposure to the machines should be provided several weeks before the election, so that voters could become familiar with the process. | ICX/ICP | General comment |
| Privacy | Because of the large screen size and clear print, some voters were concerned about privacy. It was easy to read the display from several feet away. | ICX/ICP | Annoyance |
| | When privacy cover is used on ballot, the ballot cannot be inserted to the bottom of the sleeve. The top of the ballot must be outside the sleeve for the scanner to pick it up. | ICX/ICP | Annoyance |
| Orientation and Navigation | For one contest on the sample ballot, (County Commissioner), the down-contest candidates are not visible on the initial screen. If it were indicated that there were "X Candidates" in total, the voter would be cued to scroll down to find them. | ICX | Problem solving |

| Function | Observation | System | Severity |
|----------------------------------|---|--------|---|
| Orientation and Navigation | If a voter wants to quickly vote straight party, the system allows selecting straight party, then review, then print. In this process, however, the voter is never presented with the ballot questions. If they do not review their ballot entirely, they receive no warning that any non-partisan contests are blank. | ICX | Problem solving |
| | As part of the overvote protection, the additional candidates or options are greyed out once the maximum number of selections has been reached. However, this means that the audio does not announce the additional candidate names. This could lead to a voter missing a desired candidate. | ICX | Likely to prevent independent voting for voters with some disabilities |
| | When using the audio, the straight party button is present in all contests. Every blind voter got stuck on this button and the instructions are unclear as to what the button is or how to navigate away from it. | ICX | Needs Assistance |
| | No blind voter was able to do the write-in process without some assistance. Most navigated to the box where the name appears, and stopped. No instructions describing the process are available. Once the voter pressed the down or right arrow buttons enough times, they discovered the keyboard, and oriented themselves within the layout. | ICX | Needs Assistance |
| | It is not obvious that to change your vote, you have to deselect the chosen candidate to bring back the check boxes on the other candidates. | ICX | Problem Solving |
| Orientation and Navigation | In ballot contests, the keypad navigation wraps from bottom to top, but not from top to bottom. In dialogs, the navigation wraps both ways. This inconsistent behavior can be confusing, and results in inefficient operation. | ICX | Problem Solving |

| Function | Observation | System | Severity |
|----------------------------------|---|--------|-----------------|
| | On contests that have a number of votes allowed, there must be the same number of write-in opportunities. When navigating by audio, each of these is announced as "Write- in" with no variation in speech. For those depending on this feedback, it is not clear that they are moving through different selections on the ballot. A voter recommended that it say "Write in #1, Write-in #2" to clarify this. | ICX | Problem Solving |
| | One voter accidentally selected the ballot "Review" button rather than "Next," after making the first selection in a contest. | ICX | Problem Solving |
| | There are four ways to insert the card, only one of which works. For a blind voter, the activation card does not have an indication of the correct orientation. (Only the visual display provides instructions). Although all of our blind voters were able to feel the integrated circuit on the card, some instruction is needed on how to insert the card. One voter suggested a small Braille dot on the card as a cue. | ICX | Problem Solving |
| | At the top of the display at all times there are controls for text size, contrast, and language. For AT users to navigate to these controls, they must press "Select" while the contest title is active, then they can scan through the settings. Used in this way, the select button is inconsistent between selecting choices and navigation, which will be an issue for those with cognitive disabilities. Some blind voters were tripped up by this. | ICX | Problem Solving |
| Orientation and Navigation | Sighted voter felt that the instruction for the number of available votes (Vote for N) should be larger, and spaced down from the contest title. | ICX | Annoyances |
| | A sighted poll worker was surprised when the "Next" button changed to "Review." Suggested "End of Ballot" message. | ICX | Annoyances |

| Function | Observation | System | Severity |
|-----------------------|--|--------|-----------------|
| | While reviewing the ballot, the voter can jump back to individual contests and make changes. The review ballot button, to return to the review process always returns to the top of the ballot. On long ballots, with voters who make multiple changes, this is an unnecessary burden. | ICX | Annoyances |
| | If the voter is looking at the second contest on a single screen, making the text larger can cause that contest "disappear." It actually moves to the next page, but that isn't obvious. | ICX | Annoyances |
| | Poll worker (retired user interface designer) indicated that there should be more space between "Scroll down" and "Print" buttons on the review screen. He accidentally pressed it a few times. | ICX | Annoyances |
| | The Up/Down and Left/Right buttons on the tactile keypad perform the same navigation. Once voters discovered it, they used only one set of buttons. | ICX | Annoyances |
| | Several voters and candidates attempted to navigate by swiping, it is not enabled on this system. | ICX | Annoyances |
| | For voters using the dual switch input, on contests with many candidates, the "Next" button requires many, many button presses. It can cause voters to overshoot their target, and have to do it again. | ICX | Annoyances |
| | When text is enlarged, text size stays the same in alert messages in a different window. | ICX | Annoyances |
| Audio Instructions | Ballot header instructions are centered. When instructions are longer than a few words, the justification can chop up sentences strangely. | ICX | Annoyances |
| | Blind poll worker said "Oh!" In response to the content voice. Then said, "Oh, that's terrible!" | ICX | Problem Solving |

| Function | Observation | System | Severity |
|-----------------------|--|--------|-----------------|
| | The voice used for the audio feedback was described by voters as "crappy" and "rinky- dink." Truncates words at high speeds. The word "write-in" was rendered as "ret." | ICX | Problem Solving |
| | The rate range of the content voice (difference between slowest and fastest rate) was much higher than the instruction voice. When adjusting, the voter can only hear the instruction voice, so may require several tries to get the voice to a desired rate. | ICX | Problem Solving |
| | The audio instructions are repeated too quickly after pausing on a selection, and they are repeated too often after each navigation. | ICX | Problem Solving |
| | "The audio instructions are needlessly complicated." | ICX | Problem Solving |
| | "The [audio] instructions are kind of confusing." | ICX | Problem Solving |
| | Blind voters indicated that they wanted a verbosity control for the audio instructions. "Give me detailed instructions the first time, then shorter after that, but let me get full instructions again if I need them." | ICX | Problem Solving |
| | Several voters indicated that they wanted contextual help, not a repeat of the instructions for the tactile keypad when pressing "Help" | ICX | Annoyance |
| | After going through the instructions for the keypad, the voter asked, "How do I get out of here." It wasn't clear that pressing the "Select" button ended the instructions and moved back into the ballot. | ICX | Problem Solving |
| Audio Instructions | At the ballot header screen, the audio instructions do not say what to do to enter the contests. Voters repeatedly got stuck. | ICX | Problem Solving |

| Function | Observation | System | Severity |
|----------|---|--------|------------------|
| | The straight party button at the beginning of every contest confused all of the voters. The audio announces it as "Selected straight party candidate republican" and then immediately beings to give instructions on how to select the button. | ICX | Problem Solving |
| | The straight party button audio instructions are confusing to voters. The visual version is confusing as well. (See more in Alerts section below.) | ICX | Problem Solving |
| | When you override a straight party vote, the audio still announces the straight party button as "selected straight party" even though none are selected. | ICX | Problem Solving |
| | One blind voter was confused by the audio instructions. When the machine instructed her to press the "right" button, she interpreted this as the right-hand button, not the right arrow under her left hand. | ICX | Problem Solving |
| | When the blind voter hit the wrong button on the "Review Screen" button, and moved to the top of the contest, "I doesn't tell me that I didn't go to the review. It takes me back to the top." | ICX | Problem Solving |
| | All blind users reselect candidates selected by straight party choice. This could suggest that the cue that they are selected is not strong enough. | ICX | Problem Solving |
| | In the testing process, the voter was instructed to vote for the candidate that was endorsed by both parties. On first pass, this was missed because the pause between "Republican" and "Slash" made it sound as if only one party was involved. | ICX | Needs Assistance |
| | There are no audio or on-screen instructions for any of the other assistive devices (buttons, sip-and puff). | ICX | Needs Assistance |

| Function | Observation | System | Severity |
|--------------------------|---|--------|---|
| Straight Party Voting | Once a voter chooses a straight party option, the system will not let them abstain from a partisan contest. It gives the voter an alert that says that even though the contest is blank, the candidates that match the straight party will be selected. (See more in the Alerts section below.) | ICX | Likely to prevent independent voting for voters with some disabilities |
| | Overriding a straight party vote deselects the straight party selections. In contests where the Vote for N number is greater than the straight party candidates, voters tried to select additional candidates, but had to reselect straight party candidates. | ICX | Problem Solving |
| | If you have overridden your straight party vote in any contest, the system will not allow you to cancel your straight party choice without de-selecting the out-of-party votes. All voters who tried to cancel their straight party had to ask how to do it. | ICX | Needs Assistance |
| | Voters complained that the system seemed to require a straight party vote. They thought it should have instructions indicating that if they do not want to vote straight party, they should select "Next." | ICX | Problem Solving |
| | Some voters thought that the straight party option selected the party's ballot, as in the primary. Poll workers independently reported the same concern, even they knew the function. Both groups said the instructions were unclear. | ICX | Annoyances |
| Alerts | The wording of the alerts is not good. Some language was too high level. One message uses the word "implicit." | ICX | Problem Solving |

| Function | Observation | System | Severity |
|----------|---|--------|-----------------|
| Alerts | Alert: If left blank, this contest will have implicit choice selections for party [straight party choice] appeared in any contest where a voter made no candidate selection. Most voters and poll workers had no idea what this meant. | ICX | Problem Solving |
| | One poll worker said "This will get us sued. Voters will say that 'You changed my vote!'" in response to the "implicit" alert in a blank straight party contest. | ICX | Problem Solving |
| | Most alerts begin with "Warning" which voters and poll workers found too overbearing. | ICX | Problem Solving |
| | One blind vote indicated "I don't like 'warnings.' I would like to have information about how to proceed or correct an error." | ICX | Problem Solving |
| | The poll workers did not like "warnings." They preferred information about options to fix them. | ICX | Problem Solving |
| | When no selection is made in the straight party contest, the system generates a message "Warning, this contest is left blank!" Voters thought they had to make a selection. | ICX | Problem Solving |
| | The straight party cancel alert language and button labels are overly confusing. This is especially true in the audio instructions. | ICX | Problem Solving |
| | The straight party audio instructions are too wordy and complicated. It asks the voter to "select 'Confirm' to cancel or 'Cancel' to cancel." | ICX | Problem Solving |
| | Many voters thought that the undervoted contests warning implied that they were required to vote for the maximum number of candidates. | ICX | Problem Solving |

| Function | Observation | System | Severity |
|---------------------------------|--|--------|---|
| | On the review screen, a poll worker questioned the location of the message that "Your ballot is valid, but you have warnings." Rather than being located at the top of the screen, she suggested that it be placed between Scroll Down and Print. She said she almost missed it. | ICX | Problem Solving |
| | On the review screen, a poll worker thought it would be better if the alert icons could be touched for more information and options. | ICX | Problem Solving |
| Printing/Ballot Verification | After you press "Print" at the bottom of the screen, the alert window warns you that you are about to "Cast" your ballot. This action does not cast your ballot. | ICX | Likely to prevent independent voting for voters with some disabilities |
| | After you print your ballot, the machine displays a message "Thank you for voting! Your ballot is successfully cast." This action does not cast your ballot. | ICX | Likely to prevent independent voting for voters with some disabilities |
| | Poll workers reported that the "your ballot is cast" language will be a problem because voters might leave without putting their ballot in the scanner thinking it is their receipt. | ICX | Needs assistance |
| | Poll workers thought that the final screen should instruct voters to take their ballot and their voter card to the scanner. | ICX | Likely to prevent independent voting for voters with some disabilities |
| | The printed ballot reports undervoted contests as "UNDER_VOTE_BY_N" where N is the number of positions still available. The ballot review screen does not do this, which means it is not announced to visually impaired voters using the audio assistance | ICX | Likely to prevent independent voting for voters with some disabilities |
| | Printed ballot displays no straight party selection as being "Blank contest." | ICX | Problem Solving |
| | Alerts on printed ballot not informative and confusing. Poll workers thought that voters might think something is wrong since the ballot review screen said something different. | ICX | Problem Solving |

| Function | Observation | System | Severity |
|--------------------|---|--------|---|
| | One voter suggested printing arrows at the top of the ballot to match those on the scanner, indicating the correct alignment. Even when the scanner accepts the ballot in all orientations, this provides a hint that will reduce confusion. | ICX | Annoyances |
| | One poll worker suggested that the printed ballot should look more like the historical paper ballots. | ICX | Annoyances |
| Write-In Screen | Using the audio, when a typo is being corrected, the letter just deleted is not announced. This makes it difficult to impossible to know where you are in the process. | ICX | Problem solving |
| | Using the audio, when deleting characters to correct a misspelling, the audio feedback is "Delete" but does not announce the letter being deleted. | ICX | Likely to prevent independent voting for voters with some disabilities |
| | When the voter leaves the Write in screen, the audio instructions say "You have written in " and spells the name entered. However, it does not voice the space, so the voter may think that they failed to enter it. "It didn't tell me I had a space. I know I put one in." when writing in a candidate using the audio assistance. | ICX | Likely to prevent independent voting for voters with some disabilities |
| | No blind voter was able to complete the write- in process without some coaching to continue moving down the write-in page until they found the alphabet. Once they found the alphabet, they were able to proceed quickly. | ICX | Needs Assistance |

| Function | Observation | System | Severity |
|--------------------|--|--------|---|
| | When writing in a candidate using the audio, each letter typed is spoken. If the user pauses, the last audio information is repeated. If the letter is entered again, (for names with double letters), the spoken feedback sounds exactly the same as the repeated feedback from the last entry. There is a high risk of inadvertent doubles or single letters. Repeated feedback and new feedback should sound different. | ICX | Likely to prevent independent voting for voters with some disabilities |
| | No blind voter was able to complete the write- in process without some coaching to continue moving down the write-in page until they found the alphabet. Once they found the alphabet, they were able to proceed quickly. | ICX | Needs Assistance |
| Write-In Screen | In standard mode, once you have entered a write-in, you cannot correct it because touching it deselects it. Then when you go back into the write-in screen, it has removed the entry. | ICX | Problem Solving |
| | The page for write-in candidates doesn't actually provide instructions on how to do the write-in. This is true for standard mode and audio instructions. Audio voters must continue to press down or right to get beyond the text box and editing buttons to find the keyboard. | ICX | Problem Solving |
| | While using the audio, one blind voter suggested that she might use Help to figure out how to use the Write-In Screen. Help only repeats the instructions for the keypad, and does not provide contextual help as expected. | ICX | Problem Solving |
| | "It doesn't tell you how to do a write-in, does it? You would never know to press down again." | ICX | Problem Solving |
| | "OK, I guess I have to go all the way to the end," said one voter when trying to find the write-in screen keyboard in audio mode. | ICX | Problem Solving |

| Function | Observation | System | Severity |
|----------------------|---|--------|------------|
| | When navigating the keyboard, the "period" key is announced as "dot." While this makes sense in some applications, names include periods, not dots. | ICX | Annoyances |
| | Poll Workers: Expected QWERTY layout for on- screen keyboard, but when saw that switch access scanned in order, saw the logic of the layout. | ICX | Annoyances |
| Assistive Devices | Poll workers felt that the keypad has too many buttons. | ICX | Annoyances |
| | The "Left/Right" and "Up/Down" buttons do exactly the same thing. Why are they both included? | ICX | Annoyances |
| Assistive Devices | There is no dedicated button on the tactile keypad to move to the next contest. | ICX | Annoyances |
| | The help button of the tactile keypad repeats the instructions for how to use the keypad. Blind voters suggested context help on the contests, indicating how to write in a candidate, how to select candidates, etc. | ICX | Annoyances |
| | The headphone and switch ports on the tactile keypad have no Braille markings, and are very difficult to see for sighted voters. | ICX | Annoyances |
| | If a voter chooses any assistive device, the touchscreen remains active, but each selection must be touched twice. | ICX | Annoyances |
| | When used for long ballots, the buttons tend to slide. A person who needs to use the paddle switches may not be able to effectively reposition them. They should be provided with small non-slip pads to hold them in place more strongly. | ICX | Annoyances |
| | The colors of the button switches (red and blue) were taken to indicate party affiliation. The buttons are provided with green and yellow caps as well, and non-partisan colors should be used. | ICX | Annoyances |

| Function | Observation | System | Severity |
|----------|---|--------|------------|
| Scanner | The scanner provides no audio feedback to the blind voter. | ICP | Annoyances |
| | Scanner screen very hard to read at all, impossible from seated position | ICP | Annoyances |
| | Entry tray for ballots is very small – not long enough to support the entire ballot | ICP | Annoyances |
| Scanner | Memory cards for poll workers are very small – hard to handle – dexterity problems handling them. But at least not the teeny tiny ones (Compact Flash cards rather than SD cards) | ICP | Annoyances |
| | "All that [absentee] paperwork after the election [is gone]. Whoopee!" One poll worker said after realizing they could scan absentees instead of tallying them by hand. | ICP | Annoyances |

Top positives

The expert examination, voter experiences, and poll worker sessions recognized several positives of these voting systems.

Independent voting

Generally, voters were able to complete their ballot on the ICX and ICP independently, once the facilitator/poll worker provided them with the appropriate accessibility features. No one found the system so difficult or frustrating that they were unable to vote, although several participants identified features that they felt would frustrate less competent voters.

Access features easily learned and helpful

As voters explored the access features, they seemed to learn them relatively easily. Most of the voters use similar assistive devices daily or when they vote.

After a very brief overview of each machine, the facilitator asked poll workers to demonstrate that they understood the function of each access feature by offering the appropriate option to the roll-play voter. Poll workers set up the machines successfully with minimal help – a reasonable outcome for an initial introduction to the system.

All four poll worker groups reported that the access features would help voters who already visit their location on Election Day. They also agreed that these features would likely assist other voters with disabilities that do not currently come to the polls on Election Day.

Default text size

The default text size was large enough for most of the participants. Once the voters discovered the settings button and options, they could easily change the font size. Only one voter required a larger font size to read the screen more easily.

Visual interface clean and intuitive

The examiners observed that the visual interface had aspects that would be intuitive to voters. Some voters echoed this as they experienced the machines, and others demonstrated the good design through use.

- **Selection behaviors.** As voters make selects, the screens behaved as expected for a modern touch interface.
 - Candidate selection. Selecting options within each contest was intuitive for voters. Touching the option once put a mark in the box for that candidate. Touching again removed the mark. Straight party votes were cleanly marked in each contest.
 - Overvoting. When voters have selected the maximum number of available candidates in a contest, the remaining candidates grey out. In this state, they are visible to the voter, but the voters are unable to select them. This behavior is not mirrored in the audio, though, and is a major problem for audio users. More discussion on this issue can be found in the problems section.
 - Undervotes. If voters have not selected the maximum number of allowed candidates in a contest, the candidates remain highlighted and available for selection. Visually, this becomes a noticeable pattern and voters quickly learn in which contests they could select additional candidates.
 - **Straight party.** If the voter selected a straight party option at the beginning of the ballot, the system placed a button just below the contest header and instructions in each partisan contest. This was an intuitive reminder to the voters that they had voted straight party.
- Furthermore, If the voter had selected a straight party option, the system did not grey out the remaining candidate names, but the matching straight party candidates had a check next to them. Voters who understood the straight party method seemed to understand

that they could make changes if necessary, but did not need to make additional selections.

• Alerts structure. While marking the ballot, if the voter left a contest blank or undervoted in a contest, for example, the system would alert the voter. The alerts were generally well placed and formatted in a way that makes sense to the voter. Also, if the voter wanted to change a straight party selection, the system alerted the voter in a new differently formatted tile. The same is true right before they printed the ballot.

All this said, the text in the alerts is small and the wording used in the alerts *was not* good and will be discussed in the problems section below.

• **Review screen.** The review screen was formatted well and generally intuitive. For any contest that was blank or undervoted, the system provided an alert and the label "No selection made" for each of the available candidate spots. This made it easy for voters to recognize how many selections they could make.

Printed ballots verifiable and accessible

The ICX prints the ballot selections on an 8.5 x 11-inch piece of heavy weighted paper. The text is small but could be read by all the sighted voters. They all agreed that this satisfied verification for them.

Voters with low-vision, however would not be able to read the printed ballot without a magnifier or other assistive technology. The print on the ballot was much smaller than the on-screen tex.

Three of the blind voters were able to use a phone-based app that took a picture of the ballot and then read its contents back to them. Each of the voters who used this option were satisfied with this as the verification step.
Accessibility report for Dominion ICX 5.1.7 Ballot Marking Device

The Pennsylvania Department of State identified the following features of the Dominion ICX 5.17 to be reviewed for accessibility:

- Added support for Provisional Voting with ICX BMD
- Added support for ICX BMD to produce a Uniform Ballot
- Added ability to configure the number of columns a contest should occupy on the ICX screen
- Added ability for text size selected on the screen to be used to print the QR ballot

The accessibility reviews were conducted by reviewing the recording¹ of a Dominion representative's introduction to the new system features. Dominion also answered questions about those features to clarify how they work. Each feature is discussed below.

Added support for Provisional Voting with ICX BMD

As a ballot marking device that produced a printed ballot, using the ICX for provisional voting relies on procedures in the polling place to ensure that the ballot is cast in the proper manner for a provisional ballot.

In answer to a question, Dominion reported that:

- The activation card produced when the voter checks in identifies the session as provisional.
- When activated, the device displays a code that a poll worker records.
- Once this is done, the ballot marking session is the same as any other session, with full use of accessibility features and the audio ballot.
- After the ballot is printed, the poll worker completes the local procedures for placing the provisional ballot in an envelope and completing any paperwork associated with the procedures.

Based on this description, all voters, with or without disabilities, are monitored by a poll worker to be sure the provisional procedures are completed correctly. The critical ballot marking portion of the voting session is completed in the same way as any other voting session. This means that there is no loss of accessibility features and that voters with disabilities can mark and print a provisional ballot with the same independence and privacy as other voters.

¹ Dominion Public Examination Recording <u>https://youtu.be/KJhPtzojBK8</u>

Added support for ICX BMD to produce a Uniform Ballot

In this new feature, at the start of the voting session (after selecting a language, if that is an option in the jurisdiction), the screen displays an image of a blank optical scan ballot for the selected ballot style. At the end of the ballot marking part of the voting session, the printed ballot is a facsimile of the optical scan ballot with the voter's choices marked on the ballot. This is a configurable feature that can be selected by the jurisdiction.

In reply to a question, Dominion says that this image is simply a preview of the ballot to be printed and that there is no audio preview of the ballot contents. Dominion says that this feature has been enabled and used in other elections, but has not done any usability tests of the feature.

It is unclear what the audio interface for this display is. Dominion said, "Since no selections can be made on this screen, there are no written or audio instructions. There is no explicit label indicating this is a ballot preview."

The preview may be multi-page. There are regular navigational buttons (Preview, Next, and "Start Voting) at the bottom of the screen, and scroll buttons (left and right arrows) in the middle of the screen. These controls are voiced by the audio interface."

As shown in the Public Examination Video and described above, this feature is not accessible for voters with all disabilities.

- The ballot preview screens at the beginning of the session have accessibility gaps for voters with visual and cognitive disabilities that may keep them from understanding the content of these screens.
 - There is no explanation about what the voters using the audio ballot will hear about the ballot preview if anything
 - It is not clear if any voters, especially those with cognitive disabilities, will understand why the preview is being shown.
 - It is not clear if there is a zoom capability for low vision. (The controls listed include a scrolling ability, but it is not clear what these controls do.)
- The printed ballot will produce a facsimile of a hand-marked optical scan ballot, rather than a list of voter selections. This means that voters with disabilities that prevent them from seeing and interpreting the optical scan marks may not be able to effectively review their printed ballot before casting it.

This feature should not be allowed for use in Pennsylvania without successful usability testing with voters with disabilities.

Added ability to configure the number of columns a contest should occupy on the ICX screen.

The best practice for ballot marking devices is to present one contest on the screen at a time. This enables voters to focus on each contest in turn and reduces the possibility that they will skip a contest because they do not notice it on a screen with two or more contests

When only one contest is presented at a time allowing the candidates in a contest to be placed on the screen in more than one column is an acceptable solution to reducing the need to scroll to see all options in a large field of candidates. This assumes:

- The system has a way of displaying the contest at the largest text size. This might mean using only a single column when there is not enough space to display the longest candidate names without breaking them.
- The order of navigation among candidates follows the jurisdiction's prescribed ballot order.
- The system still includes a way to scroll the screen to display more selections, when needed.

The description did not say whether the screen navigation order goes across the rows, or up and down the columns (newspaper-style). In general, moving across rows before moving down the screen might be more usable, especially in cases where screen scrolling is still needed.

This feature does not have obvious accessibility problems, but usability testing might be helpful in providing counties with guidance about using it and explaining the interaction in voter education.

Added ability for text size selected on the screen to be used to print the QR ballot

This addition to the accessibility features will help voters who need large text to read the screen to also be able to review their selections printed on a "QR ballot" at the same size.

XI. Attachment C- Acceptance Testing Attestation





Voting System Implementation Attestation

System Name: Democracy Suite 5.17

County: _____

Date Installed/Upgraded:

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

| System Component | Softwar e or Firmwar e Version | Hardware Version | Model | Comments |
|-----------------------------|--|---------------------|-------|--|
| Election Event Designer | | | | (Please specify the implementation, single device (desktop/laptop), Client/server) |
| Results Tally and Reporting | | | | |
| Application Server | | | | |
| File System Service | | | | |
| Audio Studio | | | | |
| Data Center Manager | | | | |
| Election Data Translator | | | | |
| ImageCast Voter Activation | | | | |
| Adjudication | | | | |

| Adjudication Service | | |
|----------------------------|--|--|
| Smart Card Helper Service | | |
| ImageCast Precinct(ICP) | | |
| ImageCast Precinct 2(ICP2) | | |
| ImageCast Central(ICC) | | |
| ImageCast X(ICX) | | |

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 Democracy Suite 5.17 system. Any ancillary components sold under this contract, such as switches, ballot boxes, and charging carts, are EAC-certified components of the Democracy Suite 5.17 voting system. (Attach a list of all ancillary components sold under this contract.)

Dominion also has validated that the system components have been installed and hardened in accordance with the EAC-certified system hardening instructions, and that no software other than the voting system software has been installed on any of the components.

Dominion and the county confirm that the system implementation adheres to the conditions of certification identified in the Secretary of the Commonwealth's system certification report dated "XX/XX/XX" (the "Report"), and that any deployment of the system for election activities will follow all conditions set forth in the Report.

| Vendor Representative Signature: | | |
|----------------------------------|---------|--|
| Vendor Representative Name: | Title: | |
| Telephone: | Email:_ | |
| County Representative Signature: | | |
| County Representative Name: | Title: | |

XII. Attachment D - Minimum Training Requirements

Dominion 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.
- B) A training session on the Voting System's election management system and/or EPBs 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 Dominion'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:
 - a. programming of all voting units and ancillary devices;
 - b. tabulating results during the unofficial and official canvass;
 - c. ensuring accuracy and integrity of results;
 - d. preparing polling places and setting up the system for election day operation;
 - e. Training on accessibility options of the voting system;
 - f. Election day operating procedures;
 - g. auditing procedures;
 - h. conducting a recount;
 - i. preserving records;
 - j. printing, designing, and formatting election reports;
 - k. troubleshooting common issues;
 - safeguarding and preventing tampering and unauthorized access to all parts of the Voting System; and
 - m. Post-election care, maintenance, and storage.
- D) Any and all system manuals necessary to allow a purchasing county to operate the Voting

System independently of the Dominion's assistance and support.

 E) Training materials for a purchasing county's 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.

XIII. Attachment E – Escrow Obligations

Dominion 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 subject to the conditions specified below in Section D(8)(d). Dominion must pay all costs associated with 1) placing the codes in escrow and 2) verifying that Dominion 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 jurisdictions, Dominion 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 Dominion, Dominion 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 Dominion.
- 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. Dominion shall provide a copy of the escrow agreement to the Department for review prior to execution of the agreement and depositing of any source code.
- d. Obtaining source code. Dominion agrees that upon the occurrence of any event or circumstance which demonstrates with reasonable certainty the inability or unwillingness of Dominion to fulfill its obligations to Commonwealth under this Contract, Commonwealth shall be able to obtain the source code of the thencurrent source codes related to Voting Systems software, EPB software, and/or any Dominion Property placed in escrow from the escrow agent.