Delaware County Bureau of Elections, PA - Hash Verification Project Report
March 13, 2025

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Purpose

The U.S. Election Assistance Commission (EAC), in partnership with the Delaware County Bureau of Elections, performed a review of Delaware County's voting system on March 13, 2025. The purpose of this review was to confirm that the system owned by and used in Delaware County is identical to the system certified by the EAC. With that goal in mind, the EAC set out to (1) observe and verify that the certified Hart InterCivic verification procedures were followed during the review; (2) perform a Scope of Certification review of Hart InterCivic's Verity Voting 2.7 (Verity 2.7) as fielded at the Delaware County Bureau of Election facilities; (3) observe, assist, and document a hash verification of a sample of the Verity 2.7 voting equipment that is used; and (4) observe the physical voting system, facility security, as well as prescribed best practices used during the project.

Background

The EAC's Testing and Certification Program assists fifty states, five U.S. territories, and the District of Columbia by providing voting machine testing and certification. This program is a requirement of the Help America Vote Act (HAVA) of 2002, legislation that created the EAC and mandated that the Commission provide certification, decertification, and recertification of voting systems, as well as the accreditation of voting system testing laboratories and quality monitoring of fielded voting systems. This legislation marked the first time the federal government provided oversight into these activities, allowing states to procure new certified voting systems without the added expense of independent testing and certification.

The EAC's Field Services Program (FSP) is tasked with implementing the Testing and Certification's Quality Monitoring Program (QMP). One element of QMP is fielded system conformance reviews, which the EAC may conduct upon invitation or with permission from the state or local election authority. The purpose of these reviews is to ensure voting systems used by jurisdictions are identical to those tested by an EAC-accredited Voting System Test Laboratory (VSTL) and certified by the EAC.

The EAC's Testing and Certification Program is the critical first step in establishing a chain of custody over the voting systems used in our nation's elections. A registered voting system manufacturer that wishes to have their system tested and certified by the EAC must provide their software code to an EAC-accredited VSTL for review and testing. The VSTL uses the manufacturer's code to build the system in a secure and safe environment and subsequently tests the system against the Voluntary Voting System Guidelines (VVSG). Once testing is completed and the VSTL determines the system conforms with all applicable requirements, the voting system may be certified by the EAC. At this point, the VSTL generates the trusted hash values for the system that will be used later to verify the voting system. This

ensures that the system deployed in any jurisdiction is identical to the system reviewed and tested by the VSTL and certified by the EAC.

The Verity 2.7 system was certified and issued a Scope of Certification by the EAC on June 7, 2022. The Verity 2.7 system used by the Delaware County Bureau of Elections includes specific hardware and software components that include an Election Management System (EMS) workstation, central scanners, count workstations, ballot scanners, ballot marking devices (BMD), secure flash drives, and other components of the certified system.

Definitions

Ballot Marking Device (BMD): A device that permits contest options to be selected and reviewed on an electronic interface, produces human-readable paper ballots, and does not make any other lasting record of the voter's selections.

Central Scanner: A high-speed, digital ballot scanner typically used at a central count facility or election office to process a high volume of paper ballots. A central scanner uses digital cameras and imaging systems to read the front and back of each ballot, analyze each ballot image, verify ballot validity, and identify marks on the ballot.

Chain of Custody: A process used to track the movement and control of an asset through its lifecycle by documenting each person and organization who handles an asset, the date/time it was collected or transferred, and the purpose of the transfer.

Conformance Review: A conformance review includes documenting all components of a voting system that are used and present to ensure that the items are listed on the Scope of Certification in the EAC's Certification process.

Election Management Guidelines (EMG): EMGs were created to assist state and local election officials in effectively managing and administering elections. These guidelines complement the technical standards for the VVSG for voting equipment. Each chapter of the EMG is vetted by recognized election experts and offers practical discussions of election issues, with examples and helpful tips, including physical security and chain of custody. The EMG's goal is to familiarize election officials with election processes and challenges they will likely encounter during their tenure and is designed to be accessible to election officials at all levels.

Election Management Software (EMS): Set of processing functions and databases within a voting system that defines, develops, and maintains election databases, performs election definitions and setup functions, formats ballots, counts votes, consolidates and reports results, and maintains audit trails.

Engineering Change Order (ECO): A change to a certified voting system's hardware, software, technical data package, or data, the nature of which does not materially alter the system's reliability, functionality, capability, or operation. Such changes require VSTL review and endorsement, and EAC approval.

Hashing: Hashing is the process of computing a unique alphanumeric value on a data file or electronic message, such as text, numbers, photos, programs, or files, into a fixed-length string of letters and numbers through a mathematical algorithm.

Hash Value: A hash value is a fixed-length digital fingerprint generated by a one-way cryptographic algorithm (e.g., SHA-1, SHA-256, SHA-512) to uniquely represent input data. Although the hash is a binary output, it is typically encoded in human-readable formats such as hexadecimal or Base64 for ease of storage and comparison.

Hash Verification Review: A hash verification review involves generating the hashes from a voting system component's software and verifying those hashes against a trusted source. This review ensures the system is the same as what was certified by the EAC and that there has been no manipulation of the program files.

Sample Review: A review of a select number of parts or devices from a voting system and its components. This review offers a representative evaluation, providing a solid basis for drawing a conclusion about the overall system.

Scope of Certification: Documentation created by the EAC at the end of system testing as part of certification. This document details the configuration of the system that underwent testing and can be used as a checklist in evaluating a fielded system.

Technical Data Package (TDP): Manufacturer documentation relating to the voting system, which can include manuals, descriptions of components, and details of architectural and engineering design.

Voluntary Voting System Guidelines (VVSG): A set of specifications and requirements against which voting systems can be tested to determine if they meet the required standards. Some factors examined under these tests include functionality, accessibility, and security capabilities. While HAVA mandates the EAC to develop and maintain these requirements, adhering to the VVSG is voluntary except in select states where it is required by their state law.

Testing and Certification Program Manual: The primary purpose of this manual is to provide clear procedures to manufacturers for the testing and certification of voting systems to the VVSG consistent with the requirements of HAVA Section 321(a)(1).

References

A. EAC Scope of Certification for Verity Voting 2.7
B. EAC Testing and Certification Program Manual
C. Verity System Administrator's Guide, Version 2.7
D. Verity Knowledge Base, Hash Testing for Verity Software and Devices
E. Help America Vote Act (HAVA)
F. EAC's Election Management Guidelines
G. EAC Chain of Custody Best Practices
H. Voluntary Voting System Guidelines Version 1.0 (2005), Volume 1
I. Delaware County Bureau of Elections, Hash Testing Procedures

Participants

U.S. Election Assistance Commission (EAC)

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Hart InterCivic Inc.

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Public Observers

Multiple members of the public

Roles

U.S. Election Assistance Commission

The EAC provided project scope, guidance, and coordination for the fielded system review, which included providing technical assistance and information to the Delaware County Bureau of Elections. During the first part of the fielded system review, the EAC staff conducted a conformance review on a sample of selected voting system devices at the Delaware County Voting Machine Warehouse to ensure conformance with the EAC Scope of Certification. Then, the EAC observed and documented the results and processes used during voting system hash verification at the Delaware County Bureau of Elections facilities in Chester, Pennsylvania. Lastly, the EAC observed and noted best practices such as the voting system and facility security measures, and innovations in procedure.

Delaware County Bureau of Elections

The Delaware County Bureau of Elections provided the technical resources and local expertise needed to conduct the review, as well as access to voting equipment and facilities. In addition, they provided computer services staff, USB drives as needed to perform hash verifications on the equipment, and access to a non-Hart computer to conduct the hash verification review. During the conformance and hash review, the Delaware County Bureau of Elections oversaw all systems' chain of custody to maintain election equipment integrity, and provided guidance and support, as necessary. Delaware County oversaw hash testing of BMDs, precinct scanners, central scanners, and count workstations, and managed the voting system chain of custody. Furthermore, staff from the Delaware County Bureau of Elections provided the EAC with detailed information regarding their election processes and their use of the voting system. At no point did the EAC directly access, interact with, or otherwise engage with the county's voting system.

Pennsylvania Department of State

The Pennsylvania Department of State provided oversight and formal approval of the hash verification project. The Department authorized the project's engagement with county boards of elections across the Commonwealth, ensuring that all activities were conducted in coordination with local election officials and were in alignment with statewide election security protocols.

Hart InterCivic Inc.

Despite not being physically present at the location, the Hart InterCivic team provided comprehensive off-site technical support. Their remote assistance included detailed procedural guidance, ensuring precise adherence to protocols and operational efficiency. This approach maintained a high standard of technical oversight while enabling effective remote collaboration.

Public Observers

Delaware County allows members of the public to attend and observe the hash verification process. During the public hash verification test conducted at the Delaware County Bureau of Elections voting machine warehouse, observers were present and able to view the procedures from a designated distance. While refraining from any interference, members of the public observed the process firsthand and were able to ask clarifying questions to better understand the system's security measures. The observers viewed the hash verification steps performed by the election staff to demonstrate that software versions matched expected values.

Scope of Review

The scope of review covers what the EAC examined, how it was examined, and the objectives achieved during the review process of this project. The scope of review provides the foundation on which results were obtained, and observations or recommendations were provided.

Device Sample Size

Delaware County implemented a random sample with a physical randomization technique using a 10-sided die. This ensures each precinct has an equal chance of being selected. The sample size of equipment inspected was agreed upon by the EAC in partnership with the Delaware County Bureau of Elections at 5% of precincts. In previous hash verification tests, Delaware County performed a 2% sample of their precincts, keeping in line with Pennsylvania Secretary of State guidelines for post-election audits. The increased sample of 5% of the county's 428 precincts included 64 Verity 2.7 voting devices. This included 22 Verity Scan precinct scanners, 23 Verity Touch Writer BMDs, and all 10 Verity Central Count scanners. In addition, 100% of the County's Verity Count tabulation system was verified — including Verity Data and Verity Build workstations.

Confirm Application of Hart InterCivic Certified Procedures

EAC staff observed and documented that the verification procedures applied during the review by the Delaware County Bureau of Elections are identical to the certified Verity 2.7 verification procedures as published in the Technical Data Package (TDP).

Voting System Conformance Review

During the conformance review process in Delaware County, the EAC reviewed and verified the sample of the Verity 2.7 voting system devices used in Delaware County to ensure they fall within the EAC's Scope of Certification as certified on June 7, 2022, and any other changes to the system configuration made through an engineering change order (ECO), if applicable.

Hash Verification Review

The EAC observed and documented the setup of a laptop computer not associated with the voting system configuration under review for the use of a verification comparison tool. The EAC observed and documented the results of the hash verification performed by Delaware County on the Verity Central, Verity Count, Verity Touch Writer, Verity Scan, Verity Data, and Verity Build stations including serial numbers of the equipment and USBs used to obtain hashes from each component, while noting the roles, protocols, and procedures used throughout the process. The hash verification procedure used during the review followed the system verification instructions created by Hart InterCivic under the VVSG 1.0 as certified by the EAC and outlined in the Verity System Administrator's Guide and Knowledge Base documentation. The third-party, open-source software used to verify the voting system's hashes was version 2.16.32.0 of WinMerge.

Physical Voting System and Facility Security Observations

The EAC observed the physical voting system and facility security processes and procedures implemented by the Delaware County Bureau of Elections to ensure that they meet industry best practices, as outlined in the EAC Election Management Guidelines, and are adequate to ensure the robust security of the voting system and facility. Specific measures observed included the use of tamper-evident seals, restricted access to sensitive areas, and documented chain-of-custody protocols.

Results and Observations

Hart InterCivic Certified Procedures

All system verification procedures followed by the Delaware County Bureau of Elections were observed by EAC personnel to ensure compliance with Verity 2.7 TDP as certified by the EAC.

System Conformance

Verity Central Workstations

Ten Verity Central Workstations at the Delaware County Bureau of Elections' Chester office were reviewed and found their model numbers matched the Scope of Certification. All proprietary and commercial off-the-shelf (COTS) components for each workstation, high-speed scanner, and printer were reviewed, and found within the Scope of Certification.

Verity Count Workstation

The Verity Count workstations were reviewed for conformance, and the model numbers matched the Scope of Certification. All proprietary and COTS software and

hardware were reviewed, found to be functional, and within the Scope of Certification.

Verity Data and Build Workstations

The workstations were reviewed for conformance, and the model numbers matched the Scope of Certification. All proprietary and COTS software and hardware were reviewed, found to be functional, and within the Scope of Certification.

Verity Touch Writer BMD Devices

The stand-alone workstation was reviewed for conformance, and the model numbers matched the Scope of Certification. All proprietary and COTS software and hardware were reviewed, found to be functional, and within the Scope of Certification.

Verity Scan Devices

The precinct scanners were reviewed for conformance, and the model numbers matched the Scope of Certification. All proprietary and COTS software and hardware were reviewed, found to be functional, and within the Scope of Certification.

Hash Verification

All randomly sampled precinct scanners, BMDs, EMS workstations and their software were reviewed. The hashes were generated and then verified against trusted hashes that the Delaware County Bureau of Elections obtained from the EAC. Field Services Program staff observed as hashes were generated and compared. Hashes for the voting system were confirmed using Verity 2.7's method of verifying outlined in its TDP. No discrepancies were identified. The serial numbers of the equipment reviewed are detailed below:

Workstations and Election Management Software

Table 1: Verity Workstations by Serial Number and Hash Match

Device Type	Serial Number	Hash Match, Yes/No?
Verity Data/Build Server	D1900247812	Yes
Verity Data/Build Client 1	D1900247612	Yes
Verity Data/Build Client 2	D1900247712	Yes
Verity Data/Build Client 3	D1900247912	Yes
Data Build Stand-alone	D1900216807	Yes
Verity Central Server Stand-alone 1	D1900216607	Yes
Verity Central Server Stand-alone 2	D1900216707	Yes
Verity Central Server Stand-alone 3	D1900236512	Yes
Verity Central Client 1	D1700189706	Yes

Verity Central Client 2	D1700190406	Yes
Verity Central Client 3	D1800194202	Yes
Verity Central Client 4	D1800203505	Yes
Verity Central Client 5	D1800203705	Yes
Verity Central Client 6	D1800204705	Yes
Verity Central Client 7	D1900230712	Yes
Verity Count Server	D1900217207	Yes
Verity Count Client 1	D1900217007	Yes
Verity Count Client 2	D1900217107	Yes
Verity Count Client 3	D1900217307	Yes
Verity Count Client 4	D1900243112	Yes

Verity Scan Precinct Scanners

Table 2: Verity Scan Precinct Scanners by Serial Number and Hash Match

Device Type	Serial Number	Hash Match, Yes/No?
Verity Scan	S1913208510	Yes
Verity Scan	S1903215210	Yes
Verity Scan	S1903222310	Yes
Verity Scan	S1903205010	Yes
Verity Scan	S1903170710	Yes
Verity Scan	S1903199310	Yes
Verity Scan	S1903188910	Yes
Verity Scan	S1903220610	Yes
Verity Scan	S1903182710	Yes
Verity Scan	S1903204510	Yes
Verity Scan	S1903222110	Yes
Verity Scan	S1903202310	Yes
Verity Scan	S1903213110	Yes
Verity Scan	S1913565212	Yes
Verity Scan	S1903186910	Yes
Verity Scan	S1913561912	Yes
Verity Scan	S1903205610	Yes
Verity Scan	S1913579012	Yes
Verity Scan	S1913568212	Yes
Verity Scan	S1903190110	Yes

Verity Scan	S1903226610	Yes
Verity Scan	S1913585112	Yes

Verity Touch Writer BMD

Table 3: Verity Touch Writer BMD by Serial Number and Hash Match

Device Type	Serial Number	Hash Match, Yes/No?
Verity Touch Writer	W1913460411	Yes
Verity Touch Writer	W1913441311	Yes
Verity Touch Writer	W1913461811	Yes
Verity Touch Writer	W1913548412	Yes
Verity Touch Writer	W2013622501	Yes
Verity Touch Writer	W2013625701	Yes
Verity Touch Writer	W1913450511	Yes
Verity Touch Writer	W1913457011	Yes
Verity Touch Writer	W2013638101	Yes
Verity Touch Writer	W1913428211	Yes
Verity Touch Writer	W1913459711	Yes
Verity Touch Writer	W1913451711	Yes
Verity Touch Writer	W2013635901	Yes
Verity Touch Writer	W2013637301	Yes
Verity Touch Writer	W1913427511	Yes
Verity Touch Writer	W2013631101	Yes
Verity Touch Writer	W2013637401	Yes
Verity Touch Writer	W1913454611	Yes
Verity Touch Writer	W2013638401	Yes
Verity Touch Writer	W2013620901	Yes
Verity Touch Writer	W1913444011	Yes
Verity Touch Writer	W2013632601	Yes
Verity Touch Writer	W1913429211	Yes

Physical Voting System and Facility Security Observations

Delaware County Bureau of Elections, Voting System Security

The Delaware County Bureau of Elections Chester facility had restricted access to the building, sensitive voting system equipment, and work areas. All visitors to the

office were subject to security screening. Members of the public, such as public observers, were required to sign physical security logs and were issued printed name badges. All election staff were identifiable by uniform and badges. Sensitive access keys and critical data storage media are restricted to top-level employees. An armed security guard was also stationed outside the voting system facility. The staff demonstrated a high level of attention to their security protocols and are aware of the importance of facility and voting system security.

Delaware County has an innovative approach to securing and storing their USB media while still allowing a specific level of transparency. Delaware County purchased a jeweler's case that stores all the USBs for the voting system, and it is viewable by the public from several angles of the video surveillance security system. The glass jeweler's case is under lock and key by the IT manager, Robert Wright. This allows accountability, security, and transparency of one of the integral parts of the voting system. This innovation can be easily and cost-effectively replicated in other jurisdictions across the country.

Pre-Visit Scanner & BMD Selection

Before the EAC's visit to Delaware County, the Election Bureau performed a random sampling of voting devices in public to determine the machines' performance and retrieved them from their secure cages. Learning from previous hash verification efforts, they preselected and staged the voting devices the day before to ensure the hash verification could be performed quickly. Furthermore, their agreement to increase the sample size required more time from staff. Prestaging precinct machines and BMDs on March 12 allowed for a smooth operation of the Hash Verification on March 13.

Suggestions

Hash Verification Program

If feasible, the EAC recommends the continuation of the 5% hash verification prior to elections, ahead of testing, and again when deployed equipment is returned to the facility during the post-election audit. To support broader coverage over time, it may also be helpful to reference prior election records of previously sampled equipment to reduce the likelihood of repeated selections. These approaches are intended to complement, rather than replace, the current methodology, and to offer additional tools for maintaining robust and comprehensive verification practices.

Use of Port Blockers at Workstations

USB and network port blocking seals can serve as cost-effective measures to enhance physical security controls. While all workstations reviewed during the inspection were found to have properly applied security seals, the assessment

identified an opportunity to further strengthen protections by incorporating port-blocking seals where appropriate.

Conclusions

The Verity 2.7 procedural, conformance, hash, and security review conducted on March 13, 2025, yielded no findings, observations, or issues that could potentially impact the security of the system as deployed.

All Verity 2.7 system verification procedures, as certified, were followed during the review. The EMS workstations and scan stations reviewed fell within either the original Scope of Certification or applicable ECOs. A sample of Verity Scan, Touch Writer, and all the Central, Verity Count, Verity Data, and Build Workstation hashes were reviewed, and all matched the EAC-trusted hashes in accordance with Verity 2.7's EAC-certified verification procedures.

The Delaware County Bureau of Elections' voting system, facility security, and counting center procedures during the review appear to be comprehensive and thoroughly followed. Therefore, the EAC can independently confirm that the software compared is equivalent to, and the hardware inspected is consistent with the Scope of Certification issued by the EAC for the Verity 2.7 voting system on June 7, 2022.

The Delaware County Bureau of Elections has successfully taken on a critical security tool with hash verification and is successfully standing this up as a pre- and post-election practice.

Recognition

Delaware County Bureau of Elections

The EAC's Field Services Team would like to recognize and thank Chief Election Director James Allen and IT Manager Robert Wright from the Delaware County Bureau of Elections for helping facilitate this project and providing vital resources and staffing to ensure a successful review. Their leadership and dedication to ensuring that Delaware County's elections are safe, secure, accurate, and accessible is noteworthy. Delaware County is one of the only counties in Pennsylvania to perform hash verification on its voting system. When presented with this opportunity several months ago, they immediately recognized the value and opportunity a project like this was for their state, and their proactive engagement is recognized. The willingness to increase their hash verification sample size highlights their commitment to the security, accuracy, and integrity of their elections. We would also like to extend our gratitude to the rest of the Delaware County Bureau of Elections' staff for their active participation and support throughout the process.

The EAC looks forward to future projects with the Delaware County Bureau of Elections.

Pennsylvania Secretary of State

We extend our sincere gratitude to the Pennsylvania Department of State for authorizing our program to collaborate with local bureaus of elections. This partnership underscores the Department of State's commitment to upholding the integrity and transparency of the electoral process within the Commonwealth. By facilitating our engagement with local election officials, Secretary Al Schmidt has enabled us to contribute meaningfully to the administration of fair and secure elections in Pennsylvania.

Hart InterCivic

The EAC's Field Services Team would also like to thank Jared Bernal, Peter Lichtenheld, and the rest of the staff at Hart InterCivic for the technical expertise they provided to the EAC and the Delaware County Bureau of Elections staff before and during the project. Their customer support and partnership with Delaware County helped ensure the review process went smoothly, and that in the event Delaware County Bureau of Elections' staff had any issues, they would be there to assist.

Public Observers

The EAC's Field Services Team would like to recognize the members of the public who served in volunteer positions for their critical contributions to the election process in Delaware County. Their dedication and commitment to ensuring transparency by acting as the "eyes and ears" of the public help to uphold the security and integrity of the election. Their role in supporting these efforts is invaluable and aids the public's trust in the election system. We commend their service in helping to maintain a secure and transparent election process.