

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF STATE

**REPORT CONCERNING THE EXAMINATION RESULTS OF
ELECTION SYSTEMS & SOFTWARE, INC. EVS, UNITY 3.4.1.0 WITH
DS200 PRECINCT TABULATOR, M100 PRECINCT TABULATOR,
M650 CENTRAL TABULATOR, DS850 CENTRAL TABULATOR AND
AUTOMARK ADA DEVICE**



Issued By:

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Secretary of the Commonwealth
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**EXAMINATION RESULTS OF ELECTION SYSTEMS & SOFTWARE, INC. EVS,
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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 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 the applicable requirements of the Pennsylvania Election Code.

Upon the request of Elections Systems and Software ("ES&S"), the Department of State's Bureau of Commissions, Elections and Legislation ("Department") scheduled an examination for September 11, 2014, of Unity 3.4.1.0 which consisted of election management software used in conjunction with the following hardware components: 1) the DS200 precinct tabulator optical scan device; 2) the M100 precinct tabulator optical scan device; 3) the M650 central tabulator optical scan device; 4) the DS850 central tabulator optical scan devices; and 5) the AutoMark Americans with Disabilities Act ("ADA") device ("Unity 3.4.1.0 Voting System"). A complete listing of items demonstrated and examined are set out in the table, *infra* at 2-3.

Jack Cobb, Laboratory Director of Pro V&V, Inc., ("Examiner") conducted an examination of the Unity 3.4.1.0 Voting System pursuant to section 1105-A(a) of the Election Code, 25 P.S. § 3031.5(a). The Examiner performed the examination on September 11, 2014, in Training Room 12B of the Commonwealth Keystone Building, 400 North Street, Harrisburg, Pennsylvania. Stuart Keckler, (former) Deputy Commissioner of the Bureau of Commissions, Elections & Legislation and Elissa Dauberman, Accessibility Coordinator of the Division of Help America Vote Act (HAVA), represented the Secretary of the Commonwealth. Benjamin Swartz, Pennsylvania State Certification Manager, represented ES&S. The examination was open to the public and the Department videotaped

the demonstration.

II. THE UNITY 3.4.1.0 VOTING SYSTEM

Unity 3.4.1.0 provides end-to-end election support; from defining an election to generating final reports. The following firmware/software, hardware, and peripheral components of the Unity 3.4.1.0 were presented for examination:

A. Firmware/Software

Component Name	Version
Election Management System (EMS)	
Audit Manager	7.5.2.0
Election Data Manager (EDM)	7.8.2.0
ESS Image Manager (ESSIM)	7.7.2.0
Election Reporting Manager (ERM)	7.9.0.0
Hardware Programming Manager (HPM)	5.9.0.0
LogMonitor Service	1.1.0.0
ES&S Tabulators	
DS850 Central Tabulator	2.9.0.0
DS200 Precinct Tabulator	1.7.0.0
Model 650 Central Tabulator	2.2.2.0
Model 100 Precinct Tabulator	5.4.4.5
Voter Assist Terminal	
AutoMARK	1.3.2907
AutoMARK Information Management System (AIMS)	1.3.257
VAT Previewer	1.3.2907

B. Hardware

Component Name	Model/Version Number	Description
DS850 Central Tabulator	1.0	central ballot scanner for tabulation of mail-in ballots, absentee ballots or Election Day ballots
DS200 Precinct Tabulator	1.2,1.3	precinct ballot scanner component of the voting system
AutoMARK	1.0, 1.1, 1.3	ADA-compliant ballot marking device
Model 100 Precinct Tabulator	1.3	precinct ballot tabulator used to process ballots at a polling place
Model 650 Central Tabulator	1.2	central ballot tabulator for tabulation of mail-in ballots, absentee ballots or Election Day ballots

C. Peripherals

Part Name	Model/Revision Number	Description
Okidata	C711	Ballot on Demand Printer
Omni Drive	----	M100 PCMCIA card
CF Card Reader	---	AutoMARK compact flash card reader
Zip Drive	---	M650 zip drive
USB	----	512 MB, 1GB, 4GB, 8GB
AutoMARK Peripherals	various	Headphones, rocker paddles, stylus, sip-n-puff

The following is a brief description of the Unity 3.4.1.0 Voting System and is drawn from Section 2.0 ("System Overview and Identification") of the Test Report for Examination of the Election Systems & Software (ES&S) Unity 3.4.1.0, a report issued by the Examiner on July 31,2017.

Unity 3.4.1.0 is a paper based voting system comprised of both precinct and central count optical scan tabulators and a Ballot Marking Device as an ADA component. The Unity 3.4.1.0 Voting System includes the following components:

Voting System Components

Product	Description
Audit Manager	Provides password security and a real-time audit log of all user inputs and system outputs for Election Data Manager and Ballot Image Manager
Log Monitor Service	Monitors Windows Event Viewer and closes any active Election Management System (EMS) program if the system detects the improper deactivation of the Windows Event Viewer
Election Data Manager (EDM)	Defines precinct, contest and candidate data and generates the election database
ES&S Ballot Image Manager (ESSIM)	Formats paper ballots and output files for programming ballot marking devices (BMD)
AutoMARK Information Management System (AIMS)	Generates equipment configurations for the AutoMARK Voter Assist Terminal. See the AIMS TDP, submitted separately, for additional details
Hardware Programming Manager (HPM)	Generates election definition media for voting system equipment
Model 100	Precinct ballot tabulator used to process ballots at a polling place
DS200	Precinct ballot tabulator used to process ballots at a polling place

ES&S AutoMARK	Accessible ballot marking system that supports audio ballot playback and ballot marking for voters with low vision or with physical disabilities
DS850	Central ballot scanner for high-volume tabulation of mail ballots, absentee ballots or Election Day ballots
Model 650	Central ballot scanner for high-volume tabulation of mail ballots, absentee ballots or Election Day ballots
Election Reporting Manager (ERM)	Results consolidation and reporting software

The Unity 3.4.1.0 Voting System can be configured in several different ways to form a complete voting system, with the accompanying software for each component, as follows:

- M100 precinct tabulation device and AutoMark ADA device with M650 central tabulation device;
- M100 precinct tabulation device and AutoMark ADA device with DS850 central tabulation device;
- DS200 precinct tabulation device and AutoMark ADA device with M650 central tabulation device; or
- DS200 precinct tabulation device and AutoMark ADA device with DS850 central tabulation device.

During an election, a voter may be presented with a blank paper ballot pre-printed with the offices to be elected or directed to the AutoMark ADA device. Once the voter has made his or her selections, the ballot is either scanned and tabulated by the DS200 or Model 100 scanners at the precinct and retained in a ballot box, or, it is retained in a ballot box for scanning centrally at the county election office using the DS850 or Model 650 scanners.

The DS200 scans voted ballots inserted in any orientation. Both sides of the ballot are processed simultaneously with high-resolution scanners and the resulting ballot images are decoded by a proprietary recognition engine. After processing voter selections, the DS200 drops the ballot into an attached, secure ballot box. Product features include a 12-inch touch screen providing voters and poll worker feedback, an

internal thermal printer for generating machine totals and log reports, and USB (Type – A) thumb drive for loading the election definition files and storing results.

The Model 100 uses a visible light-based mark recognition system to identify valid marks. The Model 100 accepts ballots inserted in any orientation. Optical sensors simultaneously read both sides of the ballot and record selections. Product features include an LCD message screen providing voters and poll worker feedback, an internal thermal printer for generating machine totals and log reports, and dual PCMCIA ports for loading the election definition and storing results.

The DS850 is a digital scan central ballot counter that uses cameras and imaging algorithms to simultaneously capture voter selections on the front and back of a ballot, evaluate the results and then sort ballots into discrete bins without interrupting scanning. A dedicated audit printer generates a continuous event log. Machine level reports are produced from a second laser printer. The scanner saves voter selections and ballot images to an internal hard disk and allows for results to be exported to a USB Memory stick for processing with Election Reporting Manager.

The Model 650 is an optical scan central ballot tabulator. The scanner 's dual-printer configuration supports a continuous audit log and the printing of results reports directly from the scanner. Election Reporting Manager (ERM) can also process scanner totals by reading results saved to Zip Disk. Ballot-handling errors, such as feed jams or sensor errors cause the motor to stop. For each error or exception condition, the tabulator displays a message that describes the cause of the error and provides instructions for resolving the error. The system uses dual dot matrix printers with standard parallel inputs to print reports and provide a continuous audit log. Model 650 components include a chassis, ballot transport controls and an output hopper. Electrical components include the optical reader, ballot conversion subsystem, the processing subsystem, the display, the control subsystem, the reporting subsystem, the backup and recovery subsystem, and the zero totals function.

III. EXAMINATION APPROACH, PROCEDURES AND RESULTS

A. Examination Approach

To ascertain whether Unity 3.4.1.0 can be safely used by voters at elections in the Commonwealth and meets all the requirements of the Pennsylvania Election Code, the Examiner developed test protocols for the examination. The test protocols separated the requirements of Article XI-A of the Pennsylvania Election Code, sections 1101-A to 1122-A, 25 P.S. §§ 3031.1 - 3031.22, into four main areas of test execution: (1) Review; (2) Targeted Functionality; (3) System Integration; and (4) Penetration Analysis.

"Review" testing consisted of analyzing VSTL ("Voting System Test Laboratories")¹ test reports, VSTL test documentation and other third-party reports for specific tests pertaining to the requirements of the Pennsylvania Election Code and verifying that the Unity 3.4.1.0 meets the requirements of the following sections of the Election Code:

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

"Targeted Functionality" testing consisted of single thread test cases designed to ensure that each component of the Unity 3.4.1.0 Voting System met the requirements set

¹ Section 1105-A(a) of the Election Code requires that an electronic voting system be examined and approved "by a federally recognized independent testing authority," or VSTL as such authorities are now called. 25 P.S. § 3031/5(a).

forth in the following sections of the Election Code:

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

"System Integration Testing" was performed to ascertain whether the Unity 3.4.1.0 Voting System, when configured as a complete system, including each of the possible configurations, met all the requirements of the Pennsylvania Election Code in the context of the execution of an entire election. This test meets many of the requirements of the

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

- 1101-A, 25 P.S. § 3031.1, requiring an electronic voting system to provide for a permanent physical record of all votes cast;
- 1107-A(4), 25 P.S. § 3031.7(4), requiring an electronic voting system to permit a voter to vote for candidates of all different parties, and write-in candidates;
- 1107-A (6), 25 P.S. § 3031.7(6), requiring an electronic voting system to permit a voter to cast votes for candidates and ballot questions he or she is entitled to vote for, and prevents a voter from casting votes the voter is not entitled to vote on;
- 1107-A(8), 25 P.S. § 3031.7(8), requiring an electronic voting system to prevent a person from casting more than one vote for a candidate or question, except where this type of cumulative voting is permitted by law;
- 1107-A(9), 25 P.S. § 3031.7(9), requiring an electronic voting system to permit voters to vote in their own parties' primaries, and prevents them from voting in other parties' primaries, while also permitting voters to vote for any nonpartisan nomination or ballot question they are qualified to vote on; and
- 1117-A, 25 P.S. § 3031.17, requiring an electronic voting system to provide for a statistical recount of a random sample of ballots.

The "Penetration Analysis" testing sought to ascertain whether the Unity 3.4.1.0 Voting System met all of the requirements of Section 1107-A(12) of the Pennsylvania Election Code , 25 P.S. § 3031.7(12) that could be met by analyzing physical security procedures. Precinct tabulation devices were installed for delivery to the precinct and analysis of security procedures performed. The Examiner did not test the software for security, but did review VSTL test reports that included test case descriptions and test results for various components of the Unity 3.4.1.0 Voting System.

B. Examination Process and Procedures

The examination commenced on September 11, 2014, at the Commonwealth Keystone Building, Training Room 125B, 400 North Street, Harrisburg, Pennsylvania. The demonstration portion of the examination lasted approximately three days. In accordance with the test protocols, the examination occurred in an environmentally controlled room. The room was configured such that the Examiner, the representatives of the Secretary of the

Commonwealth, and ES&S each had their own independent work areas. Members of the public were allowed as observers for the examination. The demonstration portion of the examination was videotaped.

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

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

C. Examination Results

On July 31, 2017, the Examiner issued his report for the testing of the Unity 3.4.1.0 Voting System. The following is a summary of the results of the examination as set forth in fuller detail in the Examiner's Report.

1. Review Testing Results

The Review testing performed by the Examiner demonstrates that the Unity 3.4.1.0 Voting System meets the relevant requirements of the Pennsylvania Election Code.

Specifically, the VSTL reports and Election Assistance Commission (EAC) certifications submitted by ES&S satisfy the requirements of Section 1105-A(a) of the

Election Code, 25 P.S. § 3031.5(a); the Unity 3.4.1.0 has been examined and approved by an ITA, or VSTL as such authorities are now called, as meeting the applicable performance and test standards established by the federal government.

The design requirements of Section 1107-A(11) and (14) of the Pennsylvania Election Code, 25 P.S. §§ 3031.7(11), (14) and the accuracy requirements of Sections 3031.7(11) and (13), are met by the Product Safety Test and Accuracy Test.

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

The VSTL reports contained specific data for summative usability reports that were accepted by the EAC. This satisfied the usability requirement of Pennsylvania Election Code, 25 P.S. §§ 3031.7(15).

The Examiner confirmed that the Unity 3.4.1.0 ensured the removal of residual votes and produced a "zero proof report" at the opening of the polls. The Examiner also confirmed that the zero-proof report cannot be generated on demand after a ballot is cast.

The Examiner's review of documentation included review of VSTL test reports that included test case descriptions and resultant data. These reports included the "National Certification Test Report for Certification Testing of the Elections Systems & Software Unity 3.2.0.0 Voting System, Revision 3," the "National Certification Test Report for Certification Testing of the Elections Systems & Software Unity 3.2.1.0 Voting System, Rev. A" and the "National Certification Test Report for Certification Testing of the Elections Systems & Software Unity 3.4.0.0 Voting System Rev B." Each of these reports contained security test data for various components of the Unity 3.4.1.0 Voting System. As a result of this review, the Examiner concluded that the VSTL performed an adequate security testing of the system.

2. Targeted Functionality Testing Results

As set forth in the Test Protocols, nine test cases were designed to determine compliance with the requirements of Sections 1107-A(1), (2), (3), (4), (5), (7), (10), (16) and (17), 25 P.S. §§ 3031.7(1), (2), (3), (4), (5), (7), (10), (16) and (17). The Examiner conducted each of these tests with necessary modifications as detailed in his report. Each specific hardware component was tested for compliance with these sections of the Election Code. The Examiner also tested the election management software for compliance with the sections of the Election Code relevant to it. No issues or anomalies were experienced during these tests, and the objective criteria established in the test protocols were met.

If the Unity 3.4.1.0 is correctly set up pursuant to item four (4) of the Directive Concerning the Use, Implementation and Operations of Electronic Voting Systems by the County Boards of Elections issued by the Secretary of the Commonwealth on June 9, 2011, the Unity 3.4.1.0 provides the requisite voter secrecy in compliance with Section 1107-A(1) of the Election Code, 25 P.S. § 3031.7(1).

Each of the components of the Unity 3.4.1.0 successfully permitted votes for "1 of 1," "N of M," and "Question" contests for both a standard voting session and an ADA voting session in compliance with Section 1107-A(2), 25 P.S. § 3031.7(2). The Unity 3.4.1.0 successfully demonstrated the "Pennsylvania Method" of straight party voting for both a standard voting session and an ADA voting session, meeting the requirements of Section 1107-A(3), 25 P.S. § 3031.7(3) and demonstrated compliance with Sections 1107-A(4) and (5), 25 P.S. §§ 3031.7(4) and (5), for straight party voting and write-in votes. The components DS850, DS200, M100, M650, and ES&S AutoMARK of the Unity 3.4.1.0 Voting System successfully passed the test case that prohibits a voter from selecting more than the number of allowable selections thus demonstrating compliance with Section 1107-A(7), 25 P.S. § 3031.7(7).

All tabulating devices presented with the Unity 3.4.1.0 provide a public counter that increments with each cast vote; provides the ability to be locked after the polls are closed; precludes the re-opening of the polls after they are closed; possesses design features that

allow tamper evident locks and seals to be placed on the voting devices; and provides a zero proof and results report, as required under Sections 1107-A(16) and (17), 25 P.S. §§ 3031.7(16) and (17).

The voting system demonstrated compliance with requirements of Section 1107-A(10), 25 P.S. § 3031.7(10) for both an ADA and standard voting session. The ES&S AutoMARK provides Ballot Review and Change capability for an ADA voting session. The DS200 and M100 precinct scanners of Unity 3.4.1.0 system provided a voter with a review screen when errors such as overvotes or undervotes were present. The voter is presented a list of contests on screen where the tabulator detected errors. The voter can either accept the ballot with errors or fill out another ballot with corrections.

3. System Integration Testing Results

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

The Unity 3.4.1.0 successfully completed both the general and closed primary elections. The Examiner experienced no issues or anomalies during these tests, and the Unity 3.4.1.0 met the objective criteria set forth in the test protocols. The Unity 3.4.1.0

provides for a permanent physical record in two formats: 1) the cast vote record; and 2) the voter-marked paper ballots. While both of these features meet the requirements of Sections 1101-A, 25 P.S. § 3031.1, the voter marked paper ballots are the official record of the votes cast for purposes of recount or audit. (See Condition C on page 18 of this report.) The examiner performed a statistical recount using the marked paper ballots satisfying Sections 1101-A, 25 P.S. § 3031.17 of the Pennsylvania Election Code.

The System Integration testing further confirmed that the Unity 3.4.1.0 complies with Section 1107-A(4), 25 P.S. § 3031.7(4), because the system successfully allowed voters in a general election to vote for candidates from all parties and political bodies, including write-in candidates. The Unity 3.4.1.0 complies with Section 1107-A(9), 25 P.S. § 3031.7(9), because test voters in the primary election were only able to vote for candidates seeking nomination from their party and the system rejected attempts to vote for party candidates seeking nomination from the other party. The Unity 3.4.1.0 meets the requirements for Sections 1107-A(6) and (8), 25 P.S. §§ 3031.7(6) and (8), because the test voters cast votes on different ballot styles for candidates and questions and the Unity 3.4.1.0 precluded test voters from over voting.

4. Penetration Analysis of Physical Security Results

During the penetration analysis test for physical security performed by the Examiner, the Unity 3.4.1.0 provided acceptable ballot security procedures and impoundment of ballots to prevent tampering with or substitution of any ballots or ballot cards based on the inspection of the physical seals and locks on the system. It also provided acceptable password management and restriction of access to administrative functions. The examiner did not test the software for security, but reviewed VSTL test reports that included security tests against VVSG standards for components of the Unity 3.4.1.0 as part of the Review Testing. Hence the examiner concluded in his report that the Unity 3.4.1.0 meets the requirements of Section 1107-A(12) of the Election Code, 25 P.S. § 3031.7(12).

D. Observations

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

1. The voting system presented for demonstration Unity 3.4.1.0 is a modification to Unity 3.4.0.0. The modifications successfully completed conformance testing to the 2005 Voluntary Voting System Guidelines (2005 VVSG) during EAC certification. But the system was certified to the 2002 VSS standard since the original system code was reviewed against 2002 VSS. The Department staff analyzed the code review report from the California state certification to evaluate non-conformities of the entire system to the 2005 VVSG standards. The report indicates low level VVSG 2005 non-conformities from the full system code review. The Department further reviewed ES&S responses provided to California Secretary of State and determined that the non-conformities reported does not affect the operation or security of the system or are non-consequential if implemented complying to Guidance On Electronic Voting System Preparation And Security, September 2016 and Directive Concerning the Use, Implementation and Operations of Electronic Voting Systems by the County Boards of Elections issued by the Secretary of the Commonwealth on June 9, 2011 . Based on the examiner's recommendation and based on the Department's review of the California source code review report, the Secretary accepts the conclusion that there is no major security risk even though part of the Unity 3.4.1.0 testing occurred against 2002 Voting System Standards. Moreover, because the Unity 3.4.1.0 provides a software independent record of voter intent in the voter-marked paper ballots, the Secretary agrees to the certification with a condition for jurisdictions to perform audits of the voter marked paper ballots exclusively, *see* section IV.C., below.

2. At the time of initial engagement as well as during the testing process, the Examiner did not conduct any security testing of the system. Nor did the examiner do a source code review of the components' software. The Examiner reviewed previous security reports prepared by the VSTL on voting systems that included components from Unity 3.4.1.0 and concluded the system to be secure for use in Pennsylvania. The Department staff discussed Penetration Testing that was performed on Unity 3.4.1.0 as part of California State Certification. The Department staff reviewed reports from California state

certification, specifically (1) a code review report identifying security weaknesses and vulnerabilities found through static code review and by searches of public vulnerability sources, and (2) a red team report identifying physical and logical security vulnerabilities within the Unity system that could result in compromising the confidentiality, integrity, and/or availability of the system. The staff further reviewed ES&S responses to the identified vulnerabilities. The responses from ES&S indicate that the common vulnerabilities and exposures (“CVE’s”) related to the operating systems used to host the Election Management System software did not consider that the system is configured within a hardened environment. A hardened environment is achieved if the system is configured using the recommended procedures for securing the Election Management System specified by the manufacturer in the document “U3410_SSS02_Hardening Procedures.pdf”; without connectivity to an outside network. Based on the review of the documents from California certification by the Department, the Secretary agrees with the Examiner’s conclusion that the Unity 3.4.1.0 will not pose a security concern for use in elections in the Commonwealth of Pennsylvania if implemented complying to Guidance On Electronic Voting System Preparation And Security, September 2016 and Directive Concerning the Use, Implementation and Operations of Electronic Voting Systems by the County Boards of Elections issued by the Secretary of the Commonwealth on June 9, 2011. Moreover, because the Unity 3.4.1.0 provides a software independent record of voter intent in the voter-marked paper ballots, the Secretary agrees to the certification with a condition for jurisdictions to perform audits of the voter marked paper ballots exclusively, *see* section IV.C., below.

3. The Examiner noted that the observer reported being able to see parts of the ballot and voter inputs while executing ADA test cases on the ES&S AutoMark Ballot Marking Device for Section 1107-A(1) of the Election Code, 25 P.S. § 3031.7(1), which requires an electronic voting system to provide for voting in secrecy. The Examiner concluded, however, that if these components are set up pursuant to item four (4) of the Directive Concerning the Use, Implementation and Operations of Electronic Voting Systems by the County Boards of Elections issued by the Secretary of the Commonwealth on June 9, 2011, provides the requisite voter secrecy so that an observer is unable to see who a voter voted for, in compliance with the Pennsylvania Election Code and Pennsylvania

Constitution.

4. During the execution of the test case designed to evaluate the ability of the EMS to support the requirements of Section 1107-A, 25 P.S. § 3031.7, the ballots printed from Okidata C711 ballot on demand printer could not be read by the M650 central tabulator due to the reflectivity of the ballot. The test was resumed using another printer and did not have any further issues and the actual results were as expected. The reason for the issue was identified to be caused by the ink density settings on the printer being too high. The Secretary accepts this to be a human error that happened during the examination and agrees to the certification with a condition that election jurisdictions must carry out a full Logic and Accuracy test on each device.

IV. Conditions for Certification

Given the results of the examination that occurred on September 11 and 12, 2014 and the findings of the Examiner as set forth in his July 31, 2017 report, the Secretary of the Commonwealth certifies the Unity 3.4.1.0 subject to the following conditions:

A. Pennsylvania counties using the Unity 3.4.1.0 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 June 9, 2011, and in particular adhere to item four (4) of the directive when setting up and positioning the AutoMark ADA component in the polling place to assure compliance with the constitutional and statutory requirements that secrecy in voting be preserved (*see* Pa. Const Art. VII § 4; and Section 1107-A(1) of the Election Code, 25 P.S. § 3031.7(1)).

B. No components of the Unity 3.4.1.0 shall be connected to any modem or network interface, including the Internet, at any time, except when a standalone local area network configuration in which all connected devices are certified voting system components. 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.

C. Because Unity 3.4.1.0 is a paper-based system, counties using the Unity 3.4.1.0 must comply at a minimum with Section 1117-A of the Election Code, 25 P.S. §

3031.17, that requires "statistical recount of a random sample of ballots after each election using manual, mechanical or electronic devices of a type different than those used for the specific election." This audit must be conducted via a manual count of the voter marked paper ballots exclusively. Counties must include in the sample ballots marked by ADA compliant components. Counties are advised to consult the Directive Concerning the Use, Implementation and Operations of Electronic Voting Systems by the County Boards of Elections issued by the Secretary of the Commonwealth on June 9, 2011 and any future revisions that may apply to audits of electronic voting systems.

D. All jurisdictions implementing the Unity 3.4.1.0 need to carry out a full Logic and Accuracy test on each device without fail and maintain evidence of Logic and Accuracy testing in accordance with the statutory requirements for pre-election and post-election testing. The Department does not recommend automated Logic & Accuracy testing, and discourages the use of preprinted ballots provided by vendors. Jurisdictions are requested to pay specific attention to the printer ink density settings for printers recommended by the vendor considering the issue that arose during the examination (See Observation 4 on page 16 of this report.)

E. In addition, pursuant to the Directive on Electronic Voting Systems issued by the Secretary of the Commonwealth on August 8, 2006, the Directive Concerning the Use, Implementation and Operation of Electronic Voting Systems by the County Boards of Elections issued on June 9, 2011 and section 1105-A(d) of the Pennsylvania Election Code, 25 P.S. § 3031.5(d), this certification and approval is valid only for the voting system discussed in this Report. If the vendor or a County Board of Elections makes **any** changes to the Unity 3.4.1.0 Voting System subsequent to the date of its examination, it must **immediately** notify both the Pennsylvania Department of State and the relevant federal testing authority or laboratory, or their successors. Failure to do so may result in the decertification of the Unity 3.4.1.0 Voting System in the Commonwealth of Pennsylvania.

F. All jurisdictions implementing the Unity 3.4.1.0 must implement Unity 3.4.1.0 under this certification and must comply with the conditions found in this report, and

any directives issued by the Secretary of the Commonwealth regarding the use of this System, in accordance with Section 1105-A(a)-(b) of the Election Code, 25 P.S. § 3031.5(a)-(b).

G. Because Unity 3.4.1.0 is a paper-based system, implementation of the system for precinct or central count scanning is scalable. Jurisdictions should calculate the number of voting booths necessary to accommodate the number of registered voters in a precinct to avoid long lines. Jurisdictions must include the AutoMark Ballot Marking Device as an ADA compliant device in configuring a precinct polling place.

H. All jurisdictions implementing the Unity 3.4.1.0 must ensure that no default passwords are used on any devices and that all passwords are complex and secured. The passwords and permissions management must comply to the Guidance on electronic Voting System Preparation and Security, September 2016.

I. All jurisdictions implementing the Unity 3.4.1.0 must implement administrative safeguards and proper chain of custody to facilitate the safety and security of electronic systems pursuant to the Guidance on electronic Voting System Preparation and Security, September 2016.

J. Jurisdictions implementing the Unity 3.4.1.0 with the Central Count Tabulator as the primary system where votes are counted only at the central counting location using Model 650 or DS850, 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.

V. Recommendations

All jurisdictions implementing Unity 3.4.1.0 Voting System should ensure that the system is correctly set up pursuant to all the recommendations of the Directive Concerning the Use, Implementation and Operations of Electronic Voting Systems by the County Boards of Elections issued by the Secretary of the Commonwealth on June 9, 2011 and Guidance on Electronic Voting System Preparation and Security, September 2016.

VI. Conclusion

As a result of the examination, and after consultation with the Department's staff and the Examiner, the Secretary of the Commonwealth concludes that the Unity 3.4.1.0 Voting System can be safely used by voters at elections as provided in the Pennsylvania Election Code and meet all of the requirements set forth in the Code, **provided the voting system is implemented with the conditions listed in Section IV of this report.** Accordingly, the Secretary certifies Unity 3.4.1.0 for use in this Commonwealth.

The Automark Ballot Marking Device can accommodate 80 voters with disabilities during an election day or 250 voters when used as the primary voting system.