



*Report Concerning the Examination
Results of Hart InterCivic Verity Vanguard
1.0 with Vault Precinct Scanners, Flex and
Adapt Ballot Marking Devices, Capture
Central Count Tabulator, and Vanguard
Workspace EMS*



Issued By:

A blue ink signature of Al Schmidt, written in a cursive style, positioned above a horizontal line.

Al Schmidt

Secretary of the Commonwealth

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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 Pennsylvania Election Code.

Upon request of Hart InterCivic Inc. (Hart), the Department of State's Bureau of Elections (Department) scheduled an examination for December 1, 2025, and supplemental examination for March 31, 2026, of the Verity Vanguard 1.0 (Vanguard) voting system. The voting system presented for certification in Pennsylvania included the Vanguard Workspace election management software used in conjunction with the following components:

- 1) Vanguard Vault (Vault) precinct scanner;
- 2) Vanguard Flex (Flex) ballot marking device;
- 3) Vanguard Adapt (Adapt) ballot marking device;
- 4) Vanguard Capture (Capture) central scanner;

The Secretary appointed Pro V&V, Inc. as professional consultants to conduct the functional examination and security testing of Vanguard 1.0. The examination process included a public demonstration, functional examination, and security testing. Whitney Quesenbery led a team of two other examiners with usability and accessibility experience from the Center for Civic Design, serving as the accessibility examiner for the evaluation of the Vanguard 1.0 system.

The functional examination was performed in Room 114/OA Training Room of the Keystone Building at 400 North Street, Harrisburg PA 17120, adjacent to the Capitol Complex. Jack Cobb, Laboratory Director, and Ryan Wilson, Project Manager, both of Pro V&V's Voting Systems Test Laboratory (Functional Examiner) conducted the functional examinations of Vanguard 1.0 pursuant to Section 1105-A(a) of the Pennsylvania Election Code, 25 P.S. § 3031.5(a). The initial examination commenced on December 1, 2025, and lasted approximately three days. The supplemental examination commenced on March 31, 2026, and lasted approximately 2 days. In attendance during the examinations were the following additional persons:

- Sindhu Ramachandran, Election Systems Strategist, representing the Secretary of the Commonwealth;
- Casey Brady, Voting Systems Analyst, representing the Secretary of the Commonwealth;
- Brandon McCulloch, Elections Analyst, representing the Secretary of the Commonwealth;
- Dan Grosser, Certification Manager, representing Hart InterCivic;
- Tyson Gosch, Senior Certification Project Manager, representing Hart InterCivic;

- Elisabeth Spring, Certification Project Manager, representing Hart InterCivic;
- Jen Moreci, Director of Product Management; representing Hart InterCivic; and
- Alec Cordova, Senior QA Engineer, representing Hart InterCivic.

Additional staff members from the Department also attended portions of the examinations. The functional and accessibility 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/agencies/dos/resources/voting-and-elections-resources/voting-systems>). The accessibility examinations of the Vanguard 1.0 system were performed in-person after the completion of the initial and supplemental functional examinations. Pro V&V Labs, serving as the security examiner, conducted a security analysis of the Hart Verity Vanguard 1.0 system. The examiner reviewed the security testing reports, including the Hart InterCivic Verity Vanguard 1.0 Penetration Test Report (HIN-23004-PTR-01, dated May 7, 2024) and the Penetration Test Report for Verity Vanguard 1.0 (dated December 19, 2025), which were prepared as part of the VVSG 2.0 certification process, and used the vulnerability and risk assessment results to guide attempted exploitations.

II. The Verity Vanguard 1.0 Voting System

Vanguard 1.0 components considered for use in Pennsylvania provide a paper-based optical scan voting system that provides end-to-end election support; from defining an election to generating final reports. The system is comprised of both precinct and central count tabulators and ballot marking device components to satisfy Americans with Disabilities Act (ADA) requirements. The following is a description of Vanguard components summarized from the System Overview section of the Functional Examiner's Test Report (TR-01-03-PA-001-HART-01) and the Vanguard System Overview document submitted by Hart as part of the Technical Data Package (TDP).

A. Verity Vanguard Workspace

Verity Vanguard Workspace is an Election Management System consisting of an interactive set of applications which are responsible for all pre- and post-voting activities necessary for defining and managing elections. This includes ballot design, proofing, and layout, ballot production, and election media creation, as well as capture, adjudication, storage, and publishing of election results. Vanguard Workspace is composed of the following hardware and software components:

- Verity Vanguard Define: An Election Management System software component used for creating and generating election definitions and ballots. This includes ballot design, ballot proofing, ballot layout, and ballot production.
- Verity Vanguard Deploy: An Election Management System software component used for creating portable media used to load the election files onto Vanguard voting devices.
- Verity Vanguard Results: An Election Management System software component used for tabulating election results, generating results reports, resolving write-in votes captured from paper ballots, and collecting and storing all election logs from every Vanguard device used in an election.
- Verity Vanguard Workspace workstation: A COTS (Commercial-Off-The-Shelf) hardware desktop workstation that hosts the Vanguard Define, Deploy, and Results EMS applications.

B. Verity Vanguard Vault

The Verity Vanguard Vault tabulator is a precinct-count ballot scanning solution suitable for early and election day in person voting, including processing ballots printed by the Verity Vanguard Flex and Verity Vanguard Adapt ballot marking devices. It also has a touch screen for voter communication and ballot review, an integrated thermal printer for printing reports, and a hot-swappable internal battery backup. The Verity Vanguard Vault application runs on the precinct tabulator, and is used to scan, count and tally marked ballots.

C. Verity Vanguard Flex

Verity Vanguard Flex is an accessible paper-based ballot marking device that provides touch screen vote or assistive device navigation and capture that incorporates the printing of the voter's selections on an independent voter-verifiable paper ballot using a thermal printer to be scanned for tabulation in the Verity Vanguard Vault or Capture tabulators. Following printing, the voter must cast the ballot using a tabulator such as the Vault.

D. Verity Vanguard Adapt

Verity Vanguard Adapt is an accessible paper-based ballot marking device that produces an auditable, summary ballot of a voter's choices. It offers the same touch screen and assistive device navigation features as the Verity Vanguard Flex but also includes an automated paper feeding system which carries the ballot into a built-in ballot box. Voters can mark their ballots using the touchscreen interface or accessible controls, including the use of personal assistive devices. Vanguard Adapt enables voters to mark, verify, and deposit their ballot in the ballot box, all without touching a piece of paper. Ballots are deposited directly into Adapt's built-in ballot box but must be transported by precinct election officials after close of polls to be tabulated in the Verity Vanguard Vault at the precinct or centrally tabulated using Verity Vanguard Capture tabulators.

E. Verity Vanguard Capture

Verity Vanguard Capture is a high-speed central scanner coupled with ballot processing applications that scan and tabulate hand-marked paper ballots and/or machine-marked paper ballots from the Verity Vanguard Flex and Adapt devices. The Verity Vanguard Capture software runs on unmodified COTS desktop computers running the Windows 10 Enterprise 2021 Long-Term Servicing Channel operating system and supports specific models of scanners. All components are unmodified COTS that are connected via a wired, closed, and isolated network not connected to any other systems or the Internet

Verity Vanguard Capture consists of the following subcomponents:

- Verity Vanguard Capture workstation: A desktop workstation which hosts the Verity Vanguard Capture application.
- Canon DR-G2110 High Speed Scanner: A high-speed COTS scanner used to convert voter selection marks into Cast Vote Records (CVR), which are later tabulated in the Verity Vanguard Results application.

F. Verity Vanguard Boost

Vanguard Boost is a poll worker-facing device to improve voter service by optimizing ballot issuance in the polling place. Vanguard Boost can be utilized by poll workers to either print a blank paper ballot on demand using an attached ballot printer, or to issue VotePasses to allow voters to access, mark and print printed vote record using Verity Vanguard Flex. The Vanguard Boost does not store vote data, does not contain any networking hardware, and is void of wired or wireless network hardware.

G. Manufacturer Software and Firmware

The Verity Vanguard 1.0 voting system consists of the following proprietary software and firmware components:

Application	Software or Firmware Version
Verity Vanguard Define	1.0.1
Verity Vanguard Deploy	1.0.1
Verity Vanguard Results	1.0.1
Verity Vanguard Vault	1.0.1
Verity Vanguard Adapt ¹	1.0.1
Verity Vanguard Flex	1.0.1
Verity Vanguard Capture	1.0.1
Verity Vanguard Boost	1.0.1

H. Manufacturer Hardware

Below is a high-level listing of the proprietary hardware components that comprise the entire system categorized by system functionality:

Hardware	Hardware Version
Vanguard Vault	A
Vanguard Flex	A
Vanguard Adapt ¹	A
Vanguard Boost	A

I. COTS Software and Firmware

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

¹ Verity Vanguard Adapt was included in the examination but is not certified for use in Pennsylvania.

III. Examination Approach

To ascertain whether Verity Vanguard 1.0 can be securely used by voters at elections in the Commonwealth and whether it meets all the requirements put forth in the Pennsylvania Election Code, the Examiners developed test protocols for the examination. The Examination was broadly divided into three categories; a Functional Examination, Security Testing, and an Accessibility Examination.

A. Functional Examination Approach

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 three main areas of test execution:

1) Physical Configuration Audit

The Physical Configuration Audit for this campaign was performed to establish a configuration baseline of software and hardware to be tested and confirm whether manufacturer's documentation is sufficient for the user to install, validate, operate, and maintain the voting system. The Functional Examiner validated compliance of the system to the following sections of the Pennsylvania Election Code during this review of Election Assistance Commission and Hart documentation:

- 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);
- 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;
- 25 P.S. § 3031.7(13), requiring an electronic voting system to correctly tabulate every vote;
- 25 P.S. § 3031.7(14), requiring an electronic voting system to be safely transportable;
- 25 P.S. § 3031.7(15), requiring an electronic voting system to be designed so voters may readily understand how it is operated;

2) Functional Configuration Audit

The Functional Configuration Audit (FCA) encompassed an examination to verify that the system hardware and software perform all the functions necessary to meet the defined requirements as set forth in the Pennsylvania Election Code. The system level hardware and software test cases were prepared independently to assess the response of the hardware and software to a range of conditions and validate compliance to the following sections of the Pennsylvania Election Code:

- 25 P.S. § 3031.1, requiring an electronic voting system to provide for a permanent physical record of all votes cast;
- 25 P.S. § 3031.7(1), provides for voting in absolute secrecy and prevents any person from seeing or knowing for whom any voter, except one who has received or is receiving assistance as prescribed by law, has voted, or is voting.

- 25 P.S. § 3031.7(2) - Provides facilities for voting for such candidates as may be nominated and upon such questions as may be submitted.
- 25 P.S. § 3031.7(5) - Permits each voter to vote for any person and any office for whom and for which he is lawfully entitled to vote, whether or not the name of such person appears upon the ballot as a candidate for nomination or election.
- 25 P.S. § 3031.7(7) - If it is of a type that registers the vote electronically, the voting system shall preclude each voter from voting for more people for any office than he is entitled to vote for or upon any question more than once.
- 25 P.S. § 3031.7(10) - If it is of a type that registers the vote electronically, the voting system shall permit each voter to change his vote for any candidate or upon any question appearing on the official ballot up to the time that he takes the final step to register his vote and to have his vote computed. If it is of a type that uses paper ballots or ballot cards to register the vote and automatic tabulating equipment to compute such votes, the system shall provide that a voter who spoils his ballot may obtain another ballot; any ballot thus returned shall be immediately cancelled and at the close of the polls shall be enclosed in an envelope marked "Spoiled" which shall be sealed and returned to the county board.
- 25 P.S. § 3031.7(12), requiring an electronic voting system to provide acceptable ballot security procedures and impoundment of ballots to prevent tampering with or substitution of any ballots or ballot cards; and
- 25 P.S. § 3031.7(16), requiring an electronic voting system which provides for precinct level tabulation to: (i) display a public counter of ballots entered for tabulation, visible from outside of the automatic tabulating equipment during operation, (ii) require a lock, or locks, by the use of which all operation of the tabulation element of the automatic tabulating equipment is absolutely prevented immediately after the polls are closed (iii) preclude every person from seeing or knowing the number of votes theretofore registered for any candidate or question and preclude every person from tampering with the tabulating element, (iv) preclude tabulation of an over-vote, and (v) print a record at the beginning of its operation that verifies that counters are set to zero before processing ballots, and print at the finish of its operation of the total number of voters whose ballots have been tabulated, the total number of votes cast for each candidate whose name appears on the ballot, and the total number of votes cast for, or against, any question appearing on the ballot.
- 25 P.S. § 3031.7(17), requiring an electronic voting system which provides for central count tabulation to (i) preclude tampering with the tabulating element during the course of operation, (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 report;

3) System Integration Testing

System Integration Testing is a system level test for the integrated operation of both hardware and software. The System Integration Test evaluates the compatibility of the voting system software components or subsystems with one another, and with other components of the

voting system environment. This compatibility was determined through functional tests integrating the voting system software with the remainder of the system. During test performance, the system was configured exactly as it would be for normal field use in an election environment. This included connecting all supporting equipment and peripherals including ballot boxes, voting booths (regular and accessible), and any physical security equipment such as locks and ties. System Integration Testing comprised the evaluation of the following requirements of the Election Code for compliance:

- 25 P.S. § 3031.7(4), requiring an electronic voting system to permit a voter to vote for candidates of all different parties, and write-in candidates;
- 25 P.S. § 3031.7(6), requiring an electronic voting system to permit a voter to cast votes for candidates and ballot questions he or she is entitled to vote for, and prevents a voter from casting votes the voter is not entitled to vote on;
- 25 P.S. § 3031.7(8), requiring an electronic voting system to prevent a person from casting more than one vote for a candidate or question, except where this type of cumulative voting is permitted by law; and
- 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.

B. Security Testing Approach

Security Testing provided a means to assess the required security properties of the voting system under examination and ascertain compliance with Pennsylvania Election Code requirements, including 25 P.S. §§ 3031.7(11), (12), (16) and (17) and PA Voting System Security Standard. Hart submitted test reports of the security evaluation and penetration testing completed as part of the federal test campaign to get the system certified to VVSG 2.0 standards. Pro V&V used findings from those reports to complete the required security testing activities for Pennsylvania. Pro V&V reviewed, Hart InterCivic Verity Vanguard 1.0 Penetration Test Report, report number HIN-23004-PTR-01 dated May 7th, 2024, and Penetration Test Report for Verity Vanguard 1.0, dated December 19, 2025. After reviewing the reports, Pro V&V used the vulnerability and risk assessment to then conduct attempted exploitations in the Pro V&V lab.

C. Accessibility Examination Approach

The accessibility examination was designed to provide insights into each voting system component's usability and accessibility with a strong focus on voters with disabilities, as well as how effectively the system could be deployed by poll workers and voters. The Accessibility Examination was administered by a team of three examiners with accessibility, usability and election process experience. The examination process was divided into three parts:

1) Expert Review by Accessibility Examiner

Expert review of the system was performed by the Accessibility Examiner, using scenarios based on personas of people with disabilities from the National Institute of Standards and Technology (NIST) and their professional experience.

2) Usability Review with Voters with Disabilities

Voters with disabilities used the system to complete the voting process on a reasonable length Pennsylvania ballot and completed a questionnaire about their experience. The Accessibility Examiner observed and made notes.

3) Election Process Experience with Poll Workers

Poll workers tested the accessibility features to evaluate how they would be activated during an election as part of a review of the system guided by the Accessibility Examiner. They commented on the system based on their experience.

IV. Examination Processes and Procedures

The procedures and processes used during the examination of Verity Vanguard 1.0 are listed in the sections below. The final recommendations contained later in this report are based on combined analyses of the results and conclusions from all examinations.

A. Functional Examination Processes and Procedures

Hart supplied all required equipment, including any software or firmware, to be tested during the examination. All trusted builds of the software and firmware of each device were installed using the appropriate media and methodologies for installation.

During the public examination, the hash codes for all components of the system were captured by the Functional Examiner with assistance from a Hart representative by using the process listed in the manufacturer's Technical Data Package (TDP). The Functional Examiner further compared all the captured hash codes to ensure they matched the hash codes for the EAC certified system executables before executing the test cases or continuing with the examination.

The initial public demonstration and functional examination portions of the test campaign commenced on December 1, 2025, in Room 114/OA Training Room 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 the hash validation component of the Physical Configuration Audit, all components of the Functional Configuration Audit and System Integration testing onsite during the public examination. The documentation review portion of the Physical Configuration Audit was completed prior to the public examination at Pro V&V test lab facilities in Huntsville, AL.

The supplemental public demonstration and functional examination portions of the testing commenced on March 31, 2026, in Room 114/OA Training Room 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 2 days. The functional examiner performed the hash validation component of the Physical Configuration Audit, all components of the Functional Configuration Audit and System Integration testing onsite during the public examination. The documentation review portion of the Physical Configuration Audit was completed prior to the public examination at Pro V&V test lab facilities in Huntsville, AL.

1) Physical Configuration Audit

The Functional Examiner reviewed submitted components and compared the voting system components submitted for evaluation to the manufacturer's technical documentation and

the defined configuration for use in testing. During execution of the PCA, the components of the Verity Vanguard 1.0 system were documented by component name, model, serial number and any other relevant information needed to identify the component. The Functional Examiner also performed a verification of the Trusted Builds of the software installed on each system component to ensure the certified versions of the software were installed correctly. If any of the software was unable to be verified, the Trusted Build of the software was installed on the component.

The following was the configuration used for testing, as documented during the PCA by the Functional Examiner:

Election Management System (Verity Vanguard Workspace)

- Define, Deploy, Results Workstation - S/N: W2500000608) HP Z2 SFF G9 Workstation PC - S/N: MXL4233CZD
- Monitor – HP P24 G4 23.8 Inch Monitor – S/N: 3CM22329MD
- Printer – HP LaserJet Pro 4001dn – S/N: VNL0714112

Central Scanner and Tabulator (Verity Vanguard Capture):

- Capture Workstation (S/N: W2500000608) – HP Z2 SFF G9 Workstation PC – S/N: MXL4233CZG
- Monitor – HP P24 G4 23.8 Inch Monitor – S/N: 3CM22329MF
- Scanner – Canon DR-G2110 – S/N: JG313298

Poll Place Scanner and Tabulator (Verity Vanguard Vault)

- Verity Vanguard Vault – S/N: V2520016907
- Verity Vanguard Vault – S/N: V2520016807
- Verity Vanguard Ballot Box – S/N: X2522220208
- Verity Vanguard Ballot Box – S/N: X2300016905

Ballot Marking Device (Verity Vanguard Flex)

- Verity Vanguard Flex – S/N: F2520015807
- Verity Vanguard Flex – S/N: F2520015707
- Verity Vanguard Flex – S/N: F2520015607
- Verity Vanguard Flex Stand
- Verity Vanguard Flex Stand
- Verity Vanguard ATI – S/N: ATI25603208
- Verity Vanguard ATI – S/N: ATI25605908
- Verity Vanguard ATI – S/N: ATI25598508

Ballot Marking Device (Verity Vanguard Adapt)

- Verity Vanguard Adapt – S/N: A2520009601

Voter Check-in Device (Verity Vanguard Boost)

- Verity Vanguard Boost – S/N: B2520017207

2) Functional Configuration Audit

This testing included all proprietary components and COTS components (software, hardware, and peripherals) in a configuration consistent with the VVSG guideline the system was federally certified with and the system's intended use. The tests were designed to assess the system's ability to meet the requirements of the Pennsylvania Election Code, and each applicable software and hardware component of the system was included in the tests. For software system tests, the tests were designed according to the stated design objective without consideration of its functional specification. Specifically, the Functional Configuration Audit for the Verity Vanguard 1.0 voting system consisted of executing the following test cases for each listed component:

Election Management System (Verity Vanguard Workspace)

- Evaluation of Election Management System (EMS)

Poll Place Scanner and Tabulator (Verity Vanguard Vault)

- 01 – 25 P.S. § 3031.7(1) Voter Secrecy
- 02 – 25 P.S. § 3031.7(2) Selection of Candidates and Questions by Voter
- 05 – 25 P.S. § 3031.7(5) Selection of Candidate and Write-in
- 07 – 25 P.S. § 3031.7(7) Attempt to Over Vote Contests and Questions
- 10 – 25 P.S. § 3031.7(10) Ballot Review and Change
- 16 – 25 P.S. § 3031.7(16) Public Counter, No Reopening of Polls, Media Security with Tamper Proof Locks and Zero Proof and Tally Reports

Central Scanner and Tabulator (Verity Vanguard Capture):

- 02 – 25 P.S. § 3031.7(2) Selection of Candidates and Questions by Voter
- 05 – 25 P.S. § 3031.7(5) Selection of Candidate and Write-in
- 07 – 25 P.S. § 3031.7(7) Attempt to Over Vote Contests and Questions
- 17 – 25 P.S. § 3031.7(17) Public Counter, No Reopening of Polls, Media Security with Tamper Proof Locks and Zero Proof and Tally Reports
- Central Count Processing

Ballot Marking Device (Verity Vanguard Flex)

- 01 – 25 P.S. § 3031.7(1) Voter Secrecy (ADA Voter)
- 02 – 25 P.S. § 3031.7(2) Selection of Candidates and Questions by Voter (Regular/ADA)
- 05 – 25 P.S. § 3031.7(5) Selection of Candidate and Write-in
- 07 – 25 P.S. § 3031.7(7) Attempt to Over Vote Contests and Questions (Regular/ADA)
- 10 – 25 P.S. § 3031.7(10) Ballot Review and Change (Regular/ADA)

Ballot Marking Device (Verity Vanguard Adapt)

- 01 – 25 P.S. § 3031.7(1) Voter Secrecy (ADA Voter)

- 02 – 25 P.S. § 3031.7(2) Selection of Candidates and Questions by Voter (Regular/ADA)
- 05 – 25 P.S. § 3031.7(5) Selection of Candidate and Write-in
- 07 – 25 P.S. § 3031.7(7) Attempt to Over Vote Contests and Questions (Regular/ADA)
- 10 – 25 P.S. § 3031.7(10) Ballot Review and Change (Regular/ADA)

3) System Integration Test

During the System Integration testing, one General Election and one Primary Election were exercised on the voting system. The Functional Examiner created the election definition using Verity Vanguard Define, and Hart transport media was used to transfer those elections to Verity Vanguard Vault, Capture, Flex, and Adapt units. The polls were opened, and zero reports were printed and verified where applicable. Hand-marked paper ballots and ballots marked electronically via the Verity Vanguard Flex and Adapt ballot marking devices were cast and tabulated through the Verity Vanguard Capture central tabulation equipment and Verity Vanguard Vault precinct count optical scan tabulator.

Polls were closed, and results reports were generated with results for the election. The results from the reports were confirmed to match the expected results of the voted ballots. Adjudication and write-in management were then performed in Verity Vanguard Results on both General and Primary Elections to demonstrate the adjudication capabilities of the Verity Vanguard 1.0 voting system.

General Election System Integration Testing

For the General Election testing, the testing team determined the test ballot parameters and constructed a typical Pennsylvania ballot combining presidential year contests, non-presidential year contests, and municipal contests into a single election held in three precincts, one of which is a split precinct on the “Representative in the General Assembly” contests. The individual contests consisted of a mix of contest types and variation in the number of candidates to be voted for each contest. Fifteen of the contests were in all ballot styles. The other six were split between at least two of the precincts with a maximum of twenty-one different contests spread across the three precincts. All voting variations supported by the Commonwealth of Pennsylvania were defined in this election. The voting variations included the following:

- Partisan contest
- Non-Partisan contest
- N of M contest
- Referendum contest
- Retention Contest
- Write-In voting
- Split Precinct
- Cross-Party Nominated

This General Election was designed to functionally test the handling of multiple ballot styles across geographical subdivisions, support for English and Spanish languages, support for all Pennsylvania voting variations, and audio support for English and Spanish.

Primary Election System Integration Testing

For the Primary Election testing, the testing team determined the test ballot parameters and constructed a typical Pennsylvania ballot for a closed Primary for two parties in three precincts. This election contained thirty-five contests compiled into six ballot styles. Each ballot style contained fifteen contests. The voting variations included in the testing are as follows:

- Partisan contest
- Non-Partisan contest
- Write-In voting
- N of M contest
- Cross-Party Filed Candidates

This closed Primary Election was designed to functionally test the handling of multiple ballot styles across geographical subdivisions, support for English, Spanish, and Chinese languages, and support for common Primary-specific voting variations.

A. Security Testing Processes and Procedures

Hart submitted security testing reports completed for EAC certification testing. Pro V&V, serving as security examiner for the Secretary, reviewed and analyzed Hart InterCivic Verity Vanguard 1.0 Penetration Test Report, report number HIN-23004-PTR-01 dated May 7th, 2024, covering the vulnerability and risk assessment for both the Verity Vanguard Flex and Verity Vault. The second report, Penetration Test Report for Verity Vanguard 1.0, dated December 19, 2025, covered the vulnerability and risk assessment for Verity Flex, Verity Vault, and Verity Adapt. Pro V&V then submitted a report to the Secretary indicating that the review and analysis of the reports found the test methodologies and results of the test conducted were complete and satisfactory. After reviewing the reports, Pro V&V used the vulnerability and risk assessment to then conduct attempted exploitations in the Pro V&V lab. The security examiner concluded by noting that the Hart Verity Vanguard 1.0 system meets the PA Voting System Security Standard. and the security measures implemented within Hart's Verity Vanguard 1.0 system provide effective risk mitigation and are aligned with established industry best practices.

B. Accessibility Examination Processes and Procedures

Accessibility Examiner provided her insights through an Accessibility Report which included top positives, mixed findings, top problems and recommendations for deployment which will be included in the Examination Results portion of this certification report. A summary of test details is provided below.

The accessibility examination portion for Verity Vanguard 1.0 commenced after the conclusion of the functional examination on December 3, 2025, in Room 114/OA Training

Room of the Keystone Building at 400 North Street, Harrisburg PA 17120, adjacent to the Capitol Complex. The examination lasted one day followed by a debrief meeting on December 11, 2025, with the Department and Center for Civic Design to discuss initial findings. This was followed by a supplemental accessibility examination of the Verity Vanguard Adapt accessible voting device on March 31, 2026, also in Room 114/OA Training Room of the Keystone Building at 400 North Street, Harrisburg PA 17120, adjacent to the Capitol Complex. The examinations included expert review by the Accessibility Examiner, usability sessions with poll workers, and sessions with six voters with disabilities using different accessible devices for voting.

1) Expert Review by Accessibility Examiner

The Accessibility Examiner conducted a review of the voting 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 understood how the system and accessibility features work and to note anything they wanted to watch during other testing.

2) Usability Review with Voters with Disabilities

During the Verity Vanguard 1.0 accessibility examination, the Accessibility Examiner used the same ballot and instructions to be used for voter review, for their expert review, so they would be familiar with the interaction voters would experience.

Sessions with Voters

The following voter population was represented in the test sessions:

- 2 blind voters with no usable vision for reading;
- 2 voters with mobility and dexterity disabilities, with one using a power wheelchair and one using braces for support; and
- 2 voters with cognitive or intellectual disabilities.

The voters' age ranged from 36 to over 71, and were from Dauphin, Cumberland, and York counties. The participants who had experience voting in the past were accustomed to Clear Ballot, Dominion, and ES&S ExpressVote XL voting based on which county they lived in.

Each voter session took approximately an hour. They included:

1. An opening interview about their previous voting experience and the types of assistive technologies they use in daily life and in voting.
2. A very basic orientation to the system with opportunities for voters to ask questions about any assistive technologies available.

3. 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.
4. Voting a ballot, following voting instructions given verbally by the facilitator, where necessary, and by reading them. 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.
5. A closing interview including a questionnaire about their voting experience and reactions to the system.

3) Election Process Experience with Poll Workers

During the Verity Vanguard 1.0 accessibility examination, the Accessibility Examiner used the same ballot and instructions to be used for poll worker review, for their expert review, so they would be familiar with the interaction voters would experience.

Sessions with Poll Worker Groups

Poll workers from a York County precinct and former poll workers now employed by the Department were invited to come as a team. These poll workers:

- were from York and Dauphin counties;
- had many years of experience as poll workers;

The session with poll workers included:

- 1) An initial orientation to the voting systems and the system's accessibility features, as would be seen in a typical poll worker training.
- 2) An opportunity for the poll workers to review vendor-provided instructions before trying the system. They marked ballots and experimented with the accessibility features.
- 3) An opportunity for the poll workers to interact with role-played voters in four different access-needs scenarios. Each scenario involved an examiner role-playing as a voter with a disability to test the poll worker's ability to determine appropriate accommodation. This sometimes required the poll worker to ask the voter what additional assistance the voter might need. Then the poll worker activated the necessary accessibility features for the voter.
- 4) 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 Accessibility Examiner then compiled the findings, categorized them as top positives, mixed findings, top problems, and recommendations for deployment.

V. Examination Results

The Examiner (Pro V&V)'s Test Report for Functional Testing for Hart Verity Vanguard 1.0 (TR-01-03-PA-001-HART-0) included details of the test cases, execution, and successful completion. Accessibility examiner issued reports from accessibility examination with her recommendations for deployment. Security Examiner submitted a letter report with conclusions.

The following Sections contain a summary of all results of the examination as explained in fuller detail in the respective Examiners' Reports.

A. Functional Examination Results

The Functional Examiner's report indicated that the system successfully completed tests executed to ascertain compliance with requirements of the Code. The Examiner report for Verity Vanguard 1.0 included details of the test execution and indicated successful completion and identified pertinent observations. The following section is a summary of the results of the examination as set forth in fuller detail in the Examiner's Report.

1) Physical Configuration Audit

Functional Examiner concluded that the following Pennsylvania Election Code requirements were met by the Verity Vanguard 1.0 voting system and were addressed as part of the PCA and documentation review:

- 25 P.S. § 3031.5(a);
- 25 P.S. § 3031.7(11);
- 25 P.S. § 3031.7(13);
- 25 P.S. § 3031.7(14); and
- 25 P.S. § 3031.7(15).

2) Functional Configuration Audit

The test cases for Verity Vanguard Workspace, Vault, Capture, Flex, and Adapt units were all performed successfully, and results were verified. The Functional Examiner also noted that the paper ballots will allow statistical recounts as required by Sections 1117-A, 25 P.S. § 3031.17. Test cases utilized during the performance of the Functional Configuration Audit are included below:

Statutory Requirement and Test Case Explanation	Device Tested
25 P.S. § 3031.7(1) - Provides for voting in absolute secrecy and prevents any person from seeing or knowing for whom any voter (except one who has received or is receiving assistance as prescribed by law) has voted, or is voting.	Verity Vanguard Vault Verity Vanguard Flex Verity Vanguard Adapt

Functional Examiner validated that the voter's selections cannot be observed after a ballot has been cast with Verity Vanguard Vault. Functional Examiner validated that the observer could not determine the voter's selection on Verity Vanguard Flex or Adapt ballot marking device from any observation position where the straight center measurement is 12 feet, and the side distance observation points are approximately 17 feet. Functional Examiner also reviewed federal test cases and test results to confirm this requirement.	
25 P.S. § 3031.7(2) - Provides facilities for voting for such candidates as may be nominated and upon such questions as may be submitted. Functional Examiner tested selection of partisan candidates in multiple contests for vote for one, "N of M" contest, and ballot questions on Verity Vanguard Flex and Adapt ballot marking devices. Functional Examiner also validated that all the votes were counted appropriately on Verity Vanguard Vault and Capture.	Verity Vanguard Vault Verity Vanguard Capture Verity Vanguard Flex Verity Vanguard Adapt
25 P.S. § 3031.7(5) - Permits each voter to vote for any person and any office for whom and for which he is lawfully entitled to vote, whether or not the name of such person appears upon the ballot as a candidate for nomination or election. Functional Examiner tested and confirmed that the system allows voting for any candidate on the ballot and allowed the voter to cast a write-in vote. System Integration Testing was used to further confirm that the candidates were presented with the correct contests that they were eligible to vote.	Verity Vanguard Vault Verity Vanguard Capture Verity Vanguard Flex Verity Vanguard Adapt
25 P.S. § 3031.7(7) - If it is of a type that registers the vote electronically, the voting system shall preclude each voter from voting for more people for any office than he is entitled to vote for or upon any question more than once. Functional Examiner tested to confirm that Verity Vanguard Flex and Adapt ballot marking devices prevented overvotes, Verity Vanguard Vault precinct tabulator warned voters for overvotes if configured, and Verity Vanguard Capture central count tabulator did not count any votes for a contest that was overvoted.	Verity Vanguard Vault Verity Vanguard Capture Verity Vanguard Flex Verity Vanguard Adapt

25 P.S. § 3031.7(10) - If it is of a type that registers the vote electronically, the voting system shall permit each voter to change his vote for any candidate or upon any question appearing on the official ballot up to the time that he takes the final step to register his vote and to have his vote computed. If it is of a type that uses paper ballots or ballot cards to register the vote and automatic tabulating equipment to compute such votes, the system shall provide that a voter who spoils his ballot may obtain another ballot; any ballot thus returned shall be immediately cancelled and at the close of the polls shall be enclosed in an envelope marked "Spoiled" which shall be sealed and returned to the county board. Functional Examiner tested to confirm that Verity Vanguard Flex and Adapt ballot marking devices allowed the voter to make changes until a ballot is printed. Verity Vanguard Vault tabulation devices allowed for the voter to scan the new ballot received after they spoiled the original ballot.	Verity Vanguard Vault Verity Vanguard Flex Verity Vanguard Adapt
25 P.S. § 3031.7(16) - If the voting system is of a type which provides for the computation and tabulation of votes at the district level, the district component of the automatic tabulating equipment shall include the following mechanisms or capabilities: (i) A public counter, the register of which is visible from the outside of the automatic tabulating equipment component into which the ballots are entered, which shall show during any period of operation the total number of ballots entered for computation and tabulation. (ii) A lock, or locks, by the use of which all operation of the tabulation element of the automatic tabulating equipment is absolutely prevented immediately after the polls are closed or where the tabulation of votes is completed. (iii) It shall be so constructed and controlled that, during the progress of voting, it shall preclude every person from seeing or knowing the number of votes theretofore registered for any candidate or question; and it shall preclude every person from tampering with the tabulating element. (iv) If the number of choices recorded for any office or on any question exceeds the number for which the voter is entitled to vote, it shall reject all choices recorded on the ballot for that office or question, provided, that if used during the period of voting it may also have the capacity to indicate to a voter that he has improperly voted for more candidates for any office than he is entitled to vote for, and in such case it shall have the capacity	Verity Vanguard Vault

to permit the voter to mark a new ballot or to forego his opportunity to make such correction. (v) It shall be equipped with an element which generates a printed record at the beginning of its operation which verifies that the tabulating elements for each candidate position and each question and the public counter are all set to zero and with an element which generates a printed record at the finish of its operation of the total number of voters whose ballots have been tabulated, the total number of votes cast for each candidate whose name appears on the ballot, and the total number of votes cast for, or against, any question appearing on the ballot. Functional Examiner validated that intended selections are recorded, stored, and reported as input by the voter. The voting device does not allow the reopening of the polls and is able to produce a “Zero Proof” and “Tally Report”. The voting device has a visible public counter and the counter increments correctly.	
25 P.S. § 3031.7(17) - If the voting system is of a type which provides for the computation and tabulation of all votes at a central counting center or if it provides for the tabulation of district totals at such a central counting center, the central automatic tabulating equipment shall include the following mechanisms or capabilities: (i) It shall be constructed so that every person is precluded from tampering with the tabulating element during the course of its operation. (ii) If the number of choices for any office or on any question exceeds the number for which the voter is entitled to vote, it shall reject all choices recorded on the ballot for that office or question. (iii) It shall have a means by which to verify that the counters for each candidate position and for each question are all set to zero and shall be able to generate a printed record of each election district showing the total number of voters whose ballots have been tabulated, the total number of votes cast for each candidate whose name appears on the ballot, and the total number of votes cast for, or against, any question appearing on the ballot. It may also be capable of generating cumulative election reports. Functional Examiner validated that intended selections are recorded, stored, and reported as input by the voter. The voting device does not allow the reopening of the polls and is able to produce a “Zero Proof” and “Tally Report”. The voting device has a visible public counter and the counter increments correctly.	Verity Vanguard Capture

Functional Examiner concluded that the following additional Pennsylvania Election Code requirements were met by Verity Vanguard 1.0 voting system and were addressed as part of the FCA:

- 25 P.S. § 3031.1; and
- 25 P.S. § 3031.7(12).

The Functional Examiner identified that 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 deal with non-functional testing aspects of acquisition, use and maintenance aspects of a voting system: 25 P.S. §§ 3031.2, 3031.3, 3031.4, 3031.6, 3031.8, 3031.9, 3031.10, 3031.11, 3031.12, 3031.13, 3031.14, 3031.15, 3031.16, 3031.18, 3031.19, 3031.20, 3031.21, and 3031.22.

3) System Integration Test

During execution of the test procedure, it was verified that the Verity Vanguard 1.0 voting system successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results.

Functional Examiner concluded that the Verity Vanguard 1.0 system met Pennsylvania Election Code requirements 25 P.S. § 3031.7(4), 25 P.S. § 3031.7(6), 21 25 P.S. § 3031.7(8), and 25 P.S. § 3031.7(9) as demonstrated by test cases used during the Primary and General Elections.

Accuracy requirements of 25 P.S. § 3031.7(11), that were ascertained by reviewing EAC test reports during the physical configuration audit documentation review were further validated by the successful tabulation and validation of the Primary and General Elections run by the Functional Examiner.

System Integration 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 in-person and central count polling activities, and accumulation and publishing of the election's results.

B. Security Testing Results

The Examiner (Pro V&V) issued a report after completion of testing activities which states that, "Following completion of the report review and additional testing, Pro V&V concludes:

- The Hart Verity Vanguard 1.0 System meets the Pennsylvania Voting System Security Standard.
- The security measures implemented within Hart's Verity Vanguard 1.0 system provide effective risk mitigation and are aligned with established industry best practices."

C. Accessibility Examination Results

The Accessibility Examiner compiled the findings from the examination into the categories noted in the examination approach in their report submitted to the Secretary. A

summary of all findings documented in the Accessibility Examiner's report is included with this report as Attachment B.

VI. Observations

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

- Verity Vanguard 1.0 does not support cumulative voting.
- The ADA compliant ballot marking device, Verity Vanguard Flex, presented as part of the Verity Vanguard 1.0 system, could be effectively used by all voters. This allows jurisdictions to expand the use of these devices for a larger universe of voters and not restrict their use to voters using assistive devices.

The Verity Vanguard Flex ballot marking device can accommodate 5 voters using assistive devices per hour and 8 voters per hour when used as the primary voting system, depending on the size of the ballot. The Verity Vanguard Vault precinct tabulators can accommodate between 60 and 480 voters per hour depending on the length of the ballot. Vault collapsible ballot boxes will hold approximately 4,000 11-inch ballots.

All testing of Verity Vanguard 1.0 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 Verity Vanguard 1.0.

The Functional 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 Verity Vanguard 1.0 demonstrates compliance with all applicable requirements as delineated in Article XI-A of the Pennsylvania Election Code, 25 P.S. §§ 3031.1 – 3031.22.

VII. Conditions for Certification

Based on the results of the examinations that occurred in December 2025 and March 2026, and the reported findings of the Examiners as set forth in their reports, the Secretary of the Commonwealth certifies Verity Vanguard 1.0 for sale and use in Commonwealth elections subject to the following conditions:

- A. The Verity Vanguard Adapt ballot marking device, though included in the examination, is not certified for use in Pennsylvania. Jurisdictions must implement Verity Vanguard Flex Ballot Marking Device at all polling locations.
- B. Pennsylvania counties using Verity Vanguard 1.0 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 22, 2025 (the “Use Directive”), any subsequent revisions of the Use Directive, and any other applicable directives currently in effect or issued in the future. This includes the requirement that Pennsylvania counties must adhere to item four (4) of the Use Directive when setting up and positioning Verity Vanguard Flex accessible voting devices 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 Pennsylvania Election Code, 25 P.S. § 3031.7(1)).
- C. 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 Verity Vanguard 1.0 is used in as laid out in the Directive Regarding the Uniform Reporting of Voting System Malfunctions to the Department of State issued April 6, 2026.
- D. No components of Verity Vanguard 1.0 shall be connected to any modem or network interface, including the Internet, at any time. A standalone local area wired network configuration may be considered, in which all connected devices are certified voting system components. Transmission of unofficial results can be accomplished by writing results to media and moving the media to a different computer that may be connected to a network. Any wireless access points in the district components of Verity Vanguard 1.0, including wireless LAN cards or network adapters, must be uninstalled or disabled prior to shipping to a County Board of Elections.
- E. Because Verity Vanguard 1.0 is a paper-based system, counties using Verity Vanguard 1.0 must comply at a minimum with Section 1117-A of the Pennsylvania Election Code, 25 P.S. § 3031.17, that requires a “statistical recount of a random sample of ballots after each election using manual, mechanical or electronic devices of a type different than those used for the specific election.” This audit must be conducted exclusively via a manual count of the voter marked paper ballots. Counties must include in the sample ballots such samples as may be marked by ADA compliant components.

Counties are advised to consult the Directive Concerning the Use, Implementation and Operation of Electronic Voting Systems by the County Boards of Elections issued by the Secretary of the Commonwealth on April 6, 2026, any subsequent revisions of that Directive, and any other directives that may apply to audits of electronic voting systems.

- F. All jurisdictions implementing Verity Vanguard 1.0 must carry out a full Logic and Accuracy (L&A) test on each device without fail and maintain evidence of L&A testing in accordance with the statutory requirements for pre-election and post-election testing. The Department does not recommend automated L&A testing and discourages the use of preprinted ballots provided by vendors. All components being used on election day, including any Electronic Poll Books being used, must be part of the L&A testing. Counties are advised to consult the Directive on Logic & Accuracy Testing 3.1 issued by the Secretary of the Commonwealth on April 7, 2025, any subsequent revisions of that Directive, and any other directives that may apply to L&A testing.
- G. Jurisdictions implementing Verity Vanguard 1.0 in Pennsylvania must use the ballot stock recommended by the vendor in the TDP and test all tabulation and ballot marking devices with the same paper stock that will be used during election. Hart must work with jurisdictions to ensure that the correct ballot stock is used, and the printer and scanner settings adhere to the identified values in TDP. Hart must work with the jurisdictions to add training sessions during implementation to ensure that the quality of ballots is maintained while handling, before, during and after elections.
- H. Jurisdictions must work with Hart to ensure that the interface for binary devices, including sip-and-puff devices and dual switches, are functioning properly, and the accessible audio-tactile interface devices work for completing a ballot marking session. Jurisdictions must use accessible audio-tactile interface devices during L&A testing to complete a ballot. Jurisdictions implementing the Verity Vanguard 1.0 system must hold voter education sessions specifically addressed to voters using accessible devices.
- I. Jurisdictions implementing Verity Vanguard 1.0 must implement the use of privacy sleeves to be used by voters carrying marked ballots between the Verity Vanguard Flex ballot marking device and Verity Vanguard Vault precinct scanner. Poll worker training must emphasize the need for helping voters without violating their privacy. This must include but not be limited to 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.
- J. Verity Vanguard 1.0 is a paper-based system, and hence, implementation of the system for precinct or central count scanning is scalable. Jurisdictions must calculate the number of voting booths and the number of ballots necessary to accommodate the number of registered voters in a precinct to avoid long lines. Jurisdictions must also take

into consideration scanning speed and ballot box and transport media capacities of polling place components when deciding on the number of voting booths.

- K. All jurisdictions implementing Verity Vanguard 1.0 must create and adhere to administrative safeguards and proper chain of custody, and document the same, to facilitate the safety and security of electronic systems pursuant to the Guidance on Electronic Voting System Preparation and Security, October 2020, and any subsequent revisions or directives.
- L. Jurisdictions utilizing the paper keys to activate ballot marking device sessions must maintain strict physical access control to these keys.
- M. Jurisdictions implementing Verity Vanguard 1.0 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.
- N. All jurisdictions implementing Verity Vanguard 1.0 must ensure that no default passwords are used on any devices and that all passwords are complex and secured. Counties must implement an audit process to review and ensure that no default passwords are used upon equipment install/reinstall and routinely change passwords (at least once prior to preparing for each Primary and Election) to avoid the possibility of any password compromise. The passwords and permissions management must at a minimum comply with the password requirements outlined in NIST 800-64-4. This publication can be accessed at <https://pages.nist.gov/800-63-4/>.
- O. Jurisdictions implementing Verity Vanguard 1.0 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 needed to perform the assigned responsibility.
- P. Jurisdictions implementing Verity Vanguard 1.0 must ensure implementation of a predetermined backup and recovery strategy for Verity Vanguard Workspace data assets.
- Q. Jurisdictions must protect installations of Verity Vanguard Workspace and its components on portable devices and must protect the laptops to prevent lost or stolen devices.

- R. All jurisdictions implementing Verity Vanguard 1.0 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).
- S. All jurisdictions implementing Verity Vanguard 1.0 must work with Hart to ensure that only the certified system configuration is installed both on first purchase, as well as any time a system component is replaced or upgraded. Jurisdictions must as part of their user acceptance test verify the implementation to ensure that the components, software, and firmware belong to the certified system. Jurisdictions must also perform a trusted build validation as part of the election preparation activities and post-election canvass activities utilizing the vendor supplied methods of validation and verification of voting system integrity. Any time the system is installed after the first purchase or an upgrade is completed, the vendor and the county must complete the implementation attestation and must make a copy available to the Secretary on request. A sample format that can be used for the attestation is included as Attachment C to this document.
- T. Hart must work with the jurisdictions implementing Verity Vanguard 1.0 to ensure that the system has been hardened for secure implementation. Jurisdictions must implement processes to ensure that all components of the voting system have been hardened per the instructions in the TDP.
- U. Jurisdictions can make use of the Verity Vanguard Results adjudication functionality to adjudicate write-ins and evaluate questionable ballots, contests, or selections to determine voter intent. Any decisions made during the adjudication process must be agreed upon by a team of at least two reviewers authorized by county election officials following Pennsylvania Election Code requirements. The ballot adjudicators and county election officials must, when necessary, consult the paper ballot to assist with determinations made during adjudication. In the event of a recount, the voter verifiable paper ballots must be used for the count.
- V. Jurisdictions implementing Verity Vanguard 1.0 must work with Hart to ensure that the implemented configuration can operate 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.
- W. Jurisdictions using the services of Hart or a third-party vendor for election preparation activities must work with Hart or the vendor to ensure that systems used for ballot definition activities are considered part of the voting system, and they must use certified voting system components. The systems used for ballot definition must be configured securely following conditions outlined in this report and following any

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

- X. Hart must ensure that any implementations in Pennsylvania counties must appropriately indicate that the Verity Vanguard Flex ballot marking devices are printing the ballot and the final messaging on the ballot marking device 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 Hart support personnel and verified by county election officials.
- Y. Jurisdictions must have appropriate instructions on the Verity Vanguard Flex accessible voting device to ensure that the voter reviews the entire ballot before printing the ballot.
- Z. Jurisdictions must work with Hart to ensure that the entire audio ballot, including audio rates and volumes on the audio ballot, is 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.
- AA. Jurisdictions must work with Hart 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.
- BB. Jurisdictions must work with Hart 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 and is occurring, 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;
 - iii. The audio ballot must provide feedback on the reason for the changes in any selections; and
 - iv. The audio ballot instructions regarding messages on the system must communicate the specific information for the task or screen displayed before the general, repeated instructions.
- CC. Jurisdictions implementing Verity Vanguard 1.0 must include poll worker training as part of the implementation plan. The training must include hands-on practice for poll workers. Poll workers must be provided with instructions on how to offer support to help

voters get started with (or re-familiarize themselves with) the key layout of the devices and functions as necessary. Follow-on training for replacement poll workers, and refresher training must also be considered. Specific consideration must be given to voters using assistive devices and poll worker education to assist voters with disabilities. Refer to Attachment B, listing detailed recommendations for deployment noted by the Accessibility Examiner.

- DD. Jurisdictions implementing Verity Vanguard 1.0 must include voter training as part of the implementation plan. The training must include hands-on practice for voters. As part of voter education and outreach efforts, specific consideration must be given to voters using assistive devices. These voters must be provided with the opportunity to use the system tactile keypad in advance of election day so that the voters will know how to use the system effectively.
- EE. Jurisdictions must implement Verity Vanguard Flex accessible voting devices in such a way to ensure that only one contest is displayed per screen.
- FF. Jurisdictions implementing Verity Vanguard 1.0 must consider the following during voting booth set up for serving voters requiring assistive devices:
- i. A table or stand for voters using the tactile keypad who do not use wheelchairs with trays that can hold the keypad to relieve fatigue and make it easier to use with both hands.
 - ii. Voters with disabilities may have assistive technology or personal notes that they need to be placed within reach. They may also need room to place the printed ballot on a flat surface to use personal technology such as magnifiers or text readers to verify it.
 - iii. For the BMD configured as a marker where the voter must complete the voting process by scanning the ballot on a precinct scanner, the path to the scanner should be as easy as possible, ideally a straight line with no obstructions. The path should include ample room to turn and maneuver a wheelchair if the machine is positioned with the screen facing the wall. The ADA standards suggest a minimum of 60 x 60 inches for this.
- GG. The electronic voting system must be physically secured and protected while in transit, storage, and while in use at their respective locations. Unmonitored physical access to devices can lead to compromise, tampering, and/or planned attacks. Pennsylvania counties using Verity Vanguard 1.0 must comply with the Directive Concerning Access to Electronic Voting Systems, including but not limited to the Imaging of Software and Memory Files, Access to Related Internal Components, and the Consequences to County Boards of Allowing Such Access issued by the Secretary of the Commonwealth on April 6, 2026, any subsequent revisions of the Directive, and any other applicable directives currently in effect or issued in the future.

- HH. Jurisdictions must implement processes and procedures involving management, monitoring and verification of seals, locks/keys, and other access methods, before, during and after the election.
- II. 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 Hart 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 offices which can be removed by authorized personnel when the port is needed.
- JJ. Jurisdictions must implement processes to gather and safekeep system logs for each component of the voting system after each election. Consistent auditing of system logs and reports is vital to maintain system transparency and to ensure that any compromise or malfunction is observed, reported and resolved in a timely manner.
- KK. Jurisdictions implementing Verity Vanguard 1.0 must ensure that the USB devices and any other removable media used for election activities are maintained with strict chains of custody. There must be a process to manage the removable media inventory to avoid misplaced and lost media. The devices must be reformatted before use in each election. Appropriate steps must be taken to ensure that the format is a full reformat of the USB devices. Jurisdictions implementing Verity Vanguard 1.0 must implement policy and procedures to ensure the use of ONLY approved, designated, and clearly marked USB devices for use in any component of the system. The system is heavily dependent on USB devices for intra-component transfer of data assets.
- LL. Jurisdictions implementing Verity Vanguard 1.0 must work with Hart to ensure that appropriate levels of training for county election officials are planned and undertaken on implementation. Counties must ensure that training adheres to the “Minimum Training Requirements” specified in Attachment D of this document.
- MM. Hart must submit the following system education materials to the Department of State and must consent to the publication and use of the video on any websites hosted by any Pennsylvania counties and the Pennsylvania Secretary of the Commonwealth, or any publicly available social media platform. The videos must be closed captioned for the hearing impaired.
- i. i. A video (in an electronic format) for voters that demonstrates how to cast a vote and ballot using the Voting System.
 - ii. ii. A video (in an electronic format) for precinct election officials that demonstrates how to set up, operate, and shut down 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 demonstrate to voters how to cast a vote. This must be provided in additional languages for any jurisdiction required to meet language thresholds requirements of the Voting Rights Act.
- NN. Hart must adhere to the following reporting requirements and submit the following to the Secretary:
- i. Equipment Reporting. Reported field issues or anomalies that occur in Pennsylvania or elsewhere with any piece of equipment deployed in the Commonwealth of Pennsylvania within 3 days of the occurrence;
 - ii. Advisory Notices. System advisory notices issued for any piece of equipment deployed in the Commonwealth of Pennsylvania regardless of whether the incident behind the notice occurred in Pennsylvania or elsewhere;
 - iii. Ownership, Financing, Employees, Hosting Location. Any changes to information on the Supplier’s employees and affiliates, locations, company size and ability to provide technical support simultaneously to several counties in the Commonwealth of Pennsylvania and other jurisdictions that use its Voting System. Additionally, Hart 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;
 - iv. Security Measures and any updated security testing or risk/vulnerability assessments conducted by the Supplier or a third-party.
- OO. Hart must adhere to the “Source Code and Escrow Items Obligations” specified in Attachment F of this document.
- PP. Hart must work with jurisdictions to ensure that the system is configured to comply with all applicable requirements of the Pennsylvania Election Code delineated in Section Article XI-A of the Pennsylvania Election Code, Sections 1101-A to 1122-A, 25 P.S. §§ 3031.1 – 3031.22.
- QQ. Any jurisdiction implementing Verity Vanguard 1.0 must work with Hart to implement the system under this certification and must comply with the conditions found in this report, and any directives issued by the Secretary of the Commonwealth regarding the use of this System, in accordance with Section 1105-A(a)-(b) of the Pennsylvania Election Code, 25 P.S. § 3031.5(a)-(b). Hart must ensure that future releases of the voting system with enhanced security and accessibility features are presented for approval to the Secretary.

RR. Hart must work with each jurisdiction implementing Verity Vanguard 1.0 and the Department of State to ensure that the system can integrate with Pennsylvania Department of State's Election Night Reporting (ENR) system.

SS. Pursuant to the Directive on Electronic Voting Systems issued by the Secretary of the Commonwealth on August 8, 2006, the Directive Concerning the Use, Implementation and Operation of Electronic Voting Systems by the County Boards of Elections issued on April 6, 2026, and Section 1105-A(d) of the Pennsylvania Election Code, 25 P.S. § 3031.5(d), this certification and approval is valid only for Verity Vanguard 1.0. If the vendor or a County Board of Elections makes any changes to the Verity Vanguard 1.0 Voting System after 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 Verity Vanguard 1.0 Voting System in the Commonwealth of Pennsylvania.

TT. Hart must work with counties and Department of State to ensure that the counties are trained on generating the reports from Verity Vanguard Results required for results certification audits.

UU. Jurisdictions implementing Verity Vanguard 1.0 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.

The Secretary's certification for Verity Vanguard 1.0 is predicated on the EAC final certification decision dated 07/07/25. The final EAC certification report is appended to this certification report as Attachment A.

VIII. Recommendations

- A. All jurisdictions implementing Verity Vanguard 1.0 should take appropriate steps to ensure that voter education is part of the implementation plan.
- B. All jurisdictions implementing Verity Vanguard 1.0 should ensure that precinct election officials and poll workers receive appropriate training and are comfortable using the system.
- C. All jurisdictions considering purchasing the Verity Vanguard 1.0 voting system should review the System Limitations as mentioned in the EAC certification scope added as Attachment A to this report.
- D. The Secretary recommends that Hart and counties work with the Department on any changes to their voting equipment including, but not limited to, purchase and upgrades.
- E. The 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. The Secretary recommends configuring the election with only one contest being displayed on each screen presented to the voter on the Verity Vanguard Flex ballot marking device. This is to ensure that all screens presented to the voter are similar and voters don't need to adapt to situations where there may be multiple contests displayed on a screen.

IX. 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 Verity Vanguard 1.0 can be safely used by voters at elections as provided in the Pennsylvania Election Code and meets all of the requirements set forth in the Code, provided the voting system is implemented with the conditions listed in Section IV of this report. Accordingly, the Secretary certifies Verity Vanguard 1.0 for use in this Commonwealth.

X. Attachment A – EAC Certification



Verity Vanguard 1.0
Certificate of Confor



United States Election Assistance Commission

Certificate of Conformance



Hart Verity Vanguard 1.0

The voting system identified on this certificate has been evaluated at an accredited voting system testing laboratory for conformance to the *Voluntary Voting System Guidelines Version 2.0 (VVSG 2.0)*. 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: Verity Vanguard

Model or Version: 1.0

Name of VSTL: SLI Compliance

EAC Certification Number: HRT-VV-1.0

Date Issued: July 3, 2025

Brianna Schletz, Executive Director

Scope of Certification Attached



Scope of Certification

Manufacturer: *Hart InterCivic*
System Name: *Verity Vanguard 1.0*
Certificate: *HRT-VV-1.0*
Laboratory: *SLI Compliance*
Standard: *VVSG 2.0*
Date: *January 30, 2026*

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Version History

Version Number	Description of Changes	Date
1.0	Initial release	07/07/2025
1.1	Updated software to match test report and system technical data package	01/30/2026

Introduction

This document describes the scope of the validation and certification of the **Hart Verity Vanguard 1.0**. 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 component of a certified system is certified for use outside the certified configuration.

Representation of EAC Certification

Manufacturers may not represent or imply that a voting system is certified unless they have 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 Hart InterCivic Verity Vanguard 1.0 voting system is a paper-based voting system encompassing both precinct and central count tabulators, as well as a Ballot Marking Device (BMD) and an all-in-one accessible voting unit. All polling place devices are equipped with components compliant with the Americans with Disabilities Act (ADA). The Vanguard software ecosystem comprises four primary components: Vanguard Define, Vanguard Deploy, Vanguard Capture, and Vanguard Results. Each server and standalone workstation contain three essential utility applications: Manage, Users, and Settings. Additionally, there are three supplementary applications available upon unlocking: Libraries, Test Decks, and Ranked Choice. The Vanguard voting devices supported within this system include Vanguard Boost, Vanguard Flex, Vanguard Adapt, and Vanguard Vault devices.

Components Included:

The **Verity Vanguard 1.0** system represents a set of software applications for pre-voting, voting and post-voting election project activities for jurisdictions of various sizes and political division complexities.

Vanguard Define is a component of the Verity Vanguard voting system used by election officials to enter election data for contests, candidates, proposition text, translations, and audio. Vanguard Define also provides the user with controls for proofing of data and layout and performs validation prior to locking the data to ensure its readiness for use in Vanguard Deploy, the election definition software.

Vanguard Deploy is used by officials to complete pre-voting tasks for creating and generating an election definition, device user Security Tickets, and ballots. Vanguard Deploy provides a ballot layout proofing process. The process establishes relationships between election data, jurisdiction, and polling place data, for the shared election definition. Vanguard Deploy will create the portable media, vDrives, to provide a method of transferring the shared election definition to Verity Vanguard voting devices and workstations.

Vanguard Capture is a central device used by officials for paper ballot scanning, contest resolution, and conversion of voter selection marks to electronic Cast Vote Records (CVRs). Once the CVRs are written to vDrive(s), they can be transferred into Vanguard Results for vote tabulation and reporting of election results. Vanguard Capture records cast vote records only; it does not tabulate. The scanner can optionally print a unique identifier to the ballot following scanning.

Vanguard Results is used by officials to complete post-voting functionality to tabulate election results and generate reports. Vanguard Results receives the CVRs from portable media devices (vDrives) used to record CVRs from Vanguard Vault devices or Vanguard Capture workstations. Vanguard Results can be used by officials to resolve Vault or Vanguard Capture write-in votes for paper ballots that were manually marked. Vanguard Results can also be used to collect and store all

election logs from every Verity Vanguard device used in the election, allowing for complete election audit log reviews.

Vanguard Manage is available only within server and standalone workstation software applications. This software enables authorized users to add, copy, import, export, archive, restore, and manage elections. Once an election is added or imported in the Election Management application, the election can be opened and handled per the features available within the Verity software installed on that workstation.

Vanguard Users enables authorized users to create and manage user accounts within the Verity system.

Vanguard Settings application is used to perform additional workstation functions such as setting the clock and exporting file hashes.

Vanguard Libraries allow users to save translations and audio from any Vanguard election and use them in future elections. Translations and Audio in Vanguard Libraries can be imported into any election in the Vanguard Define application on the same workstation.

Vanguard Test Decks allows users to generate a pre-marked set of ballots (a "Test Deck") that can be used for Logic and Accuracy Testing of the Vanguard voting system. Vanguard Test Decks allows users to select a marking pattern and generate a test deck which is then available to print and/or export within the Vanguard Deploy software application.

Vanguard Ranked Choice allows users to perform tabulation of ranked choice contest results that have been read into Vanguard Results.

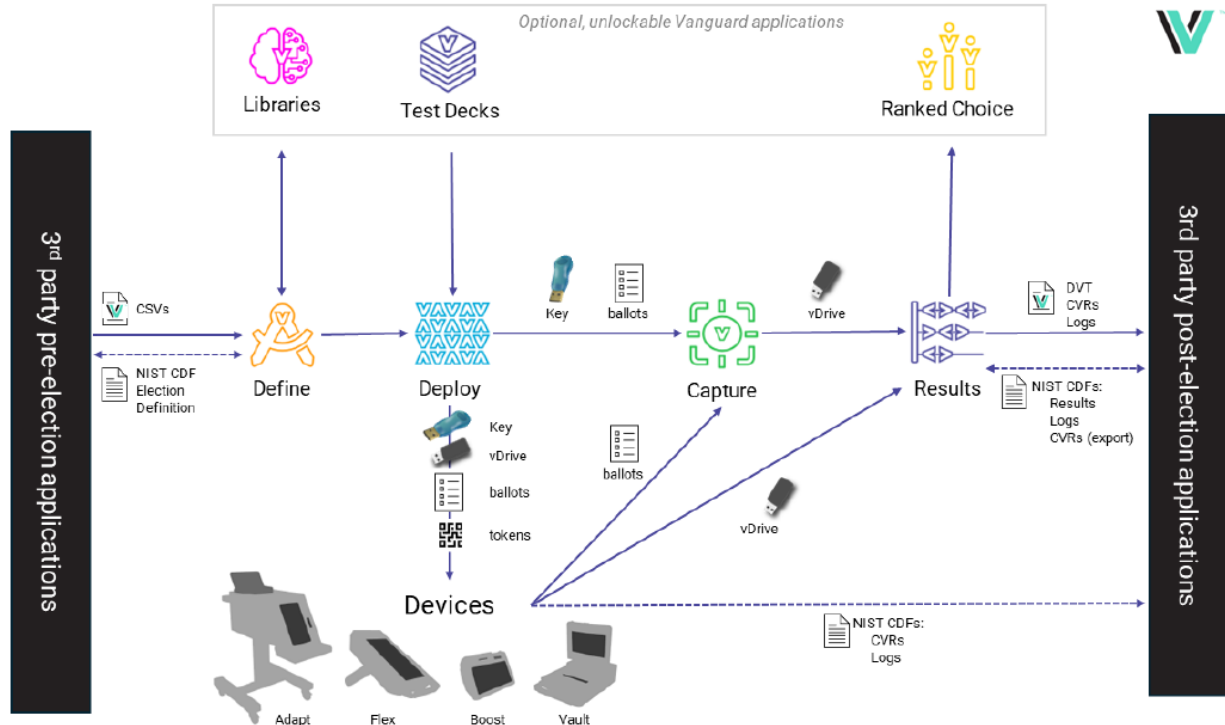
Vanguard Boost is a poll worker-facing device designed to improve voter service by optimizing ballot issuance in the polling place. Vanguard Boost can be utilized by poll workers in two ways. Vanguard Boost may be used to print blank paper ballots on demand, using an attached ballot printer. Vanguard Boost may also be used to issue VotePasses, which allow voters to access, mark, and print a printed vote record using Vanguard Flex. Vanguard Boost does not store vote data.

Vanguard Flex is a universal ballot marking device that produces an auditable summary ballot of a voter's choices that does not encode voter selections in barcodes or QR codes. Voters can mark their ballots using the touchscreen interface or a wide variety of accessible controls. Printed summary ballots are then scanned in Vanguard Vault for tabulation.

Vanguard Vault is a polling place scanning device that captures voter choices whether using ballots marked by hand or machine, including summary ballots [printed vote records (PVRs)] which are counted using Optical Character Recognition. Vanguard Vault can print a unique identifier to the ballot following scanning using an optional purpose-built Imprinter.

Vanguard Adapt is an all-in-one voting device that produces an auditable, summary ballot of a voter's choices. Voters can mark their ballots using the touchscreen interface or a wide variety of accessible controls. Vanguard Adapt enables voters to mark, verify, and cast their ballot, all without touching a piece of paper.

System Diagram



Proprietary Software

System Component	Software or Firmware Version
Vanguard Define (Pre-election EMS)	1.0.1
Vanguard Deploy (Pre-election EMS)	1.0.1
Vanguard Capture (Central Scanning)	1.0.1
Vanguard Results (Post-election EMS)	1.0.1
Vanguard Manage (EMS)	1.0.1
Vanguard Ranked Choice (EMS)	1.0.1
Vanguard Libraries (EMS)	1.0.1
Vanguard Test Decks (EMS)	1.0.1
Vanguard Boost (Polling Place Ballot Issue)	1.0.1
Vanguard Flex (Polling Place BMD)	1.0.1
Vanguard Vault (Polling Place Scanner)	1.0.1
Vanguard Adapt (Polling Place all-in-one accessible voting device)	1.0.1
Imprinter Firmware	REV 7

Touch Sensor Firmware	REV 19
Verity Access Firmware	1.0.1
Main MCU Firmware	REV 47

Proprietary Hardware

Description	Version
Vanguard Vault (Precinct Scanner with optional Imprinter)	A
Vanguard Flex (Ballot Marking Device (BMD))	A
Vanguard Adapt (All-in-one accessible voting device (Limited Dexterity Mark, Verify, and Cast) device)	A
Vanguard Boost (Ballot Issuance Device)	A

COTS Software and Firmware

Manufacturer	Description	Version
Workstations		
Brother	Brother HL-L6400DWVS Printer Driver	1.8.168.8
Canon	DR-G2000 Series Driver	1.1.11807.24001SP2
empira Software GmbH	PDFSharp	1.50.5147.0
HP	HP LaserJet Pro 4001 4002 4002 4004 PCL 6	8.00.2101.9302
Intel	Integrated Performance Primitives	2021.5.3.585
Intel	Z2G9 Intel Graphics	31.0.101.4502
IntoPrint	SP1360(PCL6) Driver	1.0.0.0
Maxim	1-Wire Driver	4.1.0
McAfee	McAfee Application Control for Devices ("Solidifier")	8.3.5.126
Microsoft	.NET Framework Runtime	4.8.1
Microsoft	Devcon	6.1.7600.16385
Microsoft	Help Viewer	2.3.28307
Microsoft	SSRS - SQL Server Standard 2019	15.0.8270.42049
Microsoft	Microsoft SQL Server Standard 2019	15.0.4316.3
Microsoft	Unity	2.1.505.2
Microsoft	Visual Studio C++2013 Redistributable x64	12.0.30501.0
Microsoft	Visual Studio C++2013 Redistributable x86	12.0.30501.0
Microsoft	Visual Studio C++ 2015-2022 Redistributable x64	14.36.32532.0
Microsoft	Visual Studio C++ 2015-2022 Redistributable x86	14.36.32532.0
Microsoft	Windows 10 Enterprise 2021 LTSC, configured for kiosk operation	10.0.19044

Neodynamic ARL	Barcode Professional	11.0.23.223
NVIDIA	Z4G4 NVIDIA Graphics Driver	31.0.15.2748
NVIDIA	Z4G4 NVIDIA HD Audio Driver	1.3.39.16
OKI Data	OKI C844 (PCL)	1.0.0.0
OKI Data	OKIWinIO	1.8.2.2
Open Source	Automapper	2.2.0.0
Open Source	Math.NET Numerics	2.6.1.30
Open Source	MVVMLight	4.0.23.37706
Open Source	Naudio	1.7.3.0
Open Source	Nhibernate	3.3.1.4000
Open Source	OTP-Sharp	1.0.0
Open Source	OWdotNET	0.9.0.0
Open Source	SoundTouch	1.7.1.0
Open Source	Tesseract Open Source OCR Engine	4.5.2.411
Open Source	Zxing.NET	0.16.4.0
Open Source	Zxcvbn C#/.NET	7.0.92
Prism Software, LLC	Prism	4.1.0.0
Telerik	Reporting	18.1.24.709
Telerik	UI for WPF	2023.2.606.45
Websupergoo	ABCpdf	12.3.0.0
Devices		
Brother	Brother HL-L6400DWVS Printer Driver	1.8.168.8
Brother	brUSBMon Printer Interface, x64	1.0.0.0
Brother	brUSBMon Printer Interface, x86	1.0.1.0
empira Software GmbH	PDFSharp	1.50.5147.0
HP	HP LaserJet Pro 4001 4002 4002 4004 PCL 6	8.00.2101.9302
HP	HP OfficeJet 200 Mobile Series	20.79.1.6738
Intel	Integrated Performance Primitives	2021.5.3.585
Intel	Intel Graphics Driver	31.0.101.2115

Maxim	1-Wire Driver	4.1.0
McAfee	McAfee Application Control for Devices ("Solidifier")	8.3.5.126
Microsoft	.NET Framework Runtime	4.8.1
Microsoft	Brother Ports Driver	01.02.00.00
Microsoft	Devcon	6.1.7600.16385
Microsoft	SQLite	3.45.3
Microsoft	Unity	2.1.505.2
Microsoft	Visual Studio C++ 2015-2022 Redistributable x64	14.36.32532.0
Microsoft	Visual Studio C++ 2015-2022 Redistributable x86	14.36.32532.0
Microsoft	Windows 10 Enterprise 2021 LTSC, configured for kiosk operation	10.0.19044
Neodynamic ARL	Barcode Professional	11.0.23.223
OKI Data	OKI C844 (PCL)	1.0.0.0
Okidata	OKIWinIO	1.8.2.2
Open Source	Automapper	2.2.0.0
Open Source	MVVMLight	4.0.23.37706
Open Source	Math.NET Numerics	2.6.1.30
Open Source	Naudio	1.7.3.0
Open Source	Nhibernate	3.3.1.4000
Open Source	SoundTouch	1.7.1.0
Open Source	OTP-Sharp	1.0.0
Open Source	OWdotNET	0.9.0.0
Open Source	Tesseract Open Source OCR Engine	4.5.2.411
Open Source	Zxing.NET	0.16.4.0
Open Source	Zxcvbn C#/.NET	7.0.92
PDI	PageScan Scanner SDK	7.2.17
PDI	PageScan USB Scanner Driver	4.0.0301.13
PDI	PDIPrintScanCut Driver for TPH850 Printer	4.1.0.0
Prism Software, LLC	Prism	4.1.0.0
SECO	Chipset Device	10.1.19222.8341

SECO	CSME_SW_2306.4.10.0_Consumer	2306.4.10.0
SECO	HID Event Filter	2.2.2.1
SECO	Programmable Services Engine Windows Drivers	1.0.10099.968
SECO	Serial IO	5.123.1.1025
SECO	Smart Sound Technology	10.30.00.7090
Seiko Instruments	SII IFD50x Driver	2.5.0.0
Telerik	Reporting	18.1.24.709

COTS Hardware

Description	Component Type
Vanguard Manage	
HP Z2 SFF G9	Workstation
HP Z4 G4	Workstation
HP P24 G5, P24 G4, P244 monitors	Workstation Monitor
Duracell DR660PSS	UPS
EATON 5P1500	UPS
Vanguard Define	
HP Z2 SFF G9	Workstation
HP Z4 G4	Workstation
HP P24 G5, P24 G4, P244 monitors	Workstation Monitor
Duracell DR660PSS	UPS
EATON 5P1500	UPS
Brother HL-L6400DW series	Mono Laser Printer
Brother HL-EX415DW series	Mono Laser Printer
HP LaserJet Pro 4001dn series	Mono Laser Printer
HP 1405-8GV3 8-port	Ethernet Switch
HPE R8R45A 8-port	Ethernet Switch
Vanguard Deploy	
HP Z2 SFF G9	Workstation
HP Z4 G4	Workstation
HP P24 G5, P24 G4, P244 monitors	Workstation Monitor

Duracell DR660PSS	UPS
EATON 5P1500	UPS
Brother HL-L6400DW series	Mono Laser Printer
Brother HL-EX415DW series	Mono Laser Printer
HP LaserJet Pro 4001dn series	Mono Laser Printer
OKI Data C831dn	Color Laser Printer
OKI Data C844dn	Color Laser Printer
OKI Data C911dn	Color Laser Printer
OKI Data C931e	Color Laser Printer
IntoPrint SP1360	Color Laser Printer
HP 1405-8GV3 8-port	Ethernet Switch
HPE R8R45A 8-port	Ethernet Switch
VinPower Digital USBShark-7T-BK	USB Duplicator
VinPower Digital USBDupeBoxES-23T, USBShark-23TBK	USB Duplicator
Vanguard Capture	
HP Z2 SFF G9	Workstation
HP Z4 G4	Workstation
HP P24 G5, P24 G4, P244 monitors	Workstation Monitor
Duracell DR660PSS	UPS
EATON 5P1500	UPS
Brother HL-L6400DW series	Mono Laser Printer
Brother HL-EX415DW series	Mono Laser Printer
HP LaserJet Pro 4001dn series	Mono Laser Printer
Canon DR-G2110	High-Speed scanner
Canon DR-G2140	High-Speed scanner
HP 1405-8GV3 8-port	Ethernet Switch
HPE R8R45A 8-port	Ethernet Switch
Vanguard Results	
HP Z2 SFF G9	Workstation
HP Z4 G4	Workstation

HP P24 G5, P24 G4, P244 monitors	Workstation Monitor
Duracell DR660PSS	UPS
EATON 5P1500	UPS
Brother HL-L6400DW series	Mono Laser Printer
Brother HL-EX415DW series	Mono Laser Printer
HP LaserJet Pro 4001dn series	Mono Laser Printer
HP 1405-8GV3 8-port	Ethernet Switch
HPE R8R45A 8-port	Ethernet Switch
Vanguard Ranked Choice	
HP Z2 SFF G9	Workstation
HP Z4 G4	Workstation
HP P24 G5, P24 G4, P244 monitors	Workstation Monitor
Duracell DR660PSS	UPS
EATON 5P1500	UPS
Brother HL-L6400DW series	Mono Laser Printer
Brother HL-EX415DW series	Mono Laser Printer
HP LaserJet Pro 4001dn series	Mono Laser Printer
Vanguard Libraries	
HP Z2 SFF G9	Workstation
HP Z4 G4	Workstation
HP P24 G5, P24 G4, P244 monitors	Workstation Monitor
Duracell DR660PSS	UPS
EATON 5P1500	UPS
Vanguard Test Decks	
HP Z2 SFF G9	Workstation
HP Z4 G4	Workstation
HP P24 G5, P24 G4, P244 monitors	Workstation Monitor
Duracell DR660PSS	UPS
EATON 5P1500	UPS
Vanguard Boost	

Brother HL-L6400DW series	Mono Laser Printer
Brother HL-EX415DW series	Mono Laser Printer
HP LaserJet Pro 4001dn series	Mono Laser Printer
OKI Data C844dn	Color Laser Printer
Duracell DR660PSS	UPS
Motorola/Zebra DS4308	Handheld Barcode Scanner
Zebra Technologies DS4608	Handheld Barcode Scanner
Vanguard Flex	
Motorola/Zebra DS4308	Handheld Barcode Scanner
Zebra Technologies DS4608	Handheld Barcode Scanner
Bausch & Lomb 819007	Handheld Magnifier
Inclusion Solutions 436	Handheld Magnifier
Vanguard Adapt	
Motorola/Zebra DS4308	Handheld Barcode Scanner
Zebra Technologies DS4608	Handheld Barcode Scanner
HP OfficeJet 200 inkjet printer	Printer
Bausch & Lomb 819007	Handheld Magnifier
Inclusion Solutions 436	Handheld Magnifier
Additional COTS Devices	
V7 HA310-2NP	Headphones
Compatible with standard sip-and-puff devices. Tested with Tash 5101	Sip-and-Puff device
AbleNet Dual Jelly Bean Switch	Tactile Switches

Language capability:

Verity Vanguard 1.0 supports the following 19 languages:

English, Spanish, Mandarin Chinese, Japanese, Korean, Khmer, Thai, Vietnamese, Tagalog, Ilocano, Hindi, Haitian Creole, Gujarati, Hmong, Lao, Hawaiian, Cantonese Chinese, Punjabi, Bengali

System Limitations

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

Election Data Limits	Testing Limit/Requirement Z240 or Z4 G4 Systems (all supported workstations except Define/Deploy/Capture/Results combined system)
Languages in a single election	19 (including English)
Precincts in an Election	3,000
Splits per Precinct	20
Total Precincts and Splits in an Election	3,000
Districts in an Election	400
Polling Places in an Election	3,050
Parties in a General Election	24
Parties in a Primary Election	10
Contests (including Propositions) in an Election	2,000
Contest Choices (voting positions) in a Contest	300
Total number of Contest Choices in an Election (independent from ballot size)	5,000
Unique write-in values per contest (Vanguard Results)	500
Unique write-in values per task (Vanguard Results)	40,000
Election	10
Tasks per Election (Vanguard Capture, Vanguard Results)	15
Registered Voters per Precinct (Vanguard Results)	99,999
Maximum Sheets per ballot	4
Ballot Stubs per ballot	2
Scan rate (Vanguard Capture)	8.5"x11": 60 PPM 8.5"x14": 60 PPM 8.5"x17": 50 PPM 8.5"x20": 50 PPM 8.5"x22": 50 PPM 11"x17": 40 PPM
Scan rate (Vanguard Vault)	PVRs: Up to 6 PPM for PVRs (any size) Standard Ballots: Up to 8 PPM for 8.5"x11", decreases linearly to 4 PPM for 8.5"x22
Ballots per vDrive: Vanguard Vault (1 sheet ballot)	25,000
Ballots per vDrive: Vanguard Capture	20,000
Ballots per election: Vanguard Capture & Vanguard Results	1,750,000
vDrives per election: Vanguard Results	3,050
Ballot Sizes – Vanguard Deploy, Vanguard Capture, Vanguard Boost, & Vanguard Vault	8.5"x11", 8.5"x14", 8.5"x17", 8.5"x20", 8.5"x22"
Ballot Sizes – Vanguard Deploy, Vanguard Capture	11"x17"
Printed Vote Record page size – Vanguard Flex	8.5"x11", 8.5"x14",
Printed Vote Record page size – Vanguard Adapt	8.5"x11"

Functionality

VVSG 2.0 Supported Functionality Declaration

Feature/Characteristic	Yes/No	Comment
System Functionality		
Election creation	Yes	
Closed primary	Yes	
Open primary	Yes	
N-of-M contest	Yes	
Precinct splits	Yes	
Ballot rotation	Yes	
Straight-party contest	Yes	
Cumulative contest	Yes	
Ranked choice contest	Yes	
Party preference contest	Yes	
Top-2 primary contest	Yes	
Presidential delegate contest	Yes	
Proportional voting contest	No	System supports casting, not tabulation.
Group voting contest	No	
Recall contest	Yes	
Top-2 IRV contest	No	
Cross-party endorsement	Yes	
Write-In voting	Yes	
Tabulation		
Provisional or Challenged Ballots	Yes	
Overvotes	Yes	
Undervotes	Yes	
Blank Ballots	Yes	
Devices Supported		
Ballot marking device	Yes	
Precinct Scanner	Yes	
Central count scanner	Yes	
All-in-one device	Yes	

XI. Attachment B - Recommendations from Accessibility Examiner



All Accessibility
Observations Vanguard



Recommendations
for Deployment Van



Top Accessibility
Positives Vanguard



Mixed Accessibility
Findings Vanguard



Top Accessibility
Problems Vanguard

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.

Severity scale

In both the expert review and voters with disabilities observations, we took notes about aspects of the system that worked well and problems they encountered. We categorized these issues 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 could prevent successful independent and private voting, even with good knowledge about how to use the system and accessibility features

Positives

Function	Observation	Severity
General	The voters was overall enthusiastic about the “tech-y” look and feel of the system. It was similar enough to technology used in daily life that he adapted quickly even though has not voted since 2008.	Positive
Activation	Nice that the ticket is spoiled by overprinting the code, so the status is visible	Positive
Control setup	Once the tactile controller is plugged in, the controls and audio are always available. No other set up is needed.	Positive

Function	Observation	Severity
Control setup	It is easy to switch from touch to tactile seamlessly, even mixing them during the interaction.	Positive
Control setup	The system responds to the last input method -for example, if you touch the screen, the highlight disappears and it expects another touch. If you use the Move wheel, the highlight instantly reappears.	Positive
Control setup	A voter did not use his right arm & hand. Only his left and that was limited. He was unable to lift his arm high enough to reach the buttons at the top of the screen. He successfully used a combination of touch and controller to operate the voting system. E.g., he used the wheel to move through candidates showing at the top of the screen but used touch on the buttons at the bottom (e.g., Next) after making a candidate selection or selecting Yes or No for the referendum question since those buttons were at the bottom	Positive
Control setup	Ability to get demonstrations of audio settings (volume and speed) was very useful.	Positive
Ballot scanning	Instructions for inserting the ballot worked for people using the audio, enabling them to cast their ballot independently, once they were given the headsets and controller	Positive
Ballot scanning	Was able to learn how to use the scanner from audio	Positive
Ballot scanning	The ballot can be inserted into the scanner in any direction. This is a positive for all voters. Poll workers should know this, so that if they are assisting someone, they can keep the side with their votes hidden while casting the ballot	Positive
Navigation	Easy to move from review screen to different sections of the ballot, make changes, and get back to the review screen.	Positive

Problems

Function	Observation	Severity
Activation	There was no place to put the activation ticket once removed and no instructions for what to do with it	Problem Solving
Activation	It was hard to figure out where to insert the activation ticket	Needs Assistance
Activation	A voter was unable to start the session without assistance. (Aide said they would have discussed and reviewed this beforehand in normal situation.)	Needs Assistance
Controller setup	There was nowhere to place the controller on the table. The position of the Flex on the table is set by the design, which includes a place to tie the device to the top of the table	Needs Assistance
Controller setup	A voter had difficulty with the controller because it slid off of her lap. Her aide moved it to the side of the voting system.	Needs Assistance
Getting started	The introductory screen, which offered English and Spanish buttons, didn't allow time for the participant to respond (i.e., move the wheel to select the English button) before it automatically shifted to Spanish. Participant unsure how to proceed. Hearing Spanish but didn't know how to get the Spanish to stop (revert back to English)	Needs Assistance
Getting started	A voter was overwhelmed at the amount of information on the help screen explaining the controller and how to navigate through screens. Abandoned the instructions and played around with it to figure it out through trial and error.	Problem Solving
Getting started	After selecting the volume he wanted, he was unsure how to move on. The "Ok this sounds good" button was at the bottom but his attention was focused at the top of the screen. Up until this point - all the things to be read and buttons to be selected were either in the middle of the screen (e.g. English vs Spanish on the first screen) or at the top (e.g., the screens for setting up the a11y options). This is the first place to encounter necessary button at the bottom	Problem Solving

Function	Observation	Severity
Controls	The screen does not support swiping to scroll in a list. If you try to swipe, it activates the object first touched. This may be because is activating on touch, not lift, so has no way to register a swipe.	Problem Solving
Controls	Touchscreen did not respond on multiple screens. 2 scenarios happened throughout session: it took 3 touches to get a response or participant touched 2-3 times and gave up, moving to the controller.	Problem Solving
Controls	Understood that the move wheel sent navigation backwards and forwards, but this was not intuitive. Voter hesitated to go back and took the long route through screens. Fairly patient with this, but it made navigation take much longer.	Problem Solving
Controls	Voter's tap, particularly on the buttons at the bottom, did not register. This was frustrating for the voter.	Annoyance
Controls	The [onscreen keyboard for write-ins] was small. Hard to hit the keys	Annoyance
Controls	[While using the onscreen keyboard] wanted directional arrows to go up and down the rows and move around more quickly	Annoyance
Controls	Voter's tap did not always register. The voter would tap several times. Sometimes the multiple taps caused the voter to inadvertently skip a contest.	Problem Solving
Controls	Initially seemed to be pressing the indentation (concave hemisphere) in the wheel after he had moved somewhere (via the wheel) and wanted to select. But then moved his hand to the select button. It was not easy for him to move his hand from side to side (he was only using left hand) - it took an extra effort for him to move between the two sides of the controller (between Select and the wheel)	Problem Solving
Audio/ Controls	There was a little bit of interference happening when the audio voiced instructions to use the wheel to move on but he was in the process of lifting his hand to tap on a	Annoyance

Function	Observation	Severity
	button. He would sometimes shift to using the wheel at that point.	
Audio	Audio starts immediately on entry to a screen. There is no pause to help someone get re-oriented. This might also be a problem for a voter marking their ballot with an assistant	Annoyance
Audio	Every contest voiced how many items were in the list (how many contests on the ballot). Voter thought it was how many candidates were in the contest. The screen says “3 of 16” whereas the audio is lengthier and less clear that 16 is the number of items on the ballot.	Annoyance
Audio	Not able to pause audio at voter need or prevent from starting when navigating to a new area.	Annoyance
Instructions	On the Learn How to Vote Your Ballot screen, the participant listened to the instructions for how to make a selection and proceeded with the practice scenario with “Sample Candidate”. Puzzled by the voicing after she pressed the Select key. Without the visuals - she didn’t know that Sample Candidate was the “name” of the “candidate”.	Annoyance
Instructions	No one noticed the Review button at the bottom of the screen, unless they used it by accident. This meant that when they made a correction from the review screen, they did not know how to get back	Annoyance or Needs Assistance
Instructions	Several instructional screens did not end with instructions for how to move forward. The participant listened to the instructions but did not know how to proceed - that they needed to use the wheel to move out of the instruction box.	Needs assistance
Instructions	When a voter is making corrections from the review screen, there is no difference in the what the screen says, to help audio-only voters stay oriented.	Problem Solving

Function	Observation	Severity
Navigation	Learned to look for buttons at the bottom to navigate through contests.	Problem Solving
Navigation	Trouble distinguishing between back and next buttons.	Problem Solving
Navigation	Unclear that review button exists because voter learned the pattern was select candidate, scroll through remaining candidates, back button, next button, navigation to next contest. (This might also be related to voter being a little unsure about the move wheel going in both directions on screen.	Problem Solving
Navigation	The Return to Review button was effectively hidden from the voter because of its position after the Next button. Someone looking at the screen can see it is there, but for her - she had no awareness of what was beyond the Next button. So she was using the Next button to move on after making changes to a contest. This meant she had to move through all of the contests after the one she modified before getting back to the Review screen.	Problem Solving
Navigation	When returning the the Review screen the voter was frustrated that she was returned to the top of the Review screen rather than to the contest she had selected to modify. It means she lost her place and had re-listen to a review of her selections - every time she modified a contest.	Problem Solving
Navigation	Voter wanted to have the Help screen read to her again. She was unable to find a way to do that.	Needs Assistance
Navigation	When making a correction after navigating from the review screen, people selected Next (as they had while initially marking the screen), and never noticed (or in the case of audio-only voters, never encountered) the review button. They were frustrated when they realized that they were going through the whole ballot again and needed assistance to find the more efficient option.	Needs Assistance

Function	Observation	Severity
Write-ins	QWERTY layout made it more challenging for blind voter to find letters.	Annoyance
Write-ins	Voter did not know how to delete a letter. She visited the Help page (for write-ins). The instructions said deleting a letter was possible but didn't not provide any information about where to find the Delete button (e.g., it comes after the punctuation options)	Annoyance
Write-ins	People didn't remember the instructions for completing the write-in, and had trouble finding the Accept button at the bottom of the page.	Needs Assistance
Write-ins	Voter uncertain where she was after letters (already in the text box) were voiced. This happened when she was trying to sort out if she had accidentally selected a letter she didn't want.	Problem Solving
Write-ins	Once the write-in has been approved and the voter has returned to the contest screen, it cannot be edited. It can only be complete erased and re-entered.	Might prevent independent voting
Write-ins	The voicing for the Delete key refers to "last entry". The voter was thought she had mistakenly selected a wrong letter but was not sure. It didn't help her determine if there was a letter that needed to be deleted.	Might prevent independent voting
Write-ins	Voter heard a mistake for write-in candidate's name as she was moving through the review screen. Because she had just heard it spelled, she thought she could edit at that point. Someone seeing the screen has visual context to realize the write-in candidate's name is not editable at the point in time (because not in an edit box). She was unsure how to proceed to fix the spelling error. Select seemed like the wrong choice because the name was mis-spelled. She didn't want to select it, she wanted to fix it.	Might prevent independent voting

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.

Hands-on practice before the election

Poll workers wanted a detailed introduction and a chance to try out the system before Election Day. They recommended:

- Opportunities for **hands-on experience voting on the accessible system**, including scenarios for different situations they might have to handle.
- **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.
- **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.

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.

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 touchscreen and facing the voter would make it clear that they are not looking at the screen.

Poll worker procedures

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

The most difficult part of the voting process with the Flex is inserting the activation ticket and the blank ballot. Giving these instructions to voters verbally would make the process smoother. Points to stress include

- The location of the slot for the ticket and the orientation of the QR code (for voters who can see) and the corner cut (for voters relying on tactile input)
- The orientation of the ballot and location of the corner cut when it is inserted
- Making sure they have the tactile controller placed in a secure position where it will not slip and fall.

At the scanner

- Let voters know that their ballot can be inserted into the scanner in any orientation. Using a privacy sleeve is the most secure. However, inserting the ballot upside down, with the print toward the floor, is sufficient.
- Reminding voters who can see to check their selections on the printed side of the ballot.
- Helping voters who need audio instructions or to use the review screen get set up. It is the same controller, so all they need is to know where it is and that it is ready to use.

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.
- Provide help plugging in personal headsets or assistive technology with verbal instructions or by doing it for the voter.
- Make sure voters are oriented and know where all parts of the voting system are, including the privacy shields or covers.
- Remind voters how to cast their ballot and how to know when they are finished.

When a voter needs help during the voting session:

- Stand to the side of the voting system, where the voter can see you, but you cannot see the screen.
- If you need to do something on the screen, ask the voter for permission first and give them a chance to navigate to a screen where their ballot choices are not visible, if possible.

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.

Top positives about this system

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

Participants felt positive about the Flex BMD and the scanner

They did not experience any major problems selecting candidates or reviewing their votes. Even when they had minor problems they said that they could learn the system, that it was straightforward to use, and that it's better than the system they have now.

For the two blind voters, having audio at the scanner to allow them to cast their ballot independently was a big success compared to the systems they were used to. This feature and the fact that it used the same now-familiar tactile controller elicited positive comments and expressions of genuine delight.

Why this is important

First reactions matter. The participants' reactions to the system because if a county selected this system, they would be more likely to be willing to learn a way of voting that feels easy and more likely to actually vote in an election.

The setup for assistive technology made it easy to use

Once connected, the tactile controller (and any accessories like special switchers or a personal headset) attached to it were always available. It was also possible to fluidly switch between using the tactile controls and the touchscreen, even within a single contest. The system remembers the last control used and continues using the appropriate visual highlights and instructions.

Why this is important

This meant that a poll worker does not have to help activate the system before the voting session begins, reducing independence. It also allowed participants to mix methods for their most efficient interaction. One participant, for example, used touch for the navigation controls at the bottom of the screen, and the controller to navigate to and select candidates.

Additional positives can be found in the "All Observations" section of this report.

Mixed findings

There were aspects of the ballot marking interface that were successful for some voters, but caused problems for others. There are also a few features that are helpful, but create differences between the information in the visual and audio interfaces.

The tactile controller and Move wheel

This tactile control and especially the Move wheel had very different reactions from participants, not correlated directly to their disability.

- They liked the simplicity of the controller, with just three buttons. However, this also reduces the functionality to essentially a dual switch, removing direct access to some features from anywhere on the screen.
- They liked the small size, but some did not like the separation of the Move wheel from the Select button.
- They liked the opportunity to move quickly through “tab stops” on the screen, but did not like it when it moved faster than they could keep up with and they lost their place in the screen. This is not dual activation, but means that it skips any voicing of some elements. This makes it more effective for voters using vision plus the tactile controls than for those navigating entirely through the audio interface,



The tactile controller is designed to be used with two hands, like a game console.

For some, the Move wheel on the controller was a success

Some of the participants loved the novel tactile controller. They found it easier to learn than previous controllers they had seen with many different buttons. They liked the simplicity of having just 3 buttons, and the familiarity compared to gaming controls compared to other controllers.

Why this is important

Assistive input controllers are highly varied. Personal devices are selected to work best for the specific disabilities of the person, including their range of motion and dexterity in the use of their hands.

This controller worked well for some people who might not be able to successfully use a more complex control, but has limited navigational options.

Some participants had problems using the tactile controller

Using the Move wheel to navigation requires a rotational gesture, which some people struggle to master, even without dexterity limitations. It can also be hard to find the right speed: too slow and the interaction feels tedious; too fast and it's easy to zoom past your choice.

It was especially hard to get the wheel to stop accurately on the four support buttons at the top of the screen. This may be because people naturally accelerate when skipping through many "stops" on the wheel, or it may be because the highlighting is not as visible on the buttons at the top and bottom of the screen.

Other complaints included:

- The relatively large distance from the Move wheel to the Select button
- Not allowing a selection by pressing the Move wheel
- Not having enough room on the table to place the controller on a flat surface (The tables that come with the system have an indentation for storing the controller to the side of the screen, but this is not an operational position.)

Why this is a problem

The tactile controller is the primary way for people with visual or dexterity disabilities to interact with the ballot marking device. In this testing, it included four of the six people.

Some people might find a repetitive action, such as using a dual switch (provided with the system) easier. This was true for one participant in the Hart VVSG 1.0 certification testing, using the same controller. Those who can both see and reach the screen might find touch easier, but there were also problems with the touch screen.

Recommendations

- Require jurisdictions to have at least one set of dual switches available as an alternative if a voter cannot use the wheel effectively, and be sure that poll workers are trained in its use.
- Do outreach to make sure voters with specialized at know that they can bring some kinds of personalized switches.
- Make the system available for voters to try out in advance, so they get practice and can test their own AT. This could be arranged through the county Center for Independent Living or through local chapter of disability groups like the National Federation of the Blind.

- Set up the Flex so that there is space between the system and the edge of the table for the controller/
- Longer term, we urge Hart to think about whether a change in the programming, like setting a maximum speed, or adding a firm press to select would be helpful. It might also think about the design of the stands to include space in front of the machine. We assume that these tables could be made available without needing certification.

The voicing of information on the contest screen is inconsistent

Two aspects of the design had a different effect in the visual and audio interfaces.

The names of parties are shown and read differently

In this case, there is information added to the display of a candidate's party endorsement (including dual endorsements).

- Visually, the party names are shown as capitalized abbreviations such as DEM, GRN, REP, LIB. They are positioned to the right or below the candidate name.
- In the audio, they are voiced as though spelled out: Democratic Party, Green, Party, and so on.

Why this is a problem

This provide different information in one mode. Visual users of both paper and electronic ballots have to be able to interpret the 3-letter acronyms as their expanded text, and understand that these are the names of parties.

Recommendations

This may be a results of the legal election requirements in Pennsylvania. If so, it can be fixed by spelling out the party name on the ballot.

The number of contests is shown and read differently

In this case, the voicing of the contest number adds information in a way that is confusing.

- Visually, this information is displayed on the right end of the contest title:

Representative in Congress
5th District

4 of 16

Vote for 1

- In the audio this is voiced with a slight pause between sections of the text, shown below by placing them on different lines.

Representative in Congress

5th District

This is ballot item

3

The total number of items on the ballot is

16

Vote for one

Why this is a problem

In the visual presentation the contest number is easy to ignore, placed to the right side. However, the audio is much harder to skip over. It is longer, with explanatory words added, but also harder to understand. “Ballot item” is a neutral term, but not a common way of referring to a contest. One participant thought it referred to the number of candidates.

Recommendations

This could be voiced in a simpler way, even with added words to make the meaning clearer, such as

This is the fourth of sixteen contests

or Fourth of sixteen contests on the ballot

Top problems

Testing identified the top problems that could reduce the ability of people with disabilities to vote independently and privately on the Hart Vanguard accessible system.

Some participants had problems using the touch screen

While this is a smaller problem, it is still important that participants had trouble figuring out how to use the touch screen, and that this included people who regularly used smart phones. They experienced:

- Multiple touches that produced accidental activations of a second control
- No touch registering, or a control seeming not to be active over the whole visual area.
- Someone trying a simple gesture (like a vertical swipe) and activating the control or candidate on the screen where they first touched.

This led to not knowing if a feature was active (even when it was) and frustration.

Why this is a problem

It is possible that voters might find both the controller and touch unavailable to them.

Recommendations

- We found that the touch control was more reliable when using a stylus. Counties using the system might want to have an inexpensive styles (without a pen) available. An unsharpened pencil with a good eraser might also work.
- Opportunities to practice in advance as noted above would help voters be prepared.
- Poll worker training – and making sure that a voter has found a successful input option before leaving them to vote independently – would also be helpful

Blind voters found the initial screens confusing

The first few screens had a number of small problems that added up to confusion for blind participants, although both were generally skilled assistive technology users. The general flow of information isn't bad, but:

- On the first screen, they were thrown by hearing Spanish, and missed the information about the tactile controller because it's only an animated image
- On the second screen (choosing accessible settings) they didn't know how to move on to make choices, or how to skip forward if the volume and speed were OK.
- The main help screen as a long text with several topics, presented in one big block, so it was only possible to listen to the whole thing.

- They did not understand the tutorial screens, which may rely too much on the visual presentation and don't do a good job of cuing the voters that this is a test screen well.

Why this is a problem

This is help that doesn't really help. It makes the system seem hard to use. Calling for help reduces confidence that the Flex can be used independently.

Recommendations

- A very short orientation script that poll workers can deliver with just a few basics when handing a voter the controller might be more useful than the on-screen tutorial. If this is created, it should be designed with blind voters to be sure it touches on the key points they need to move forward confidently

Inconsistent navigation cues confuse voters

This affects voters using only the audio.

In most places, for instance in navigating a list of candidates, each chunk of content ends with an instruction of the next step and how to continue, for example, "To go to the next candidate, [do this]."

However in a few places, mostly on the entry, settings, and help screens, the voicing of the current object ends without a "next step" instruction.

Why this is a problem

Like the previous problem, this is mostly an issue on the non-contest screens. Those screens are very consistent in the voicing pattern, and the same patterns repeat for each candidate and contest. So, it is in the moments when voters are trying to manage the system controls that the problem appear.

Recommendations

- Review all of the audio prompts and fix the problem.

There is no way to pause the audio

This occurs in two places

- In blocks of text, such as the help screens and ballot questions
- When entering a screen and reading the header

Voters can skip in and out of the audio, but cannot pause it in place and then restart it. Participants found this annoying, especially when there were several topics in one block of text.

When a voter selects Continue to move from one screen to another, the voice begins immediately, and begins reading the contest header. Participants found this disorienting, pushing them forward with no moment to reorient to the new context,

Why this is a problem

In some ways, this is a small problem, but it made voters relying on the audio feel that they were not in control of the process of marking a ballot.

Recommendations

Without changing the buttons on the tactile controller, there is not much that can be done, but the content might be adjusted:

- Break the topics on a multi-topic screen into separate blocks
- Put the title of the contest into one block, then the additional information in separate blocks. (This would require more button presses, but allow voters to control the pa

Write-in votes are a perennial frustration

The write-in interface is one of the most difficult in any ballot marking device (as well as on paper ballots). The frustration it causes is high enough that many of what might be solvable annoyances mean that voters either need assistance or could be unable to vote independently.

Editing a write-in

The biggest problem, and the one most likely to prevent voting successfully is that once the write-in has been approved and the voter has returned to the contest screen, it cannot be edited, only be complete erased and re-entered. Participants were dismayed by this and took some time deciding how to react.

- They expected a warning before pressing the Accept button. There are instructions at the top of the screen, but they only say “To confirm your choice and return to the ballot, touch “Accept”
- The text being entered is before the keyboard, so to hear the full name read back, the voter has to navigate from the last key entered all the way around the alphabet to the top row of the menu and into the field where the name is being assembled.
- One voter was confused when encountering the Delete key. She thought it meant that she had a mistaken letter, but could not figure out how to get it to read back the letters she had already entered.
- They only discovered the mistake once they had accepted the entry and were back on the contest screen.

The system does not try to read the name, but only spells out the letters. This made it hard to tell the difference between hearing the letters read on the write-in entry screen, or on the contest or review screens.

Typing the name

The keyboard is a QWERTY layout. Voters experienced with typing are used to this layout, but the memory demands of remembering both what you have already typed and where keys fall in a linear sequence add to the difficulty.

- More experienced participants wondered why they could not go up and down between rows in the keyboard layout.
- Participants asked why the layout was not in alphabet order if they had to move all the way through the keys one by one.
- This could be an option, allowing voters to use the keyboard layout that is simpler for them.

For the blind participants, it was hard to remember (and check) what has been entered so far, and the navigation after selecting a letter, for reading back the entry, and for deleting a letter is confusing.

One participant with limited reach wanted to use the touchscreen to enter a name, realizing how much more quickly that input method would be. But he had trouble activating the touchscreen with his arm extended and became frustrated and quit after 5 letters.

The contextual help was not very helpful

Participants only tried the Help button when they could not figure out how to do something, so the general information it offered was not very helpful. For example, when a participant turned to help to learn how to delete a letter, it told her that there was a delete key, but not how to find it or where it was placed in the linear sequence.

XII. Attachment C – Acceptance Testing Attestation



Voting System Implementation Attestation

System Name: Hart InterCivic Verity Vanguard 1.0

County: _____

Date Installed/Upgraded: _____

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

System Component	Software or Firmware Version	Hardware Version	Model	Comments
Verity Vanguard Workspace				(Please specify the implementation, single device (desktop/laptop), Client/server)
Verity Vanguard Vault				
Verity Vanguard Capture				
Verity Vanguard Flex				
Verity Vanguard Boost				

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 Verity Vanguard 1.0 system. Any ancillary components sold under this contract, such as switches, ballot boxes, and charging carts, are EAC-certified components of the Verity Vanguard 1.0 voting system. (Attach a list of all ancillary components sold under this contract.)

Hart 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.

Hart 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 8/6/2026 (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:** _____

XIII. Attachment D – Minimum Training Requirements

Hart 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 Hart 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;
 - l. 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 Hart'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 set up, operate, and close down the Voting System on Election Day.

XIV. Attachment E – Escrow Obligations

Hart 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). Hart must pay all costs associated with 1) placing the codes in escrow and 2) verifying that Hart 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, Hart shall deliver a true, accurate and complete copy of all source code 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 Hart, Hart 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 Hart.
- c. Escrow agreement. An escrow agreement must be executed by the parties, with terms acceptable to the Commonwealth prior to depositing any source code into escrow. Hart 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. Hart agrees that upon the occurrence of any event or circumstance which demonstrates with reasonable certainty the inability or unwillingness of Hart to fulfill its obligations to Commonwealth under this Contract, Commonwealth shall be able to obtain the source code of the then-current source codes related to Voting Systems software, EPB software, and/or any Hart property placed in escrow from the escrow agent.