NYSBOE ES&S EVS 6.0.4.1 Voting System
Final Test Report

Report Number: NYS-ESS6041-TR-01

Prepared for:

Vendor Name	*Election Systems and Software (ES&S)*
Vendor System	*EVS 6.0.4.1*
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Revision History

Date	Version	Author	Revision Summary
April 26th, 2019	1.0	D George	Initial Draft
March 13th, 2020	1.1	D George	Updates based on NYSBOE Feedback
October 16th, 2020	1.2	J Panek	Updates based on NYSBOE feedback and additional testing performed

Disclaimer

The information reported herein must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

All testing conducted for this engagement has been done outside of the U.S. Election Assistance Commission's (EAC) Test and Certification Program. In no way does this test report represent an EAC certification against the Voluntary Voting System Guidelines (VVSG) or any other standard.

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The tests referenced in this document were performed in a controlled environment using specific systems and data sets, and results are related to the specific items tested. Actual results in other environments may vary.

Opinions and Interpretations

There are no opinions or interpretations included in this report.

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1 INTRODUCTION

SLI Compliance (SLI) is submitting this Final Test Report as a summary of the testing performed and testing leveraged on the **ES&S EVS 6.0.4.1** voting system against the Voluntary Voting System Guidelines 1.0 (VVSG 1.0) and the State of New York (NY) 2019 Election Law requirements. The ES&S EVS 6.0.4.1 voting system contains new devices and software in addition to significant modifications to hardware and software from the previous NYSBOE certified ES&S voting system.

This report includes an overview of the EAC certification testing performed on the ES&S voting systems that EVS 6.0.4.1 was modified from: EVS 6.0.0.0, 6.0.2.0, and 6.0.4.0. These voting systems were subject to EAC certification testing and are currently EAC certified. The EVS 6.0.4.1 voting system uses EVS 6.0.4.0 as a baseline; therefore, the VVSG 1.0 test results from the branch of systems that EVS 6.0.4.1 was built from have been leveraged for this test effort.

In addition, SLI conducted a full documentation review of the EVS 6.0.4.1 Technical Data Package, source code review, security analysis, and functional testing for all NY 2019 Election Law requirements and a subset of modified VVSG 1.0 requirements. This report describes the scope of the testing SLI performed on the ES&S EVS 6.0.4.1 voting system and provides an overview of the results and findings.

1.1 Test Report Attachments

The following attachments apply to this Test Report:

- Attachment A - New York Requirements Matrix EVS 6.0.4.1
- Attachment B - Discrepancy report
- Attachment C - Documentation
- Attachment D - Functional
- Attachment E - Security
- Attachment F - Source Code Review
- Attachment G - Prior VSTL Testing

1.2 References

The following key documents were used in preparing this Test Report:

1. Election Assistance Commission Voluntary Voting System Guidelines, 2005 Version 1.0 Volumes I and II (VVSG 1.0)
2. State of New York 2019 Election Law (NY 2019 Election Law)
3. NIST Handbook 150: 2016
4. NIST Handbook 150-22: 2017
5. SLI VSTL Quality System Manual, v 3.2, June 8, 2020

1.3 Terms and Abbreviations

The following terms and abbreviations will be used throughout this document:

Table 1 - Terms and Abbreviations

Term	Abbreviation	Description
Activation Card	NA	A voter verifiable paper record. Not to be confused with the voter verifiable paper audit trail (VVPAT). Also referred to as the Vote Summary Card.
Ballot (VVSG 1.0)	NA	The official presentation of all of the contests to be decided in a particular election.
Ballot Marking Device	BMD	An accessible computer-based voting system that produces a marked ballot (usually paper) that is the result of voter interaction with visual or audio prompts.
Compact Flash card	CF	This is a type of flash memory card in a standardized enclosure often used in voting systems to store ballot and/or vote results data.
Commercial Off the Shelf	COTS	Term used to designate computer software, hardware or accessories that are ready-made and available for sale, lease, or license to the general public.
Common Vulnerability Exposure	CVE	CVE® is a list of entries – each containing an identification number, a description, and at least one public reference – for publicly known cybersecurity vulnerabilities.
Cryptographic Module Validation Program	CMVP	The Cryptographic Module Validation Program (CMVP) is a joint effort between the National Institute of Standards and Technology under the Department of Commerce and the Canadian Centre for Cyber Security, a branch of the Communications Security Establishment. The goal of the CMVP is to promote the use of validated cryptographic modules and provide Federal agencies with a security metric to use in procuring equipment containing validated cryptographic module

Term	Abbreviation	Description
Direct Recording Electronic (NY Election Law)	DRE	A direct recording electronic voting system in which, through a touch screen, push button, or other electronic mechanism, a vote is immediately recorded onto electronic media, by means of a ballot display provided with mechanical or electro optical components, or an ultrasonic, capacitive or other touch screen, which is activated by the voter.
Direct Recording Electronic (VVSG 1.0)	DRE	An electronic voting system that utilizes electronic components for the functions of ballot presentation, vote capture, vote recording, and tabulation which are logically and physically integrated into a single unit. A DRE produces a tabulation of the voting data stored in a removable memory component and in printed hardcopy.
Election Assistance Commission	EAC	An independent, bipartisan commission created by the Help America Vote Act (HAVA) of 2002 that operates the federal government's voting system certification program.
Election Management System	EMS	The software used by the voting system to describe ballot layout, collect and report election results, and maintain audit trails.
Federal Information Processing Standard Publication 140-2	FIPS 140-2	Security requirements for Cryptographic modules.
Firmware	NA	A computer program stored in read-only memory (either programmable or non-programmable), that becomes a permanent part of the computing device that is not subject to change or modification without review by the State Board.
Functional Configuration Audit	FCA	The testing activities associated with the functional testing of the system.
Known Vulnerability Database	KVD	A platform aimed at collecting, maintaining, and disseminating information about discovered computer security vulnerabilities.
Marksense	NA	A system by which votes are recorded by means of marks made in voting response fields designated on one or both faces of a ballot or ballot cards. Marksense systems may use an optical scanner or similar sensor to read the ballots. Also known as optical scan.

Term	Abbreviation	Description
Message Digest 5	MD5	A widely used hash function producing a 128-bit hash value.
Modification	NA	Any change in the software, firmware or hardware, data storage location of files, or any other component of the voting system, and shall require re-examination of certified system or equipment by the State Board.
Optical scan voting system (NY Election Law)	NA	A voting system in which a voter records his or her vote by placing a mark in a designated voting response field on a paper ballot or card, which is read and tabulated using optical-scan technology or a marksense system that reads the paper ballot or card by scanning the ballot and interpreting the contents.
Optical scan voting system (VVSG 1.0)	NA	System by which votes are recorded by means of marks made in voting response fields designated on one or both faces of a ballot card or series of cards. An optical scan system reads and tabulates ballots, usually paper ballots, by scanning the ballot and interpreting the contents. Also known as marksense.
Paper-based voting system (NY Election Law)	NA	Any electronic or computerized ballot counting system or equipment which tabulates and reports votes cast on paper ballots.
Paper-based voting system (VVSG 1.0)	NA	Voting system that records votes, counts votes, and tabulates the vote count, using one or more ballot cards or paper ballots.
Physical Configuration Audit	PCA	Confirms that the documentation submitted meets the national certification requirements. Includes Trusted Build activities.
Software	NA	Any programming instructions used by the vote counting system, including but not limited to system programs and application programs. System programs include but are not limited to the operating system, control programs, communication programs, database managers, and device drivers. Application programs include but are not limited to, any program that processes the data.

Term	Abbreviation	Description
Source Code	NA	The computer program in its original form, as written by the programmer. Source code is not executed by the computer directly, but is converted into machine language by compilers, assemblers and interpreters.
State Board	NYSBOE	The New York State Board of Elections.
Technical Data Package	TDP	The data package supplied by the vendor, which includes Functional Requirements, Specifications, End-user documentation, Procedures, System Overview, Configuration Management Plan, Quality Assurance Program, and manuals for each of the required hardware, software, firmware components of a voting system.
Time Bomb	NA	A malicious program that is programmed to "detonate" at a specific time and release a virus onto the computer system or network.
Virus	NA	A computer virus is a type of computer program that, when executed, replicates itself by modifying other computer programs and inserting its own code.
Voter Verifiable Paper Audit Trail (NY Election Law)	VVPAT	A paper record of the voter's ballot choices printed or displayed to the voter prior to the voter making their ballot choices final, that constitutes a complete record of ballot choices that can be used in audits of the accuracy of the voting systems electronic records, in audits of the election results, and in full recounts. In the case of a paper-based voting system, the ballot marked by the voter shall constitute the paper record.
Voter Verifiable Paper Audit Trail (VVSG 1.0)	VVPAT	One of several classes of independent verification systems whereby the voter can directly compare the electronic summary screen of the voting machine with the printed paper audit record. The printed paper audit record is not to be confused with the paper ballot that is produced by optical scan voting systems that the voter visually verifies before placing it in the ballot box or tabulator.
Vote Summary Card	NA	See Activation Card

Term	Abbreviation	Description
Voter Verifiable	NA	A voting system feature that provides the voter an opportunity to verify that his or her ballot selections are being recorded correctly, before the ballot is cast.
Voter Verifiable Audit Record	NA	Human-readable printed record of all of a voter's selections presented to the voter to view and check for accuracy.
Worm	NA	A computer worm is a type of malware that spreads copies of itself from computer to computer. A worm can replicate itself without any human interaction, and it does not need to attach itself to a software program in order to cause damage.

1.4 System Identification

This section provides a description of the scope of **ES&S EVS 6.0.4.1** voting system TDP and the documents submitted for testing.

The ES&S EVS 6.0.4.1 voting system is composed of the following devices, software applications, firmware, and COTS hardware and software.

1.4.1 Components and Additions

Components Currently in NY Configuration

- **Electionware –** Electionware is an end-to-end election management software application that provides election definition creation, ballot formation, equipment configuration, result consolidation, adjudication, and report creation. Electionware is composed of five software groups: Define, Design, Deliver, Results and Manage.
- **DS200 –** DS200 is a polling place paper-based voting system, specifically a digital scanner and tabulator that simultaneously scans the front and back of a paper ballot and/or vote summary card in any of four orientations for conversion of voter selection marks to electronic Cast Vote Records (CVR).
- **DS850 –** DS850 is a central scanner and tabulator that simultaneously scans the front and back of a paper ballot and/or vote summary card in any of four orientations for conversion of voter selection marks to electronic Cast Vote Records (CVR).

Component Enhancements/Additions

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

- **DS450** is a central scanner and tabulator that will simultaneously scan the front and back of a paper ballot and/or vote summary card in any of four orientations for conversion of voter selection marks to electronic Cast Vote Records (CVR).
- **Electionware** Reporting Module – Electionware Reporting Module is for results consolidation, Election Night reporting, and ballot/write-in adjudication. Also included is a new Electionware Touch Screen Ballot module to layout ballots for the ExpressVote XL Marker and Tabulator.

1.5 Software and Firmware

The ES&S EVS 6.0.4.1 voting system consists of the following software and firmware components and versions:

Table 2 - EVS 6.0.4.1 Software/Firmware

Application	Version
Electionware	5.2.0.0
DS200	2.19.0.0
DS850	3.2.0.0
DS450	3.2.0.0
ExpressVote XL	1.1.0.0

1.6 Equipment

The following equipment is required for the execution of the functional testing. This includes system hardware, general purpose data processing and communications equipment, and any test instrumentation required.

1.6.1 EVS 6.0.4.1 Equipment

The following manufacturer equipment was used in testing:

Table 3 - EVS 6.0.4.1 Equipment

Hardware	HW Revision	Model
DS200 Precinct-based Scanner and Tabulator	1.3	N/A
DS450 Central Count Scanner and Tabulator	1.0	N/A
DS850 Central Count Scanner and Tabulator	1.0	N/A
ExpressVote XL Full-Faced Universal Voting System	1.0	N/A
DS200 Collapsible Ballot Box	1.1	98-00009
DS200 Plastic Ballot Box	1.5	57521
DS200 Tote Bin	1.0	00074
DS450 Cart	N/A	3002
DS850 Cart	N/A	6823

Hardware	HW Revision	Model
Universal Voting Console	1.0	98-00077

1.7 TDP Documentation

The ES&S EVS 6.0.4.1 voting system consists of the following TDP documentation:

Table 4 - EVS 6.0.4.1 TDP Documentation

Documentation	Version
Preface	
ESSSYS_6'0'4'1_L_RequirementsMatrix_TDP	1.3
System Overview	
ESSSYS_6'0'4'1_D_SysOvr	1.10
System Functionality Description	
ESSSYS_6'0'4'1_D_SFD	1.3
System Hardware Specification	
DS200_1'2_SPC_HWSpec	3.5
DS200_1'3_SPC_HWSpec	4.7
DS450_1'0_SPC_HWSpec	1.9
DS850_1'0_SPC_HWSpec	1.9
EVOTEXL_1'0_SPC_HWSpec	1.2
DS200_1'2_L_APL	1.1
DS200_1'3_L_APL	1.6
DS450_1'0_L_APL	1.4
DS850_1'0_L_APL	1.4
EVOTEXL_1'0_L_APL	1.2
Software Design and Specification	
DS200_2'19'0'0_SDS	1.3
DS450_3'2'0'0_SDS	1.1
DS850_3'2'0'0_SDS	1.1
ELS_1'6'0'0_SDS	1.3
ESSSYS_1'0_P_CodingStandards	1.4
ESSSYS_1'0_P_SysDevProgram	1.5
ESSSYS_1'0_SPC_LicenseAgreements	1.6
EVOTEXL_1'1'0'0_SDS	1.5
EWARE_5'2'0'0_SDS	1.3
EWARE_99'3_D_PostGreSQLDescriptions_EVS6041.zip	N/A
EWARE_99'5_D_XMLDiagrams_EVS6041.zip	N/A
System Test and Verification	
ESSSYS_6'0'4'1_D_TestPlan	1.0
DS200_1'3_D_CIFRpt	N/A

Documentation	Version
EVOTEXL_1'0_D_CIFRpt	N/A
ESSSYS_6'0'4'1_QA_TC_Integration	1.0
System Security Specification	
ESSSYS_6'0'4'1_SPC_EMSServerSetupConfigGuide	1.8
ESSSYS_6'0'4'1_SPC_ENT_ClientWorkstationSetupConfigGuide	1.5
ESSSYS_6'0'4'1_SPC_ENT_StandaloneWorkstationSetupConfigGuide	1.5
ESSSYS_6'0'4'1_SPC_PRO_ClientWorkstationSetupConfigGuide	1.4
ESSSYS_6'0'4'1_SPC_PRO_StandaloneWorkstationSetupConfigGuide	1.4
ESSSYS_6'0'4'1_SPC_SecBestPract	1.5
ESSSYS_6'0'4'1_SPC_SecurityScriptDesc	1.4
ESSSYS_6'0'4'1_SPC_SystemSecurity_Local	1.7
ESSSYS_6'0'4'1_D_VerProc_DS200	2.1
ESSSYS_6'0'4'1_D_VerProc_DS450	2.1
ESSSYS_6'0'4'1_D_VerProc_DS850	2.1
ESSSYS_6'0'4'1_D_VerProc_EMS	2.1
ESSSYS_6'0'4'1_D_VerProc_EVOTEXL	2.1
ESSSYS_6'0'4'1_D_VerProc_VerificationPCSetup	2.1
ESSSYS_6'0'4'1_VerificationPack.zip	N/A
DS200_2'19_L_ValFileList	1.0
DS450_3'2_L_ValFileList	1.0
DS850_3'2_L_ValFileList	1.0
EMS_5'2_L_ValFileList	1.1
EVOTEXL_1'1_L_ValFileList	1.2
ESSSYS_EVS5'2'2'0_BP_cipherUpdateKeysVMTrustedBuild1	1.2
ESSSYS_6'0'0'0_BP_DS200AncillaryTrustedBuild1.0	1.1
ESSSYS_6'0'0'0_BP_DS200AncillaryVMBuildEnvironment	1.0
ESSSYS_6'0'0'0_BP_DS450VMBuildEnvironment	1.1
ESSSYS_6'0'0'0_BP_EMSTrustedBuild1.0	1.1
ESSSYS_6'0'0'0_BP_EMSVMBuildEnvironment	1.1
ESSSYS_6'0'0'0_BP_XTXLBuildEnvironment	1.1
ESSSYS_6'0'0'0_BP_XTXLPackagingEnvironment	1.0
ESSSYS_6'0'2'0_BP_EMSTrustedBuild-1.0	1.1
ESSSYS_1'0A1_BP_XTXLBuildEnvironment	1.0
ESSSYS_6'0'4'1_BP_DS450VMTrustedBuild1	1.1
ESSSYS_6'0'4'1_BP_DS850TrustedBuild1	1.1
ESSSYS_6'0'4'1_BP_EMSVMTrustedBuild1	1.1
ESSSYS_6'0'4'1_BP_ExpressLinkTrustedBuild1	1.1
ESSSYS_6'0'4'1_BP_XTXLVMTrustedBuild1	1.1
ESSSYS_6Æ0Æ4Æ1_BP_DS200VMTrustedBuild1	1.1
System Operations Procedures	
DS200_2'19'0'0_SOP	1.5

Documentation	Version
DS450_3'2'0'0_SOP	1.6
DS850_3'2'0'0_SOP	1.6
ELS_1'6'0'0_SOP_NY	1.3
EVOTEXL_1'1'0'0_SOP	1.8
EWARE_5'2'0'0_SOP_01Admin	1.3
EWARE_5'2'0'0_SOP_02Define	1.3
EWARE_5'2'0'0_SOP_03Design	1.6
EWARE_5'2'0'0_SOP_04Deliver	1.3
EWARE_5'2'0'0_SOP_05Results	1.6
EWARE_5'2'0'0_SOP_06Appendices	1.4
System Maintenance Manuals	
DS200_2'19'0'0_SMM	1.5
DS450_3'2'0'0_SMM	1.5
DS850_3'2'0'0_SMM	1.4
EVOTEXL_1'1'0'0_SMM	1.6
Personnel Deployment and Training	
ESSSYS_1'0_P_TrainingProgram	1.1
Configuration Management Plan	
ESSSYS_1'0_P_CMProgram	1.4
ESSSYS_1'0_P_TDProgram	1.3
QA Program	
ESSSYS_1'0_P_MNFQAProgram	1.7
ESSSYS_6'0'4'1_P_SWQAProgram	1.0
ESSSYS_M_I_DataWinISOCert_9001-2015	N/A
ESSSYS_M_I_PivotISOCert_9001-2015	N/A
ESSSYS_QA_M_DataWin	N/A
ESSSYS_QA_M_Pivot	N/A
Attachments	
BPG_1'0_SOP	3.2
State Required Files	
ESSSYS_1'0_P_FormatCentralCountHD	1.3
ESSSYS_6'0'4'1_SPC_VotingSystemThreatMatrix	1.0

1.8 Test Materials

The following test materials are required for the performance of testing including, as applicable, test ballot layout and generation materials, test ballot sheets, test ballot cards and control cards, standard and optional output data report formats, and any other materials used in testing.

- Ballots and blank ballot grade paper
- Activation cards

- Ballot pens
- Printer paper rolls

1.9 Supporting Test Equipment

This section outlines the test equipment that was used in this test campaign.

1.9.1 Security Testing Software

Table 5 - Supporting Test Software

Manufacturer	Application	Version
Open Source	Wireshark	2.2.3
Tenable	Nessus	Professional
Rapid 7	Metasploit	4.16.45
Offensive Security	Kali Linux	Rolling
Kevin Yuan	Wifi Analyzer	3.11.2
ReFirmLabs	Binwalk	2.1.2
Lo Saur	ENT	2011-2012
Andrew W. Phillips	HexEdit	3.6
MH-Nexus	HXD	2.4.0.0

1.9.2 Security Testing Hardware

The following hardware was required for the execution of the relevant security tests. This included system hardware, general purpose data processing and communications equipment, and any test instrumentation required.

- USB3 test plug
- Lock pick set and lock pick gun, tubular lock picks
- Basic 10/100 HUB
- Hak5 bash bunny
- Hak5 Packet Squirrel

2 EVALUATION OF PRIOR VSTL TESTING

The ES&S EVS 6.0.4.1 voting system is based on a branch of ES&S voting systems that originated with the fully tested and EAC certified EVS 6.0.0.0 voting system. Subsequent EAC certified versions of the EVS 6.0.0.0 voting system, EVS 6.0.2.0 and EVS 6.0.4.0, were certification tested by SLI for changes to the original fully tested EVS 6.0.0.0 voting system during each respective EAC test campaign. Please see *Attachment G - Prior VSTL Testing* for details regarding test plans, test reports, and artifacts for each system.

The EVS 6.0.4.1 voting system uses the EVS 6.0.4.0 voting system as a baseline for modifications. This section contains an overview of the testing performed on the ES&S voting systems that EVS 6.0.4.1 was modified from: EVS 6.0.0.0, 6.0.2.0, and 6.0.4.0.

These voting systems were subject to EAC certification testing and are currently EAC certified. Please refer to the documentation, artifacts, and reports provided for each system regarding specific details of the testing performed.

The ES&S EVS 6.0.0.0 voting system was a new system that was subject to full EAC certification testing. A full review of the source code, technical data package review, hardware testing, and functional testing were performed to examine the system for compliance against all applicable requirements within the VVSG 1.0.

The ES&S EVS 6.0.2.0 voting system was modified from the ES&S EVS 6.0.0.0 voting system. Source code review was performed on all modified software and firmware applications. A PCA review of the EVS 6.0.2.0 voting system documentation was performed in order to verify conformance with the EAC VVSG 1.0 requirements. Functional and security testing was conducted based on analysis of the modifications between the EVS 6.0.0.0 and EVS 6.0.2.0 systems.

The ES&S EVS 6.0.4.0 voting system was modified from the ES&S EVS 6.0.2.0 voting system. Source code review was performed on all modified software and firmware applications. A PCA review of the EVS 6.0.4.0 voting system documentation was performed in order to verify conformance with the EAC VVSG 1.0 requirements. Functional, security, and hardware testing was conducted based on analysis of the modifications between the EVS 6.0.2.0 and EVS 6.0.4.0 systems.

3 MASTER REQUIREMENTS MATRIX

A master requirements matrix is necessary in order to demonstrate how all VVSG 1.0 and NY 2019 Election Law requirements have been covered in the EVS 6.0.4.1 voting system test campaign. In conjunction with the EVS 6.0.4.1 test reports, SLI has created a master requirements matrix that provides a clear traceability of requirements to test cases for all applicable VVSG 1.0 and NY 2019 Election Law requirements used in this test effort. This matrix is included in *Attachment A – New York Requirements Matrix EVS 6.0.4.1*.

4 TDP DOCUMENTATION REVIEW

The following section contains a summary of the TDP documentation review and findings observed during the ES&S EVS 6.0.4.1 voting system test campaign. Please see *Attachment C – Documentation* for the PCA document review forms, test cases, and test report containing additional details of SLI's TDP documentation review of the EVS 6.0.4.1 voting system.

4.1 TDP Documentation Review Summary

SLI reviewed the documentation supplied in the EVS 6.0.4.1 TDP to verify compliance against VVSG 1.0 and NY 2019 Election Law requirements. SLI traced in a set of internally developed test cases where each NY 2019 Election Law requirement is met by the vendor documentation. In addition, SLI used a set of internally developed PCA document review

forms to trace and demonstrate where each VVSG 1.0 requirement is met by the vendor documentation based on changes in the TDP.

In addition to the SLI developed PCA review forms, SLI has provided a requirements matrix for EVS 6.0.4.1 that includes a mapping of the NY 2019 Election Law requirements to the corresponding document review test cases.

The PCA review forms and document review test cases contain tracings of the vendor documentation and sections that satisfy the requirements. Thus, the requirements matrix, PCA review forms, and document review test cases demonstrate how the EVS 6.0.4.1 TDP documentation satisfies VVSG 1.0 and NY 2019 Election Law requirements.

4.2 TDP Documentation Review Findings

The following section contains findings from the TDP documentation review conducted on the EVS 6.0.4.1 system. These findings are also referenced in *Attachment B - Discrepancy Report*.

- JIRA ESS6041-1

  Requirement - N/A

  TDP Section - System Security Specification

  Description - The workstation setup and configuration guides contain a list of COTS to use that does not match what the vendor requested SLI obtain in advance of the setup process. As a result, it is unclear what COTS should be used to set up and configure the system.

  Resolution - The workstation setup and configuration guides were updated to list COTS consistent with what the vendor requested SLI obtain in advance of the setup process.

- JIRA ESS6041-3

  Requirement - VVSG 8.6.b: To meet the conformance inspection requirements the vendor or manufacturer shall: Deliver a record of tests or a certificate of satisfactory completion with each system or component

  TDP Section - Quality Assurance

  Description - ESSSYS_1'0_P_SWQAProgram section 11. TEST CASES states “Product test cases are stored in the ES&S technical documentation repository. Product test cases associated with the current release are escrowed with the individual certification project’s TDP, stored in the Test Cases section of the Resources folder." There are no test cases in the Resources folder.

  Resolution - Test cases were provided to NYSBOE but not to SLI. This issue was closed. New issues opened ESS6041-6, ESS6041-7, ESS6041-8 to address more specific NY Election Law requirements.

- JIRA ESS6041-4

Requirement - 2.5.5.2: The vendor shall identify the compilers or assemblers used in the generation of executable code and describe the operating system or system monitor.

TDP Section - Software Design and Specification

Description - EVOTEXL_1'1'0'0_SDS.pdf states in section 2.5.5.2. Software Environment, that “The compilers and assemblers used to develop the software for the ExpressVote XL are listed in section 2.5.3.5.” Section 2.5.3.5 covers Certifications, and the compilers & assemblers are not listed.

Resolution - This issue was resolved in Rev 1.3 of EVOTEXL_1'1'0'0_SDS, section 2.5.5.2 of the EVS 6.0.4.1 TDP.

- JIRA ESS6041-5

  Requirement - N/A

  TDP Section - System Overview

  Description - Incorrect table number referenced in ESSSYS_6'0'4'1_D_SysOvr. Pg. 17 top states: “Table 2 lists the functional subsystems included with ES&S Voting System 6.0.4.1”
  Section should be labeled “Table 3” as displayed on the bottom of pg. 17 “Table 3: Functional Subsystems”

  Resolution - This issue was resolved in the final EVS 6.0.4.1 TDP submission.

- JIRA ESS6041-6

  Requirement - 6209.6.D.2.ii (a) copies of all procedures used for module or unit testing, integration testing and system testing;

  TDP Section - System Test and Verification

  Description - No records supplied of all tests performed, including error correction and retest.

  Resolution - This issue was resolved in the final EVS 6.0.4.1 TDP submission. ESSSYS_1'0_P_CMProgram.pdf Rev 1.4, entire document meets this requirement.

- JIRA ESS6041-7

  Requirement - 6209.6.D.2.ii (b) copies of all test cases generated for each module and integration test and sample ballot formats or other test cases used for system;

  TDP Section - System Test and Verification

  Description - Product test cases, sample ballot formats, and sample election coding are provided by ES&S in the EVS 6.0.4.1 TDP. No test cases were delivered with the EVS 6.0.4.1 TDP.

  Resolution - This issue was resolved in the final EVS 6.0.4.1 TDP submission. ESSSYS_1'0_P_CMProgram.pdf Rev 1.4, entire document meets this requirement.

- JIRA ESS6041-8

Requirement - 6209.6.D.2.ii (c) records of all tests performed by the procedures listed above, including error correction and retest.

TDP Section - System Test and Verification

Description - No records supplied of all tests performed, including error correction and retest.

Resolution - This issue was resolved in the final EVS 6.0.4.1 TDP submission. ESSSYS_1'0_P_CMProgram.pdf Rev 1.4, entire document meets this requirement.

- JIRA ESS6041-9

  Requirement - 6209.2.F (16) Vendor documentation shall include procedures for investigating and resolving malfunctions including but not limited to misreporting of votes, unreadable paper records, paper jams, low ink, mis-feeds and power failures.

  TDP Section - System Operations Procedures

  Description - EVS 6.0.4.1 TDP documentation does not contain procedures for investigating and resolving malfunctions including but not limited to misreporting of votes, unreadable paper records, paper jams, low ink, mis-feeds and power failures.

  Resolution - This issue was resolved in the final EVS 6.0.4.1 TDP submission. EVOTEXL_1'1'0'0_SOP.pdf Revision 1.8. Released: July 27, 2020 resolved outstanding issues.

- JIRA ESS6041-10

  Requirement - 6209.2.F (18) Protective coverings intended to be transparent on voting system devices shall be maintainable via a predefined cleaning process. If the coverings become damaged such that they obscure the paper record, they shall be replaced.

  TDP Section - System Maintenance Manuals

  Description - EVS 6.0.4.1 TDP documentation does not contain procedures for maintenance of protective coverings.

  Resolution - This issue was resolved in the final EVS 6.0.4.1 TDP submission. EVOTEXL_1'1'0'0_SMM.pdf, revision 1.6, released: July 27, 2020. Chapter 4: Added 4.3.3 Clean the Card Review Window - this section satisfies the requirement.

- JIRA ESS6041-11

  Requirement - 6209.6.E.4 Each system shall be submitted for electronic and technical security and integrity analysis by independent certified security experts, who shall be given full unrestricted access to production units of the system, for such analysis. Whenever the vendor is able to provide documentation for the State Board and its testing authority, to establish that the standards of this section of these regulations have been met; then the State Board may, in its discretion, accept such documentation as satisfaction of the tests required by this Part.

  TDP Section - N/A

Description - Unable to locate any documentation in the TDP regarding electronic and technical security and integrity analysis by independent certified security experts. As the ITA has been tasked with a full security assessment of the system, it is not clear if the lack of documentation to show additional testing by a party other than the ITA constitutes a failure.

Resolution - The security assessment referenced in the requirement would be reviewed if the vendor chose to perform this analysis prior to submission of the system for review by the ITA. As it is optional, not having this assessment in the TDP is not an issue.

- JIRA ESS6041-24

  Requirement - 6209.6.D.3c - (iii) Audit procedure.

  Required data items include draft and formal documentation of the vendor's software development program which are relevant to the design and conduct of qualification tests. The vendor shall identify all documents, or portions of documents, which the vendor asserts contain proprietary information not approved for public release. The State Board or its designee shall agree to use any proprietary information contained therein solely for the purpose of analyzing and testing the software and shall refrain from disclosing proprietary information to any other person or agency without the prior written consent of the vendor or a court order. The State Board or its designee shall review the vendor's source code and documentation to verify that the software conforms to the documentation, and that the documentation is sufficient to enable the user to install, validate, operate and maintain the voting system. The review shall also include an inspection of all records of the baseline version against the vendor's release control system to establish that the configuration, being qualified, conforms to the engineering and test data.

  TDP Section – System Security Specification

  Description - Once the Windows 7 operating system has been installed; the next time the workstations are powered on a warning is displayed stating that Windows 7 is no longer supported.

  The workstation setup and configuration documentation should provide a description of critical messages like this encountered by the end user during the workstation setup and configuration process.

  ESSSYS_6'0'4'1_SPC_ENT_ClientWorkstationSetupConfigGuide
  ESSSYS_6'0'4'1_SPC_ENT_StandaloneWorkstationSetupConfigGuide
  ESSSYS_6'0'4'1_SPC_PRO_ClientWorkstationSetupConfigGuide
  ESSSYS_6'0'4'1_SPC_PRO_StandaloneWorkstationSetupConfigGuide

  Resolution - This issue was resolved in the final EVS 6.0.4.1 TDP submission.

- JIRA ESS6041-25

  Requirement - Requirement - 6209.6.D.3c - (iii) Audit procedure.

Required data items include draft and formal documentation of the vendor's software development program which are relevant to the design and conduct of qualification tests. The vendor shall identify all documents, or portions of documents, which the vendor asserts contain proprietary information not approved for public release. The State Board or its designee shall agree to use any proprietary information contained therein solely for the purpose of analyzing and testing the software and shall refrain from disclosing proprietary information to any other person or agency without the prior written consent of the vendor or a court order. The State Board or its designee shall review the vendor's source code and documentation to verify that the software conforms to the documentation, and that the documentation is sufficient to enable the user to install, validate, operate and maintain the voting system. The review shall also include an inspection of all records of the baseline version against the vendor's release control system to establish that the configuration, being qualified, conforms to the engineering and test data

TDP Section - System Security Specification

Description - The following documents in the TDP are missing the instruction ”Ensure “Automatically reboot and recall” is selected” in the WSUS offline update section:

ESSSYS_6'0'4'1_SPC_ENT_ClientWorkstationSetupConfigGuide, section 4.4, pg. 26
ESSSYS_6'0'4'1_SPC_ENT_StandaloneWorkstationSetupConfigGuide, section 4.4, pg. 26
ESSSYS_6'0'4'1_SPC_PRO_StandaloneWorkstationSetupConfigGuide, section 4.4, pg. 25

This instruction is correctly present in ESSSYS_6'0'4'1_SPC_EMSServerSetupConfigGuide and ESSSYS_6'0'4'1_SPC_PRO_ClientWorkstationSetupConfigGuid documents.

Resolution - This issue was resolved in the final EVS 6.0.4.1 TDP submission.

- JIRA ESS6041-26

  Requirement - Requirement - 6209.6.D.3c - (iii) Audit procedure.

  Required data items include draft and formal documentation of the vendor's software development program which are relevant to the design and conduct of qualification tests. The vendor shall identify all documents, or portions of documents, which the vendor asserts contain proprietary information not approved for public release. The State Board or its designee shall agree to use any proprietary information contained therein solely for the purpose of analyzing and testing the software and shall refrain from disclosing proprietary information to any other person or agency without the prior written consent of the vendor or a court order. The State Board or its designee shall review the vendor's source code and documentation to verify that the software conforms to the documentation, and that the documentation is sufficient to enable the user to install, validate, operate and

maintain the voting system. The review shall also include an inspection of all records of the baseline version against the vendor's release control system to establish that the configuration, being qualified, conforms to the engineering and test data

TDP Section - System Security Specification

Description - Once the Cerberus FTP Server has been installed, a warning message is displayed stating that this version of the Cerberus FTP Server is not supported on Windows Server 2008 or Windows Server 2008 R2.

The workstation setup and configuration documentation should provide a description of critical messages like this encountered by the end user during the workstation setup and configuration process.

ESSSYS_6'0'4'1_SPC_EMSServerSetupConfigGuide
Section 9 - Install Cerberus FTP Server

Resolution - This issue was resolved in the final EVS 6.0.4.1 TDP submission.

- JIRA ESS6041-27

  Requirement - 6209.6.D.3 Physical configuration audit.

  The physical configuration audit is an examination of the software configuration against its technical documentation to establish a configuration baseline for approval. The physical configuration audit shall include an audit of all drawings, specifications, technical data and test data associated with the system hardware and this audit shall establish the system hardware baseline associated with the software baseline. All subsequent changes to the software or hardware shall be subject to reexamination.

  TDP Section - 00 State Required Files

  Description - The COTS listed in ESSSYS_6'0'4'1_CM_L_COTSPIP for the EMS on pg. 25 do not match what is listed in the system overview and within the workstation setup and configuration documentation in the TDP.

  The COTS PRODUCT IMPLEMENTATION PLAN section lists:
  Windows 10 Enterprise
  Windows Server 2016
  Sumatra PDF

  The EVS 6041 system overview and used within the workstation setup and configuration documentation lists:
  Windows 7 Enterprise
  Windows 7 Professional
  Windows Server 2008
  Adobe Acrobat

  Resolution - This issue was resolved in the final EVS 6.0.4.1 TDP submission.

5 FUNCTIONAL TESTING

The following section contains a summary of the functional testing and findings observed during the ES&S EVS 6.0.4.1 voting system test campaign. Please see *Attachment D – Functional* for the test cases and test report containing additional details of functional testing SLI performed on the EVS 6.0.4.1 voting system.

5.1 Functional VVSG 1.0 "Should to Shall" Testing Summary

The ES&S EVS 6.0.4.1 voting system was functionally tested to a specific subset of VVSG 1.0 requirements. As required by NYSBOE, in all VVSG 1.0 requirements where the word "should" appears, "should" was replaced with "shall". These requirements can be broken down into three general categories: errors and warning messages, ADA and accessibility, and validation.

- The error and warning message requirements specify for the devices to display warning messages with the appropriate color and symbol to convey the level of severity along with instructions to clear the message when applicable as outlined in VVSG 1.0 requirement 3.1.4 d and e. For testing, a sample of error conditions were purposely caused on each device within the EVS 6.0.4.1 system configuration, and the tester verified that the color, symbols, and messages displayed were correct.
- ADA requirements, only applicable to the ExpressVote XL voting device, reviewed the ease of use by those with hearing and language disabilities. Using the UVC controller and headphones, the tester verified the VVSG 1.0 requirement 3.2.2.2 that all information on the ballot is converted to audio and pronounced correctly and fully, ensuring that the disabled voter gets the same full voting experience of a non-disabled voter. In addition, the voter has control over the tempo, allowing them to speed up or slow down the audio.
- The accessibility requirements pertained to both the hardware and software of the voting devices. The size and weight of the equipment were checked to ensure that they are compatible with their intended use and location, along with the ability for poll workers to replace paper with minimal disruption and without the circumventing of security features. The visual style of the ballot for the ExpressVote XL was also verified in its presentation of font type, size, and displaying of contests and candidates, along with its alternative languages access for non-English speakers.

5.2 NY 2019 Election Law Functional Testing Summary

The EVS 6.0.4.1 system was subject to a complete suite of functional tests based on the NY 2019 Election Law requirements. The test cases can be broken down into the following categories: Election Creation, Ballot Verification, ExpressVote XL Testing, DS200 Testing, DS450 Testing, DS850 Testing, and EMS Election Results. Each of the test cases were executed using modified election templates provided by ES&S.

Election Creation

Test cases in this subsection cover the requirements that were tested on the Electionware EMS during the election creation process. During the ballot creation process, test cases were executed on the Electionware EMS to test adding and updating the ballot emblem and party images, verifying that the ballot layout and display are consistent across districts and precincts, verifying that the EMS is capable of organizing the contest order, verifying that the party and candidate names are capable of being abbreviated and displayed on the ballot, and verifying that the ballot rotation correctly rotated candidates depending on the rotation pattern selected. Testing also included configuring an election definition to include an uncontested office with only one candidate. This configuration prevents that contest from being displayed on the ballot. Additionally, a candidate that was nominated for multiple parties was added using the EMS.

Ballot Verification

Test cases in this subsection cover the requirements that were tested on the physical paper ballot or the voter activation card. This section of the functional test case verified that the ballot was capable of being modified to follow the NY 2019 Election Law requirements. The formatting of contests, candidates, and parties were examined against the NY 2019 Election Law to determine if they followed state laws appropriately. The ballot formatting was also examined against each polling place and district to verify that it was uniform across all the ballots.

Each ballot was examined to determine that the ballot instructions were fully displayed on the front or back of the ballot. If the ballot instructions are located on the back of the ballot, a message is displayed on the front of the ballot stating that the ballot instructions were on the back of the ballot. The paper ballot was examined to determine that the proper candidate formatting was utilized. With each candidate, contest, and party containing corresponding associating letters and numbers. Paper ballots were also examined to determine if a ballot was capable of being displayed on a single ballot, using both the front and back faces of the ballot. Contests on the paper ballot may display candidates across multiple columns if necessary. The Governor and Lieutenant Governor contests were displayed with both names in a single space with a unique identification number and letter. Additionally. The paper ballot was measured to determine that the sizes and spacing of the ballot text size was between 3-4mm or 6.3-9 mm and the distance between ballot selections were identical between any two candidates.

ExpressVote XL Testing

Test cases in this subsection cover the requirements that were tested on the ExpressVote XL system. Because the ExpressVote XL is considered a hybrid type of voting device that comprises a combination of voting system functionality, the NY 2019 Election Law requirements were applied and tested in their entirety, per the direction of the NYSBOE, rather than only testing the applicable requirements based on voting device definitions. This testing included both ballot marking and tabulation functionality requirements. Testing conducted consisted of activation card requirements, formatting of the screen and activation cards, device functionality, and device settings.

The general candidate formatting was checked on the XL to verify that candidates were capable of being displayed either horizontally or vertically next to their respective contests. Additionally, candidates were assigned to multiple parties and verified on the XL to see if they would appear on the appropriate locations with the appropriate parties. Each candidate, contest, and party were examined to identify if they contained an associating letter and number which would be unique to that selection. The size of the text and spacing on the screen and the activation cards were measured to determine that the sizes and spacing of the ballot text size was between 3-4 mm or 6.3-9 mm and the distance between ballot selections were identical between any two candidates.

Testing for the multiple memory storage included testing of the CFast cards and the election media stick to identify if a warning message would be displayed if the maximum number of ballots were tabulated on the storage media. Ballots containing over-voted ballots, ballots with candidates on multiple party lines, ballots that contained multiple pages, and ballots that contain multiple languages were created and tabulated through the XL to determine how the device would handle each scenario. The return ballot setting was examined to determine if a voter could cancel their ballot or to continue voting their ballot “as is”.

Device tests included testing the ballot storage and tabulation, diagnostic status, audio level, screen illumination and space, inclusion of public and private counters, and extra peripheral testing. It was verified that the ballot is not counted until the ballot is stored within the secure ballot bin. The menu settings and reports were also examined to determine if the XL contained a diagnostic test for the system status. To test the audio levels during system operations, a decibel meter was used to verify that normal system operations did not reach 70 decibels. Headphones were also utilized to determine if a second individual could hear any audio cues or names coming from the headphones. The screen illumination and screen space were also examined to determine if there was sufficient illumination and space for normal voter operations. The public and protective counters were verified to be capable of being identified by election officials. The extra peripherals included a tactile pad and headphones, with both being tested for functionality.

DS200 Testing

Test cases in this subsection cover the requirements that were tested on the DS200 system. The test cases for this device consisted of testing the Memory storage devices, ballot storage, ballot scanning functionality, general device functionality, and privacy setups.

Testing for the multiple memory storage included testing of the Election Media USB and Backup Election USB media and verifying that a warning message would be displayed if the maximum number of ballots were tabulated on the storage media. Ballots containing over-voted ballots, ballots with candidates on multiple party lines, ballots that contained multiple pages, and ballots that contain multiple languages were tabulated through the DS200 to determine how the device would handle each scenario. When an abnormal ballot, such as an over-vote, is scanned there was a test to determine if the DS200 tabulates the ballot or returns the ballot.

Device tests included testing the ballot storage and tabulation, diagnostic status, audio level, screen illumination and space, inclusion of public and private counters, and ballot privacy. It was verified that the ballot is not counted until the ballot is stored within the secure ballot bin. The menu settings and reports were also examined to determine if the DS200 contained a diagnostic test for the system status. To test the audio levels during system operations, a decibel meter was used to verify that normal system operations did not reach 70 decibels. The screen illumination and screen space were also examined to determine if there was sufficient illumination and space for normal voter operations. The public and protective counters were examined to determine if they were capable of being identified by election officials. Additionally, the testing of the privacy blinders was used on the DS200 to verify that the voter's privacy is maintained while tabulating their ballot.

DS450 Testing

Test cases in this subsection cover the requirements that were tested on the DS450 system. The test cases for this device primarily tested the ballot scanning functionality. The DS450 was tested to determine how it would handle a ballot containing multiple sheets that were scanned out of order. This was achieved by scanning the first and second page of ballots out of order, so that ballots that were created together were not scanned together. Functionality for multiple languages was verified by scanning ballots in multiple languages. Simultaneous machine and human readability were tested. Additionally, the DS450 was tested to determine if the device appropriately contained multiple memories as well as functionality to perform a diagnostic test on the system status.

DS850 Testing

Test cases in this subsection cover the requirements that were tested on the DS850 system. The test cases for this device primarily tested the ballot scanning functionality. The DS850 was tested to determine how it would handle a ballot containing multiple sheets that were scanned out of order. This was achieved by scanning the first and second page of ballots out of order, so that ballots that were created together were not scanned together. Functionality for multiple languages was verified by scanning ballots in multiple languages. Simultaneous machine and human readability were tested. Additionally, the DS850 was tested to determine if the device appropriately contained multiple memories as well as functionality to perform a diagnostic test on the system status.

EMS Election Results

Test cases in this subsection cover the requirements that were tested on the Electionware EMS during the election results process. The functionality of the Electionware EMS system was tested against the NY 2019 Election Law requirements listed in tables 5 and 6. These test cases were created to verify that ballots were correctly tabulated on the Electionware EMS system from each of the devices. An additional test was conducted to determine how write-in stamps and stickers were tabulated from the different scanning devices and imported into the Electionware EMS results system. The write-ins were then tabulated through the Electionware EMS results software.

5.3 Functional Test Findings

The following section contains findings from the functional testing conducted on the EVS 6.0.4.1 system components. These findings are also referenced in *Attachment B - Discrepancy Report*.

- JIRA ESS6041-1

  Requirement – N/A

  TDP Area – Setup and Configuration Guides

  Documentation:

  ESSSYS_6'0'4'1_SPC_EMSServerSetupConfigGuide, Revision 1.3, Section 2.3.3 - Downloaded Software

  ESSSYS_6'0'4'1_SPC_ENT_ClientWorkstationSetupConfigGuide, Revision 1.1, Section 2.3.3 - Downloaded Software

  ESSSYS_6'0'4'1_SPC_ENT_StandaloneWorkstationSetupConfigGuide, Revision 1.1, Section 2.3.3 - Downloaded Software

  ESSSYS_6'0'4'1_SPC_PRO_ClientWorkstationSetupConfigGuide, Revision 1.1, Section 2.3.3 - Downloaded Software

  ESSSYS_6'0'4'1_SPC_PRO_StandaloneWorkstationSetupConfigGuide, Revision 1.1, Section 2.3.3 - Downloaded Software

  Description - Within each of these documents the incorrect COTS have been called out as being used. The following files were recommended for use by ES&S during the hardening process:

  Symantec - Intelligent Updater (File-Based Protection) - 20190122-001-core15sdsv5i64.exe

  Symantec - Intelligent Updater (Network-Based Protection) - 20190121-062-IPS_IU_SEP_14RU1.exe

  Symantec - Intelligent Updater (Behavior-Based Protection) - 20190115-001-SONAR_IU_SEP.exe

  WSUS Microsoft Windows Offline Update Utility - 11.5; WSUS_MicrosoftWindowsUpdates_Version-11-5_2019-01-22.SHA256SUM.zip

  Expected - COTS specified within the documentation should correspond with documents that have been recommended/used.

  Observed - The COTS specified within the documentation do not match the COTS that have been recommended/used. The COTS specified are:

  Symantec - Intelligent Updater (File-Based Protection) - 20181203-002-core15sdsv5i64.exe

  Symantec - Intelligent Updater (Network-Based Protection) - 20181130-061-IPS_IU_SEP_14RU1.exe

Symantec - Intelligent Updater (Behavior-Based Protection) - 20181126-001-SONAR_IU_SEP.exe

WSUS - WSUS_MicrosoftWindowsUpdates_Version-11-4_2018-12-03.zip

Resolution - This issue was resolved in the final 6041 TDP submission and closed.

- JIRA ESS6041-12

  Requirement - 6209.2.F.1.iv: In the case of a DRE voting system, the paper and electronic display of the voter's selections shall be presented and positioned so as to allow the voter to easily read and compare the two.

  Description - For the ExpressVote XL, there shall be a means for the voter to observe the paper and electronic records of the voter's selections. The voter shall be capable of comparing the two. However, within the XL device when the paper ballot is printed and displayed to the voter, the electronic record is partially obstructed.

  Expected - The user is capable of easily reading and comparing the paper and electronic display of the voter's selections.

  Observed - When the ballot is generated and displayed behind the glass pane, the electronic record, or on-screen display, is partially covered by the "Cast Ballot" popup. This prevents the voter from accurately comparing the electronic ballot to the physical ballot.

  Resolution - This discrepancy is unresolved.

  ES&S takes exception to SLI's determination that the ExpressVote XL, by definition, is considered a DRE as indicated in its findings for § 6209.2 (f) (1) (iv).

  Per NYSBOE, the issue at hand is that the full ballot is only shown during the initial marking of choices, but the voter can never see the full ballot compared with the printed choices. This will be brought up for further review by the commissioners.

- JIRA ESS6041-13

  Requirement - 6209.2.F.4: The voting system shall allow the voter to approve or reject the paper record, in the case of DRE systems, marking the ballot as such in the presence of the voter.

  6209.2.F.4.i: Any DRE voting system shall provide a means to reconcile the number of rejected paper records with the number of occurrences of rejected electronic selections, and procedures shall be in place to address any discrepancies.

  Expected - The DRE voting system shall provide a means to reconcile the number of rejected paper records with the number of occurrences of rejected electronic selections, and procedures shall be in place to address any discrepancies.

  Observed - The ExpressVote XL does not contain a direct method to reconcile the number of rejected paper records. The ExpressVote XL supports an Audit log that records the activation card rejection events. Reconciling the total number of

activation cards rejected requires filtering the activation card rejection events from the rest of the audit lot events and summing them together.

Resolution - Per NYSBOE in email to SLI dated 8/31/2020, this issue can be closed.

- JIRA ESS6041-14

  Requirement - 6209.2.F.4.ii: Prior to reaching the maximum number of ballots allowed pursuant to statute, any DRE voting system shall display a warning message to the voter indicating the voter may reject only one more ballot, and that the third ballot shall become the ballot of record.

  Description - Prior to reaching the maximum number of activation cards allowed pursuant to statute, any DRE voting system shall display a warning message to the voter indicating the voter may reject only one more activation card, and that the third activation card shall become the ballot of record.

  Expected - The ExpressVote XL system shall alert the voter that they may only reject 1 more activation card, and that the third activation card shall be cast.

  Observed - The ExpressVote XL does not alert the voter that they may reject the activation card only one more time. The XL system will allow the voter to continuously keep rejecting activation cards.

  Resolution - This Jira has been closed. This intent of this requirement is focused on the voter and voting procedures, not the voting system. If a voter were to spoil 3 ballots/activation cards, then they would no longer be able to receive another ballot.

  This resolution was provided by NYSBOE during a call with SLI and NYSTEC on 7/15/2020.

- JIRA ESS6041-15

  Requirement - 8-308.2: No write-in ballot shall be voted for any person for any office whose name appears on the machine as a nominated or designated candidate for the office or position in question; any write-in ballot so voted shall not be counted.

  Description - No write-in ballot shall be voted for any person for any office whose name appears on the machine as a nominated or designated candidate for the office or position in question; any write-in ballot so voted shall not be counted.

  Expected - When a write-in is entered for a candidate that has been nominated for a contest or position, that write-in shall not be tabulated.

  Observed - Within Electionware, the write-ins for a candidate that has been nominated for a contest are capable of being tabulated. Although it creates a separate "candidate", it is still possible to count the write-in.

  Resolution - This Jira has been closed. This intent of this requirement is focused on polling officials rather than the voting system. If a poll worker sees a write-in name that has been nominated for a contest, that vote would be voided.

  This resolution was provided by NYSBOE during a call with SLI and NYSTEC on 7/15/2020.

- JIRA ESS6041-16

  Requirement - 8-308.4: A write-in ballot may also be cast by the use of a name stamp. The use of name stickers, labels or pasters is prohibited.

  Description - A write-in ballot may also be cast by the use of a name stamp. The use of name stickers, labels or pasters is prohibited.

  Expected - When a write-in is voted for by using a sticker, label, or paster, it shall be rejected.

  Observed - A write-in that uses stickers, labels or pasters is counted within the scanning devices. Additionally, within Electionware the write-in review screen may still assign the sticker to a candidate.

  Resolution - This Jira has been closed. The intent of this requirement is to prevent a person from handing out stickers to voters to place within the write-in spot. It is not the intent of the requirement that the voting system itself prohibit the use of stickers or stamps.

  This resolution was provided by NYSBOE during a call with SLI and NYSTEC on 7/15/2020.

- JIRA ESS6041-17

  Requirement - 7-202.1.l: Be suitable for the use of election officers in examining the counters such that the protective counters and public counters on all such machines or systems must be located so that they will be visible to the inspectors and watchers at all times while the polls are open;

  Description - On each device, the protective and the public counters shall be displayed at all times in an easily identifiable position. These counters shall be made visible to the inspectors and watchers.

  Expected - Both the Protected and the Public counts shall be visible at all times on the voting device. These times shall include while the device is in a standby phase or when the device is used to vote a ballot.

  Observed - The Protected counts are no longer visible during the duration of a user voting a ballot on the ExpressVote XL.

  Resolution - Per NYSBOE, as the requirement indicates that the counters must be located such that they will be visible to the inspectors and watchers at all times while the polls are open, it is not necessary to display during voting session because the on-screen display must be private during a voting session.

  This resolution was provided by NYSBOE during a call with SLI on 8/7/2020.

- JIRA ESS6041-18

  Requirement - 6209.2.F.3: The voting system shall display, print, and store a paper record in any of the alternative languages chosen for making ballot selections. Candidate names and other markings not related to the ballot selection on the paper record shall appear in English.

Description - Ballots and activation cards created for the State of New York shall display, print, and store a paper record in any of the alternative languages chosen when voting a ballot or activation card. Candidate names and other markings not related to the ballot selection on the paper record shall appear in English.

Expected - A activation card created on the ExpressVote XL, shall display, print, and store the activation card in the language chosen.

Observed - The activation card is always printed in English, no matter which language is selected.

Resolution - This discrepancy is unresolved.

Per ES&S, the ES&S ExpressVote XL has been certified numerous times by the Election Assistance Commission (EAC) and several individual states as meeting the EAC Voluntary Voting System Guidelines, the Voting Rights Act of 1965 (VRA) and the Help America Vote Act of 2002 (HAVA) as well as each individual state law requirements where the ExpressVote XL has been certified.

Per NYSBOE, this is only a discrepancy when dealing with languages other than English. This will be brought up for further review by the commissioners.

- JIRA ESS6041-19

  Requirement - 6209.2.F.11: In the case of a DRE voting system, the electronic and paper records shall be linked by including a unique identifier within each record that can be used to identify each record uniquely and correspond the two accordingly.

  Description - In the case of a DRE voting system, the electronic and paper records shall be linked by including a unique identifier within each record that can be used to identify each record uniquely and correspond the two accordingly.

  Expected - The paper record and electronic display shall contain a unique identifier to allow the two to be correlated during an audit.

  Observed - The paper record and the electronic display do not contain a unique identifier within each record that can be used to identify each record uniquely and correspond the two accordingly.

  Resolution - Per NYSBOE, this is not applicable to the ExpressVote XL.

  This resolution was provided by NYSBOE during a call with SLI on 8/7/2020.

- JIRA ESS6041-20

  Requirement - 6209.2.F.7: The voting system shall not record the electronic record as being approved by the voter until the paper record has been stored.

  Expected - A paper record shall not be tabulated until it has been approved by the voter and physically stored.

  Observed - For the DS200 and ExpressVote XL devices, it is possible to tabulate a paper record before it is physically stored if a paper jam occurs between the output of the paper path and the paper record storage container. During this paper jam, both devices will display an error message and play an audible warning chime tone.

The device system maintenance manuals provide a list of system messages - DS200_2’19’0’0_SMM, EVOTEXL_1’1’0’0_SMM.

The system operation procedures documents also contain a basic troubleshooting guide with instructions for investigating certain scenarios - DS200_2’19’0’0_SOP, EVOTEXL_1’1’0’0_SOP.

Resolution - Per NYSBOE, a ballot, activation card, or vote summary card is considered stored as long as it is physically contained within the device. The ExpressVote XL will tabulate the summary card when the cast button is pressed but just prior to the card entering the attached ballot bin or container. Since storage occurs when the card is inserted, this is not considered an issue.

This resolution was provided by NYSBOE during a call with SLI on 8/7/2020.

6 SECURITY REVIEW

The following section contains a summary of the security testing and findings observed during the ES&S EVS 6.0.4.1 voting system test campaign. Please see *Attachment E – Security* for artifacts, test cases, and the test report containing additional details of security testing SLI performed on the EVS 6.0.4.1 voting system.

6.1 Security Review Summary

SLI conducted a security examination against the EVS 6.0.4.1 voting system. The review consisted of an evaluation of VVSG 1.0 and NY 2019 State Election Law requirements. Utilizing the requirements and deriving test cases to validate them, SLI evaluated the voting system.

Physical Security

It was determined that all locks/keys provided with the EVS 6.0.4.1 system are default. This means that any keys used on the EVS 6.0.4.1 hardware are able to unlock any of the ES&S hardware. This was reported in discrepancy ESS6041-22. This discrepancy was resolved as being addressed through a process guide by NYSBOE.

Protection against Malicious Software

This system contains anti-virus protection within the Election Management System (EMS). Anti-virus or malicious software protection software is not configured on the devices at this time. There are logical design considerations that limit and restrict the systems from introduction of unauthorized software. This includes utilization on all devices of a customized Linux operating system that has been configured in a locked down KIOSK restricted system.

Software Setup Validation

During the examination it was determined that the Electionware software is the only part of the ES&S EVS 6.0.4.1 system that utilizes disk encryption for the operating system storage. Disk encryption for OS storage is not required in any of the requirements tested,

and thus did not warrant an official deficiency. The examiner considers this a potential vulnerable point in the system if proper processes and procedures are not followed during transportation, storage or setup.

Generally, unencrypted file systems have the potential to allow for the following compromises given unmonitored unrestricted access to the devices listed:

1. Modification of the boot device for the system
2. Ability to access user password hashes for the device
3. Potential to alter/halt the system on startup or shutdown
4. Access to election specific software
5. Potential for introduction of malicious software

It should be noted that the EVS 6.0.4.1 voting system has physical security measures in place that restrict the ability to perform modification of unencrypted file systems during an election; these mitigation components include:

1. Lock/key combinations, tamper evident seals.
2. Vendor documented recommendations that all equipment must be verified using specified procedures to confirm the software/firmware contained on each device.
3. Recommendations supplied by the vendor to secure and monitor the equipment while in storage and while in use at the polling place and central count locations.

Cryptography

During the examination, the Security team determined that all cryptographic modules created during the election software trusted build and integrated into the EVS 6.0.4.1 voting system utilize CMVP validated modules.

- OpenSSL FIPS Object Module SE Version 2.0.12, Certificate Number #2398
- OpenSSL FIPS Object Module SE Version 2.0.16, Certificate Number #2398
- OpenSSL library 1.0.2d, Certificate Number #2398
- OpenSSL library 1.0.2h, Certificate Number #2398
- OpenSSL library 1.0.2k, Certificate Number #2398
- RSA BSAFE Crypto-C Micro Edition with ECDSA v. 4.1.0.0 Certificate Number #2300

It was also determined that most of the COTS software within the system utilizes FIPS validated software and FIPS 140-2 Validated algorithms; these include:

- Windows 7 Professional: #1319, 1326, 1327, 1328, 1329
- Windows 7 Enterprise: #1319, 1326, 1327, 1328, 1329
- Windows 2008 Server: #1319, 1326, 1327, 1328, 1329
- Cerberus Enterprise 11.0.10: #1747

- Adobe Acrobat Standard: #2056

During the examination and identification of all cryptographic software utilized by the system, it was determined there were three instances where CMVP validated cryptography was not utilized.

1) PostgreSQL: examiner was unable to determine if the MD5 hashing of database passwords referenced from ES&S documentation utilizes FIPS mode RSA/OpenSSL encryption calls.
2) ES&S Linux based on Yocto 2.0: cryptographic usage at the operating system level was not confirmed to be using FIPS validated cryptographic calls for operating system level cryptographic calls.
3) ES&S Linux 6.2 based on Linux from Scratch 6.2.5: cryptographic usage at the operating system level was not confirmed to be using FIPS validated cryptographic calls for operating system level cryptographic functions.
4) Caveat: Adobe Acrobat Standard is capable of utilizing FIPS encryption as noted above. However, FIPS mode is not being utilized for Adobe Acrobat Standard.

6.2 Security Review Findings

The following section contains findings from the security review conducted on the EVS 6.0.4.1 system components. These findings are also referenced in *Attachment B - Discrepancy Report*.

- JIRA ESS6041-2

  Requirement - 7.9.4 Equipment Security and Reliability

  j. Printing devices should contain sufficient supplies of paper and ink to avoid reloading or opening equipment covers or enclosures and thus potential circumvention of security features; or be able to reload paper and ink with minimal disruption to voting and without circumvention of security features such as seals.

  TDP Section – System Security Specification

  Documentation - ESSSYS_1'0_SPC_SecBestPract, Revision 2.0, Section 4.4, 4.5

  Description - Every device shall have the ability of reloading the thermal paper without circumventing the security features of the device, including security seals.

  Based on the documentation provided. The security seals are recommended to be placed in a specific manner which would impede the process of replacing the paper roll. These security seals would have to be removed or tampered with in order to access the compartment necessary to replace the thermal paper roll.

  Resolution - Per NYSBOE, this will be addressed procedurally using seal log and adding new seal. This resolution was provided by NYSBOE during a call with SLI on 8/7/2020.

  JIRA ESS6041-21

Requirement - 6209.2.F.10a (i): All cryptographic software in the voting system shall have been approved by the U.S. Government's Crypto Module Validation Program (CMVP) as applicable.

Description – The security review concluded that all cryptographic modules that are a part of the election software that is built via trusted build and is integrated into the voting system utilize CMVP validated modules. It was inconclusive whether or not CMVP validated cryptographic modules are utilized for the following three items:

- PostgreSQL - unable to determine if the MD5 Hashing of database passwords referenced from ES&S documentation utilizes FIPS mode RSA/OpenSSL encryption calls.
- ES&S Linux based on Yocto 2.0 - cryptographic usage at the operating system level was not confirmed to be using FIPS validated cryptographic calls for operating system level cryptographic calls.
- ES&S Linux 6.2 based on Linux from Scratch 6.2.5 - cryptographic usage at the operating system level was not confirmed to be using FIPS validated cryptographic calls for operating system level cryptographic functions.

Resolution - Per NYSBOE, this is addressed with compensating controls.

- JIRA ESS6041-22

  Requirement - 6209.2.H: Any submitted voting system shall provide methods through security seals or device locks to physically secure against attempts to interfere with correct system operations. Such physical security shall guard access to machine panels, doors, switches, slots, ports, peripheral devices, firmware, and software.

  Description - The keys for the vendor provided systems have the same key numbers and open the locks of any like type; thus, they are not unique. Any person who has access to the information gained from the engraved numbers on the lock/key could obtain a copy of the key.

  Resolution - Per NYSBOE, this should be addressed by field procedures guide or similar; closing as this is not a functional issue. This resolution was provided by NYSBOE during a call with SLI on 8/7/2020.

7 SOURCE CODE REVIEW

The following section contains a summary of the source code review performed and findings observed during the ES&S EVS 6.0.4.1 voting system test campaign. Please see *Attachment F – Source Code Review* for artifacts, test cases, and the test report containing additional details of the source code review effort of the EVS 6.0.4.1 voting system.

7.1 Source Code Review Summary

Throughout the Source Code Review effort, results were marked as follows:

- **Accept –** Criteria is accepted as successful.
- **Reject** – Criteria is rejected as unsuccessful.

Test results **Reject** include comments explaining the reason for the result.

Issues encountered during review were documented in the applicable Discrepancy Report. Issues that did not conform to the requirements of the VVSG 1.0 or NY 2019 Election Law requirements were marked as **Discrepancies** (a discrepancy occurs when the source code does not meet defined requirements or specifications).

7.2 Source Code Review Findings

SLI conducted a source code review against the EVS 6.0.4.1 voting system. The review consisted of a comparison of the EVS 6.0.4.0 source code that previously underwent a full source code review by SLI Compliance for Federal certification against ES&S delivered EVS 6.0.4.1 source code for this New York State Board Of Elections (NYSBOE) project. All changed code was reviewed against the VVSG 1.0 requirements. All source code delivered for the EVS 6.0.4.1 project was reviewed against the NYS election code.

The review consisted of four parts, two utilizing the automated source code review tool, Understand, and two utilizing manual reviews.

Understand was utilized with two different sets of review criteria. The first set reviewed the code base for source code related issues. The second set reviewed the code base from a security perspective. The automated analysis returned findings against the implemented criteria set that were then manually reviewed by a Source Code Reviewer.

Review of the findings resulted in determinations of no actual discrepancies found, i.e., no violations of the requirements set forth by the VVSG 1.0 and the NY 2019 Election Law requirements.

Manual reviews also utilized two different sets of review criteria. The first set reviewed the code base for source code related issues and the second set reviewed the code base from a security perspective. The manual review returned determinations of no actual discrepancies being found.

8 COMPLIANCE AND TRUSTED BUILD

SLI conducted both compliance and trusted builds as part of the EVS 6.0.4.1 project. The compliance and trusted builds verified that only the submitted and reviewed source code was applied and used to build the EVS 6.0.4.1 output files, or executables, that were used to install the software and firmware for the components tested.

Compliance builds were performed after the initial source code review process was completed. Additional compliance builds were conducted for all subsequent source code

review efforts due to additional source code submissions by ES&S for the EVS 6.0.4.1 project. The compliance builds were utilized in functional testing and security analysis. The compliance builds followed the exact same step-by-step vendor supplied build process and verification as the final trusted build with the exception of minor version changes per ES&S's configuration management process.

A final trusted build was conducted after it was determined by NYSBOE that no code modifications were necessary to resolve any remaining discrepancies. All builds were conducted on site at SLI's facility. SLI utilized its approved standard lab procedure that details the processes for controlling, managing, and conducting the trusted build. This process included the following:

- Preparation for the Builds – Obtaining and reviewing ES&S's procedure for constructing the build platform, verifying the target build platform, and acquiring and verifying the necessary materials.
- Execution of the Builds – SLI performing the compliance and trusted builds by using the step-by-step build procedure, as provided by ES&S to create a pristine build environment. SLI ascertains and records the following items throughout the build process:
    - Build environment images at various key points
    - Build environment hashes at various key points
    - Build environment hardware characteristics
    - Build results from code compilation and file hashes
    - Final software install files and file hashes
- Deliverables to Testing – Upon completion of the build, specific items were sent to the SLI test group. The final result was media containing the following:
    - Final software install files
    - Hash values to validate install files
- Final Record Keeping and Archiving Procedures – At the conclusion of the final trusted build process, SLI completed all final record keeping and archiving procedures at SLI's facility. This record keeping included any unique identifiers, results of the build with version numbers and dates and descriptions of all hashes and images in the repository.

9 CONCLUSION

SLI has successfully completed TDP documentation review, functional testing, security review, and source code review of the ES&S EVS 6.0.4.1 voting system. The testing and reviews were conducted against the identified VVSG 1.0 and NY 2019 Election Law requirements. All findings are included in this report and/or accompanying documentation referenced in this Final Test Report. Two findings are unresolved, JIRAs ESS6041-12 and ESS6041-18.

End of Final Test Report