Certification Test Report - Modification

Report Number: ESY-18004-CTR-01

Prepared for:

Vendor Name	*Election Systems and Software (ES&S)*
Vendor System	*EVS 6.0.4.0*
EAC Application No.	*ESSEVS6040*
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NVLAP TESTING
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Accredited by the Election Assistance Commission (EAC) for Selected Voting System Test Methods or Services

Revision History

Date	Version	Author	Revision Summary
March 18th, 2019	1.0	J. Panek	Initial Draft

Disclaimer

The Certification Test results 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. Results herein relate only to the items tested.

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, except as noted under Recommendations.

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1 INTRODUCTION

SLI Compliance is submitting this Certification Test Report as a summary of the modification and regression testing performed on the **ES&S EVS 6.0.4.0** system against the Voluntary Voting System Guidelines 1.0 (VVSG 1.0). **ES&S EVS 6.0.4.0** is a modification of the **ES&S EVS 6.0.2.0** voting system, certified by the EAC on October 4th, 2018. The system was tested based on the "modified system" requirements, as set forth in section 4.6.2.3 of the "EAC Voting System Testing and Certification Program Manual, version 2.0". The purpose of this document is to provide an overview of the testing and findings for the **ES&S EVS 6.0.4.0** voting system.

This effort included review of updates made to the Technical Data Package, source code changes, modification, and regression testing of the **ES&S EVS 6.0.4.0** voting system. The process consisted of the development of a test plan, managing system configurations, component and system level tests prepared by SLI, and analysis of results. The review and testing were performed at SLI's Wheat Ridge, Colorado facility.

1.1 Certification Test Report Attachments

The following attachments apply to this Certification Test Report:

- Attachment A – ES&S EVS6040 Attestation Letter
- Attachment B – ES&S EVS6040 Implementation Statement
- Attachment C – ES&S EVS6040 TDP Document List
- Attachment D – ES&S EVS6040 Trusted Build Record
- Attachment E – Accredited Hardware Test Lab Certifications
- Attachment F – ES&S EVS6040 Hardware Test Plans
- Attachment G – ES&S EVS6040 As Run Test Plan
- Attachment H – ES&S EVS6040 Discrepancy Report
- Attachment I – ES&S EVS6040 Hardware Test Reports
- Attachment J – ES&S EVS6040 Safety Report

1.2 References

The following key documents were used in preparing this test plan.

1. Election Assistance Commission Voluntary Voting System Guidelines (EAC VVSG), 2005 Version 1.0 Volumes I and II.
2. NIST Handbook 150: 2016.
3. NIST Handbook 150-22: 2017.
4. EAC Voting System Testing and Certification Program Manual, United States Election Assistance Commission, v 2.0, May 2015
5. SLI VSTL Quality System Manual, v 3.0, February 12, 2019.

1.3 Terms and Abbreviations

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

Table 5 – Terms and Abbreviations

Term	Abbreviation	Description
American Association for Laboratory Accreditation	A2LA	A nonprofit, non-governmental, public service, membership society whose mission is to provide comprehensive services in laboratory accreditation and laboratory-related training.
Cast Vote Record	CVR	Permanent record of all votes produced by a single voter whether in electronic, paper or other form. Also referred to as ballot image when used to refer to electronic ballots.
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.
Direct Recording Electronic	DRE	Voting systems that, using touch screen or other user interfaces, directly record the voter's selections in each race or contest on the ballot in electronic form.
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	Typically, a database management system used to enter jurisdiction information (district, precincts, languages, etc.) as well as election specific information (races, candidates, voter groups (parties), etc.). In addition, the EMS is also used to layout the ballots, download the election data to the voting devices, upload the results and produce the final results reports.
Electromagnetic Compatibility	EMC	The goal of EMC is to validate the correct functioning of different equipment in the same environment and the avoidance of any interference effects between them.
Functional Configuration Audit	FCA	The testing activities associated with the functional testing of the system.
Hybrid Device	No Abbreviation	A device that combines features of two or more functionalities that traditionally have been implemented separately. For example, ExpressVote HW2.1 can function as a vote capture device and as a precinct scanner, two functions that traditionally have not been implemented in the same hardware device.

Term	Abbreviation	Description
National Institute of Standards and Technology	NIST	A non-regulatory federal agency within the U.S. Dept. of Commerce. Its mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.
National Voluntary Laboratory Accreditation Program	NVLAP	A division of NIST that provides third-party accreditation to testing and calibration laboratories.
Physical Configuration Audit	PCA	Confirms that the documentation submitted meets the national certification requirements. Includes Trusted Build activities.
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.
Test Method	No Abbreviation	SLI proprietary documents which are designed to group sets of EAC VVSG requirements in a logical manner that can be utilized to efficiently validate where and how requirements, or portions of a requirement, are met.
Test Module	No Abbreviation	An actionable component of a Test Method, that functionally verifies that a requirement is met within a voting system. Test Modules are at a generic level within the Test Method, and are customized for a particular voting system, within a Test Suite.
Test Suite	No Abbreviation	An actionable grouping of test modules designed to test a set of functions of a voting system or component in a specific way.
Trusted Platform Module	TPM	A dedicated microcontroller designed to secure hardware through integrated cryptographic keys.
Universal Voting Console	UVC	The UVC features large, color-coded keys labeled with both visible text and Braille characters. The UVC keys enable the voter to adjust the audio volume and tempo, navigate the ballot, make contest selections, open the help screen, and use the blank privacy screen feature.
Voluntary Voting System Guidelines	VVSG	A set of specifications and requirements against which voting systems can be tested to determine if the systems provide all the basic functionality, accessibility and security capabilities required for EAC certification.
Voting System Test Lab	VSTL	An independent testing organization accredited by NVLAP and the EAC to conduct voting system testing for EAC certification.

1.4 System Identification

This section provides a description of the scope of **ES&S EVS 6.0.4.0** voting system and components.

The **ES&S EVS 6.0.4.0** voting system is composed of software applications, central count location devices and polling place devices with accompanying firmware, and COTS hardware and software.

1.4.1 Electionware®

Electionware election management software 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.

1.4.2 ExpressVote XL™

ExpressVote XL Full-Faced Universal Voting System (**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**.

1.4.3 ExpressTouch®

ExpressTouch Electronic Universal Voting System (**ExpressTouch**) is a DRE voting system which supports electronic vote capture for all individuals at the polling place.

1.4.4 ExpressVote® Hardware 1.0

ExpressVote Universal Voting System Hardware 1.0 (**ExpressVote HW1.0**) 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, to be scanned for tabulation in any one of the ES&S precinct or central scanners.

1.4.5 ExpressVote® Hardware 2.1

ExpressVote Universal Voting System Hardware 2.1 (**ExpressVote HW2.1**) 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 HW2.1** is capable of operating in either marker or tabulator mode, depending on the configurable mode that is selected in Electionware.

1.4.6 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).

1.4.11 Block Diagrams

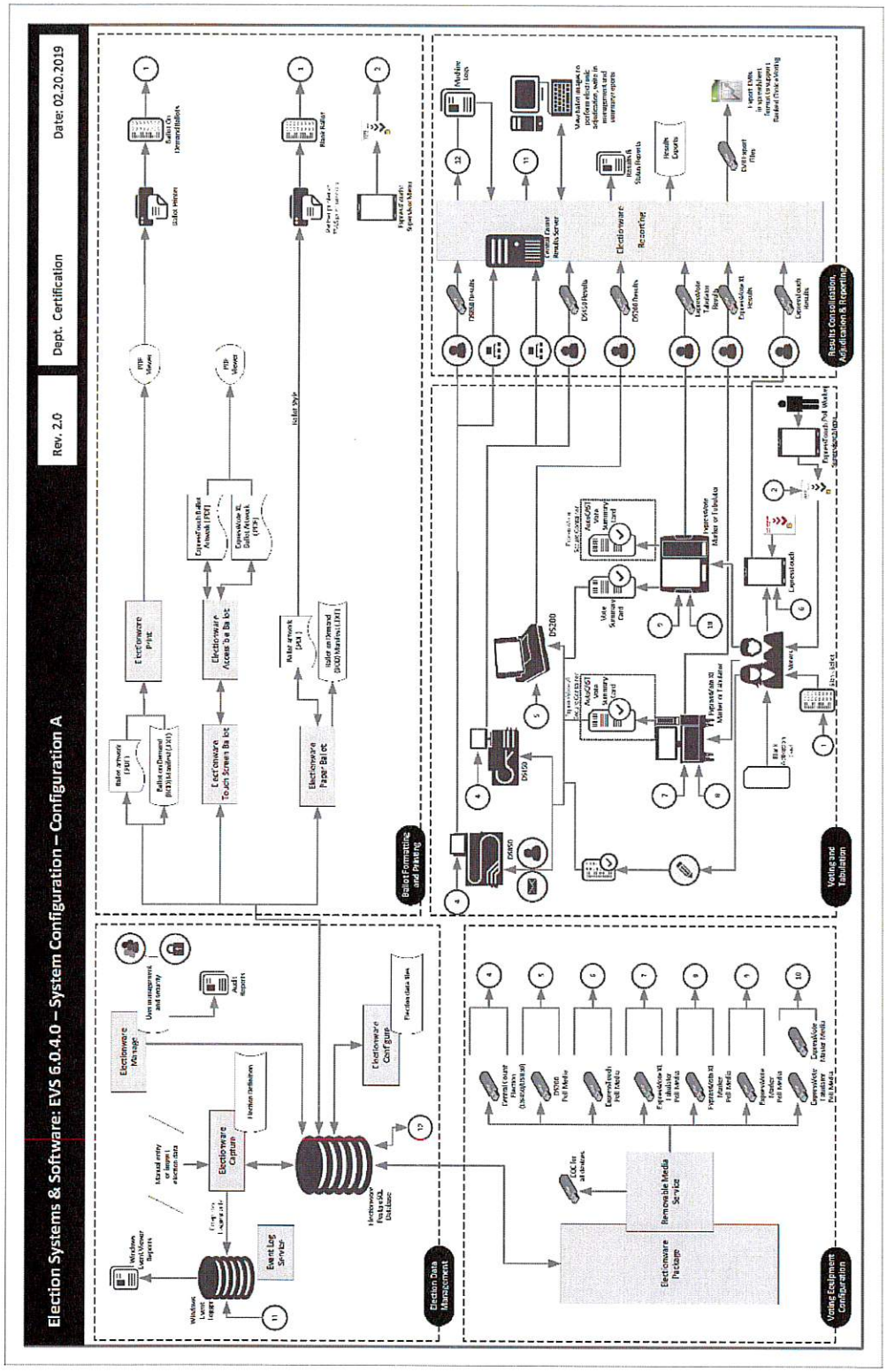

Figure 1: Voting System Overview – Configuration A

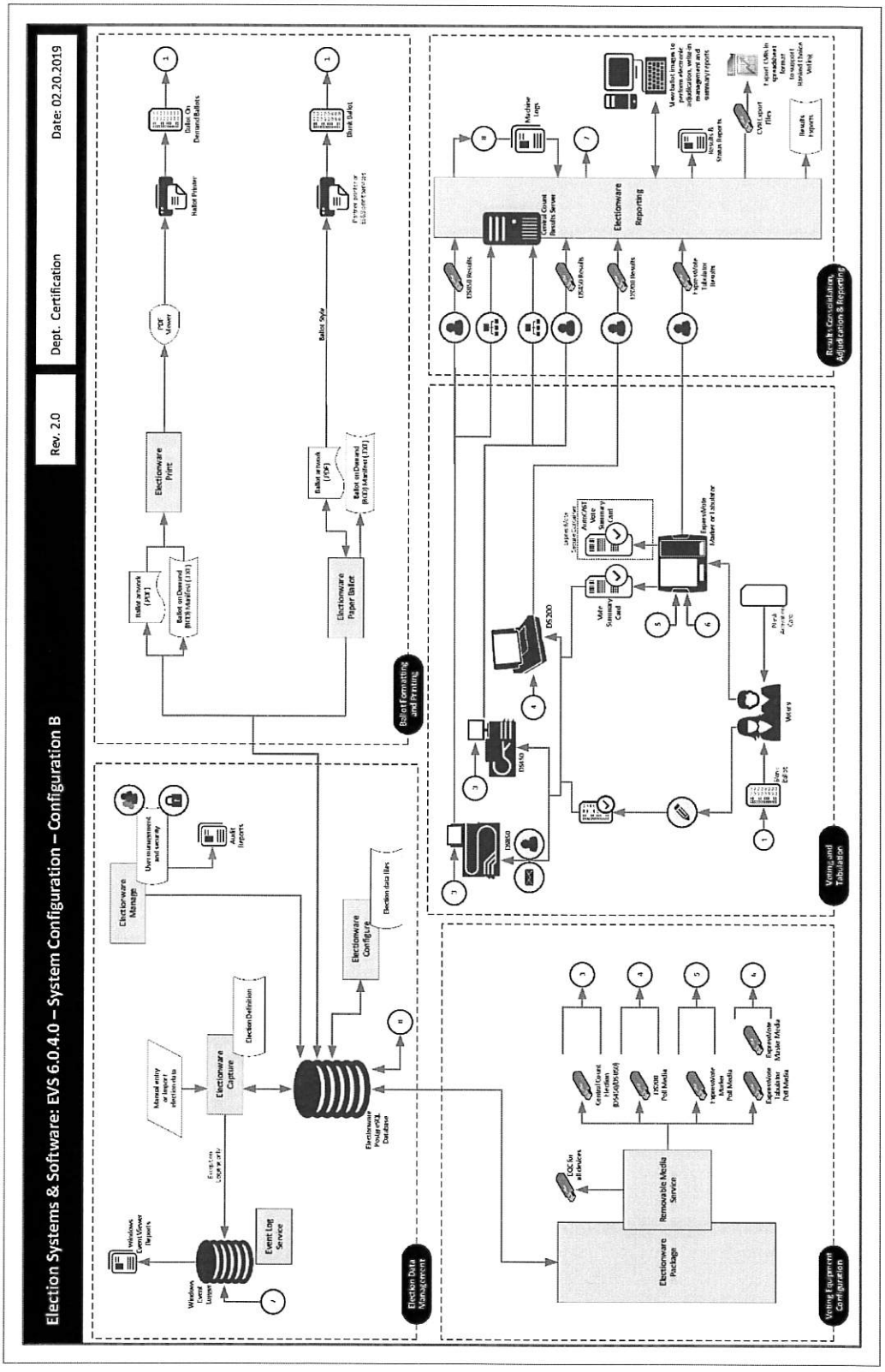

Figure 2: Voting System Overview – Configuration B

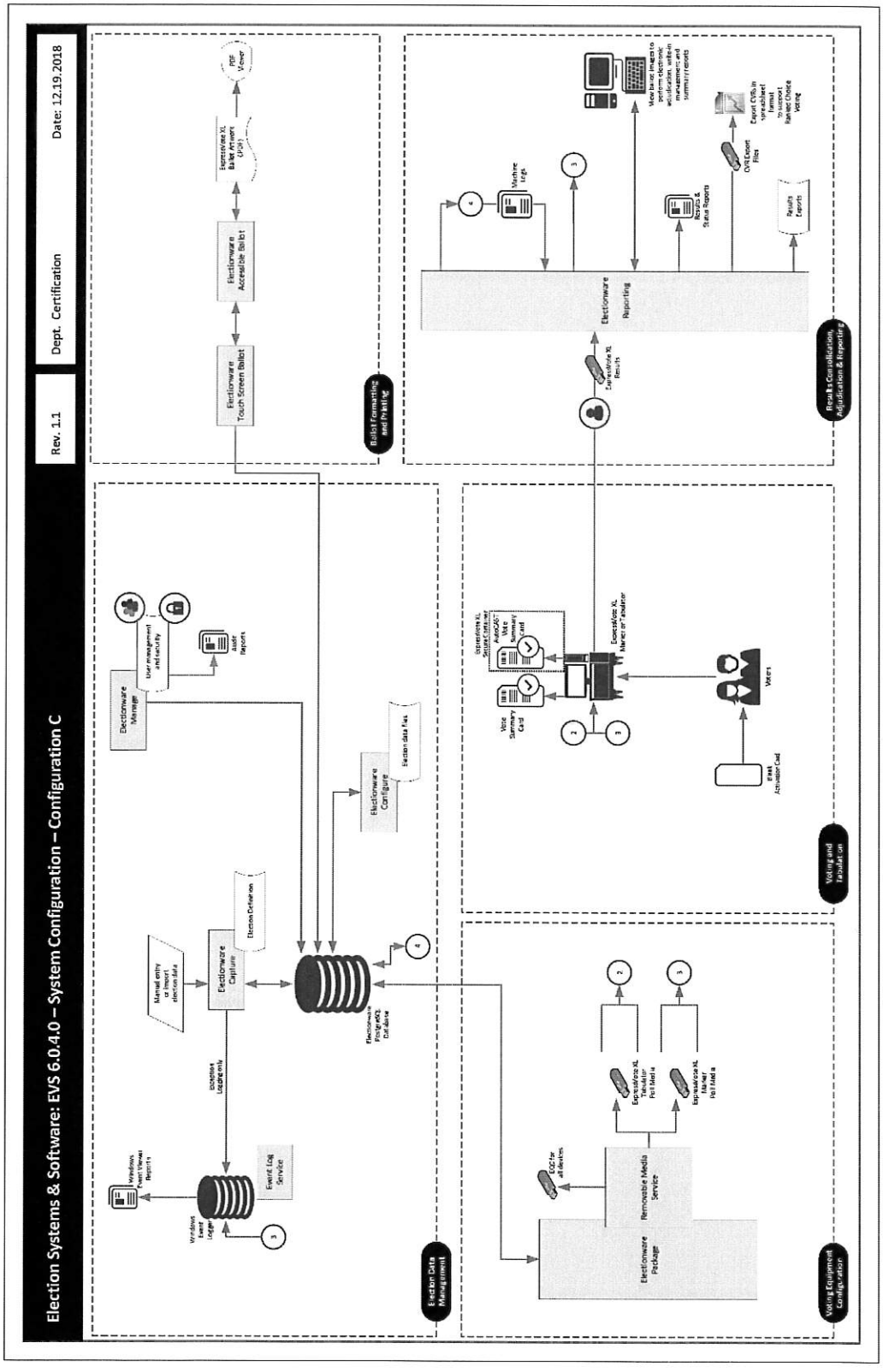

Figure 3: Voting System Overview – Configuration C

1.5 Software and Firmware

All software/firmware to be used by the declared voting system whether directly or indirectly, in a production environment, must be validated during the certification process.

The software and firmware employed by **ES&S EVS 6.0.4.0** consists of two types, custom and commercial off the shelf (COTS). COTS applications were verified to be pristine or were subjected to source code review for analysis of any modifications and verification of meeting the pertinent standards.

1.5.1 Manufacturer Software/Firmware

The **ES&S EVS 6.0.4.0** voting system consists of the following software and firmware components:

- **Electionware** Election database creation, media programming and tally/reporting software
- **DS450** Central Count scanner and tabulator, Central Tabulator firmware
- **DS850** Central Count scanner and tabulator, Central Tabulator firmware
- **DS200** Precinct scanner and tabulator, Precinct Tabulator firmware
- **ExpressVote HW1.0** Precinct ballot marker, Universal Voting System firmware
- **ExpressVote HW2.1** Precinct ballot marker and/or Precinct scanner and tabulator, Universal Voting System firmware
- **ExpressVote HW1.0 Previewer** ballot preview software
- **ExpressVote HW2.1 Previewer** ballot preview software
- **ExpressVote XL** Precinct ballot marker and/or Precinct scanner and tabulator, using a full-face touchscreen and Universal Voting System firmware
- **ExpressTouch** DRE, Electronic Universal Voting System firmware
- **Event Log Service (ELS)** software service monitoring user's interactions with the Election Management System
- **Removable Media Service (RMS)** software service supporting election media programming

Table 1 – ES&S EVS 6.0.4.0 Software/Firmware

Application	Version
Electionware – Client/Server	5.0.4.0
Event Log Service	1.6.0.0
Removable Media Service	1.5.1.0
ExpressVote HW1.0	1.5.2.0
ExpressVote HW1.0 Previewer	1.5.2.0
ExpressVote HW2.1	2.4.5.0
ExpressVote HW2.1 Previewer	2.4.5.0
DS200	2.17.4.0

Application	Version
DS200 Ancillary (used to build the DS200, but no resultant output)	6.0.0.0
DS850	3.1.1.0
DS450	3.1.1.0
ExpressVote XL	1.0.3.0
ExpressTouch	1.0.3.0

Note: The Previewer and DS200 Ancillary file(s) are built during the same build as the respective **ExpressVote** and **DS200** application.

1.5.2 COTS Software/Firmware

This section details the COTS software and firmware utilized within the **ES&S EVS 6.0.4.0** voting system.

Table 2 – COTS Software/Firmware

Manufacturer	Application	Version
Microsoft Corporation	Windows 7 Professional	SP-1 (64-bit)
Microsoft Corporation	Windows Server 2008	R2, SP-1 (64-bit)
Microsoft Corporation	Windows 7 Enterprise	SP-1 (64-bit)
Microsoft Corporation	WSUS Microsoft Windows Offline Update Utility	11.5
Symantec	Symantec Endpoint Protection	14.2.0_MP1 (64-bit)
Symantec	Symantec Endpoint Protection Intelligent Updater (File-Based Protection)	20190122-001-core15sdsv5i64.exe
Symantec	Symantec Endpoint Protection Intelligent Updater (Network-Based Protection)	20190121-062-IPS_IU_SEP_14RU1.exe
Symantec	Symantec Endpoint Protection Intelligent Updater (Behavior-Based Protection)	20190115-001-SONAR_IU_SEP.exe
Gigabyte	WindowsImageTool	B17.1116.01
Cerberus	Cerberus FTP Server - Enterprise	10.0.5 (64-bit)
Adobe	Adobe Acrobat Standard	XI
Microsoft Corporation	Visual C++ Redistributable	en_visual_cpp_2015_redistributable_x86_8487157.exe (32-bit)
RSA Security	RSA BSAFE Crypto-C ME for Windows 32-bit	4.1
OpenSSL	OpenSSL	2.0.12
OpenSSL	OpenSSL	2.0.16
OpenSSL	OpenSSL	1.02d
OpenSSL	OpenSSL	1.02h

Manufacturer	Application	Version
OpenSSL	OpenSSL	1.02k

1.6 Equipment

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

1.6.1 ES&S EVS 6.0.4.0 Equipment

The following manufacturer equipment was used in testing:

Table 3 – ES&S EVS 6.0.4.0 Equipment

Hardware	HW Revision	Model
ExpressVote Universal Voting System	1.0	N/A
ExpressVote Universal Voting System	2.1, 2.1.2.0	2.1.2.0 includes display versions 6.4 and 6.8
DS200 Precinct-based Scanner and Tabulator	1.2, 1.3,1.3.11	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
ExpressTouch Electronic Universal Voting System	1.0	N/A
ExpressVote Rolling Kiosk	1.0	98-00049
Quad Express Cart	N/A	41404
ExpressVote Voting Booth	N/A	98-00051
MXB ExpressVote Voting Booth	N/A	95000
ExpressVote Single Table	N/A	87033
ExpressVote Double Table	N/A	87032
ExpressVote ADA Table	N/A	87031
DS200 Collapsible Ballot Box	1.0, 1.1	98-00009
DS200 Plastic Ballot Box	1.2, 1.3, 1.4, 1.5	57521
DS200 Tote Bin	1.0	00074
DS450 Cart	N/A	3002
DS850 Cart	N/A	6823
Universal Voting Console	1.0	98-00077
Tabletop Easel	N/A	14040
ExpressTouch Voting Booth	N/A	98-00081

1.6.2 COTS Equipment

The following COTS equipment was used in testing:

Table 4 – COTS Equipment

Manufacturer	Hardware	Model	Operating System
Innodisk	USB EDC H 2SE (1GB)	DEUH1-01GI72AC1SB (for ExpressVote HW1.0)	N/A
Innodisk	USB EDC H 2SE (16GB)	DEUH1-16GI72AC1SB (for ExpressVote HW2.1)	N/A
Delkin Devices	USB Embedded 2.0 Module (16GB)	MY16TNK7A-RA042-D	N/A
Symbol	Scanner (External)	DS9208	N/A
Zebra Technologies	Scanner (Integrated)	DS457-SR20009 DS457-SR20004ZZWW	N/A
OKI	Audit Printer	Microline 420	N/A
Dell	Report Printer	S2810dn	N/A
OKI	Report Printer	B431DN B431D B432DN	N/A
Tripp Lite	Spike Cube	SPIKECUBE	N/A
APC	Backup power supply (Uninterruptible Power Supply)	Back-UPS Pro 1500 Smart-UPS 1500 Back-UPS RS 1500	N/A
Dell (EMS Standalone configuration)	• Processor: Dual Core • RAM: 4 GB, 8 GB recommended • Hard Disk: 150 GB • Keyboard • Mouse • Monitor: 1280x800 resolution • Monitor – ExpressVote XL (Monitor needed for programming election for ExpressVote XL)	Latitude 5580 Latitude E6430	Windows 7 Professional, SP-1 (64-bit) Windows 7 Enterprise, SP-1 (64-bit)

Manufacturer	Hardware	Model	Operating System
	1920x1080p resolution • CD/DVD reader: 16x min (internal or external) • 2 USB ports: 2.0 min • Report Printer: w/printer control language driver		
Dell (EMS Networked Server and Client configuration)	• Processor: Dual Core or Quad Core • RAM: 4 GB, 8 GB recommended • Hard Disk: 150 GB or 320 GB • Keyboard • Mouse • Monitor: 1280x800 resolution • Monitor – ExpressVote XL Program Your Own: 1920x1080p resolution • CD/DVD reader: 16x min (internal or external) • 2 USB ports: 2.0 min • Report Printer: Network printer w/printer control language driver • Ethernet Port • Backup power supply: 865 Watts / 1500 VA output capacity • Network Switch: 1 GB throughput	OptiPlex 5040 OptiPlex 5050 OptiPlex 7020 PowerEdge T420 PowerEdge T630	Windows Server 2008 R2, SP-1 (64-bit) Windows 7 Professional, SP-1 (64-bit) Windows 7 Enterprise, SP-1 (64-bit)
Delkin	USB Flash Drive: 512 MB, 1 GB, 2 GB,	N/A	N/A

Manufacturer	Hardware	Model	Operating System
	4 GB, 8 GB		
Delkin	USB Flash Drive: 16 GB (Validation only)	N/A	N/A
Delkin Devices	USB Flash Drive: 56 KB (BitLocker)	10004	N/A
AVID	Headphones	86002	N/A
Seiko Instruments	Thermal Printer	LTPD-347B	N/A
NCR / Nashua	Paper Roll	2320	N/A
Delkin	Compact Flash Memory Card: 1 GB max	CE0GTFHHK-FD038-D	N/A
Delkin	Compact Flash Memory Card Reader/Writer	6381	N/A
Delkin	CFAST Card, 2 GB, 4 GB	N/A	N/A
Lexar	CFAST Card Reader/Writer	LRWCR1TBNA	N/A
CardLogix	Smart Card, 16 KB	CLXSU128KC7 / AED C7	N/A
SCM Microsystems	Smart Card Writer	SCR3310	N/A
Fujitsu	Thermal Printer	FTP-62GDSL001 FTP-63GMCL153	N/A
TDS	Ink Cartridge	2278	N/A
HP Inkjet	Ink Cartridge	87002	N/A
Dell	Trusted Platform Module (TPM) chip, version 1.2	R9X21	N/A

1.7 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
- Smart cards
- Ballot pens
- Printer paper rolls

1.8 ES&S EVS 6.0.4.0 Documentation

The documents that are a part of the **ES&S EVS 6.0.4.0** voting system are detailed in "Attachment C – ES&S EVS6040 TDP Document List".

1.9 Modifications

The following modifications are part of the **ES&S EVS 6.0.4.0** voting system:

New Hardware Configurations

- The MXB ExpressVote Voting Booth accommodates seated voters on one side and standing voters on the other.
- The Quad Express Cart holds up to four ExpressVote units securely in place. Three of the units are positioned for standing voters while the fourth accommodates a seated voter.

Hardware Modifications

- **DS200** (Revision 1.3.11) updated the following components that were certified with previous versions of the system due to end-of-life:
  - Motherboard
  - Display
  - Touch screen controller and drivers
  - Scanner board motor driver
- **DS200 Collapsible Ballot Box.** (Revision 1.1) introduces better ballot box sidewalls and auxiliary slot for product improvement.
- **DS450** added new uninterruptible power supply (UPS) and report printer as alternatives to accommodate end-of-life component replacement.
- Added a new kiosk barcode scanner due to the old version going end-of-life for the **ExpressVote HW1.0** and **ExpressVote HW2.1**.

Software/Firmware Modifications

- Modification for Windows® 7 Enterprise and Windows® Server 2008 Bitlocker configuration. Bitlocker is a full-volume encryption feature included in select Microsoft operating systems.
- Provided support for the Windows® 7 Enterprise operating system to be used for the **EMS**. This operating system includes BitLocker, which is Microsoft's proprietary disk encryption utility. This operating system also includes the optional dual-factor authentication ability, which is a security enhancement that allows you to present two pieces of evidence when logging in to an account. This modification impacts **Electionware**.
- Introduced Marker mode with front eject only for the **ExpressVote XL**. This modification also affects **Electionware**.
- Removed configuration options that allow a voter to cast a vote without the option of first reviewing the printed card. The voter must be able to choose to Review Card or Cast Vote, rather than only providing the option for Cast Vote. This modification is

applicable to **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, and **ExpressVote XL**.

- Updated voter-facing screens to increase focus on the Review Card option before the Cast Vote option. This modification is applicable to **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, and **ExpressVote XL**.
- Added an **Electionware** configuration setting to show or hide the Write-Ins icon, which is used to access the onscreen write-in review feature, on the **DS200** Polls Closed screen.
- Updated the copyright date in the startup splash screen. This modification is applicable to the **DS200**, **DS450**, and the **DS850**.
- Provided support for multi-language audio playback of the write-in keyboard on the **ExpressVote HW1.0**, and **ExpressVote HW2.1**.
- Modified the user interface to properly handle manual candidate selection(s) in a contest after the selections made by the straight party selection are automatically deselected in that contest. This modification applies to the **ExpressVote HW1.0, ExpressVote HW2.1**, and **ExpressVote XL**.
- Modified the **ExpressVote HW1.0** and **ExpressVote HW2.1** firmware/software to accommodate a new version of the kiosk barcode scanner due to the old version going end-of-life.
- Enhanced support for kiosk barcode scanner in "low light" mode for the **ExpressVote HW1.0** and **ExpressVote HW2.1**.
- Modified the **DS200** firmware to accommodate end-of-life component replacement.
- Modified the **DS450** firmware to support an alternative UPS and report printer.
- Modified the **DS850** firmware to support an alternative UPS and report printer. The alternative UPS and report printer are not included in the hardware configuration of the **DS850** for this system and is intended to be used in a future release.
- Removed support in **Electionware** for Adjudication Status Controls for vote summary cards generated from the **ExpressVote HW1.0**, **ExpressVote HW2.1**, and **ExpressVote XL**.
- Enhanced the Reporting Admin Settings in **Electionware** for the Precinct Summary Report to suppress results on a contest-by-contest basis rather than by ballots cast in the precinct.
- Added the ability in **Electionware** to recognize and load media burned from an election restored on any instance of **Electionware** when loading results.
- Updated Users.xml to ensure the most up-to-date version is utilized in **Electionware**.
- Incremented the **ExpressTouch** firmware version to remain synchronized with common code changes in the **ExpressVote XL**.
- Removed **DS200** Status from **ExpressVote HW1.0** System Readiness Report since "tethered mode" will not be supported.
- Removed Ballot Online (BOL) scanner setup functionality from the Maintenance Menu for the **ExpressVote HW1.0**.
- Modified the user interface for the **ExpressVote XL** to properly handle write-in entry for a multiple Vote-For contest.
- Corrected straight party audio inconsistency for the **ExpressVote XL** when changing selection(s).

- Resolved a scenario where the cast button was displayed after the vote session timed out for the **ExpressVote XL**.
- Enhanced the **ExpressVote XL** user interface to display a warning corresponding to the media door being opened.
- Added the ability to automatically print a test deck from tabulation mode for the **ExpressVote XL**. Test deck cards include the word "Test" when printed.
- Added a configuration setting to the **ExpressVote XL** to control on screen selection presentation. Options include show the borders around the selection checkmark, show only the selection checkmark or show nothing.
- Improved latest version of **RMS** to ensure media packaging remains consistent.

2 Certification Test Background

This section provides a brief overview of the EAC Certification Program and the activities involved for a voting system to be considered for certification against the EAC VVSG and the EAC program manual.

2.1 System Revision History

ES&S EVS 6.0.4.0 is a modification of the **ES&S EVS 6.0.2.0** voting system, certified by the EAC on October 4th, 2018. Specific engineering changes are listed in section 1.8 of this report.

2.2 Implementation Statement

The **ES&S EVS 6.0.4.0** voting system incorporates all software and hardware, as well as supporting documentation, as declared in the **ES&S**'s implementation statement, as provided to the EAC. Please refer to "Attachment B – ES&S EVS6040 Implementation Statement".

2.3 PCA - Document and Source Code Reviews

The Physical Configuration Audit (PCA) review of the **ES&S EVS 6.0.4.0** voting system documentation, submitted in the requisite Technical Data Package (TDP), was performed in order to verify conformance with the Election Assistance Commission Voluntary Voting System Guidelines 1.0 (EAC VVSG 1.0). Source code was reviewed for each software and firmware application modified from **ES&S EVS 6.0.2.0** for the **ES&S EVS 6.0.4.0** voting system. Source code was not reviewed for firmware or software applications that were not modified for **ES&S EVS 6.0.4.0.**

All PCA reviews were conducted in accordance with *Volume 2 Section 2* of the EAC VVSG 1.0, to demonstrate that the system meets the requirements. Results of the PCA documentation review can be found in section 3.2 of this Certification Test Report. Inconsistencies or errors in documentation were identified to **ES&S** for resolution or comment.

All PCA source code reviews were conducted in accordance with *Volume 1 Section 5.2 and Volume 2 Section 5* of the EAC VVSG 1.0, to demonstrate that the system meets the requirements. Results of the PCA source code reviews can be found in section 3.1 of this Certification Test Report.

2.4 FCA - Functional & System Testing

The Functional Configuration Audit (FCA) review of the test documentation submitted by **ES&S** in the TDP was executed to verify testing of the voting system requirements defined in *Volume 1 Sections 2, 6, 7,* and *9* of the EAC VVSG 1.0. Changes made to the TDP from **ES&S EVS 6.0.2.0** to the TDP submitted with **ES&S EVS 6.0.4.0** were reviewed in detail. In addition, the **ES&S** System Development program was reviewed to ensure processes and procedures are properly documented and in agreement with observations by the VSTL through the duration of this test campaign.

SLI's standard Test Suites were customized for the **ES&S EVS 6.0.4.0** voting system and conducted in accordance with *Volume 2 Section 6,* in conjunction with the source code review, TDP review, integration, accuracy, security, modification, and regression tests. Simulations of elections were conducted to demonstrate a beginning-to-end business use case process for the **ES&S EVS 6.0.4.0** voting system.

2.4.1 Test Methods

All test methods employed are within the scope of SLI's VSTL accreditation. The following validated test methods were employed during this test campaign:

Table 6 – Test Methods

SLI VSTL Test Method Name
TM_Accuracy v1.1
TM_Basic_Election_Components v1.0
TM_Tally_and_Reporting v1.0
TM_Ballot_Counter v1.1
TM_Accumulating_and_Transmitting_Results v1.1
TM_Pre-Voting_Capabilities v1.2
TM_Voting_Capabilities v1.3
TM_Closing_the_Polls v 1.1
TM_Security_Access_Control v1.1
TM_Security_Software_Security v1.1
TM_Security_Physical_Security_Measures v1.1
TM_Voting_Vote_for_N_of_M v1.1
TM_Voting_Straight_Party v1.2

The above listed test methods are implemented in a complementary fashion: modules are employed from various methods to form suites. Suites include a logical sequence of functionality that is used to validate the requirement addressed by each module within the

suite. Please see the Terms and Abbreviations table for additional information about Test Modules and Test Suites.

2.4.2 3rd Party Hardware Testing

Hardware testing was conducted by 3rd Party certified hardware test laboratories to verify the voting system devices that have been modified in the **ES&S EVS 6.0.4.0** voting system are in compliance with the EAC VVSG 1.0 hardware requirements.

SLI Compliance is responsible for all core voting system tests as identified in the NIST NVLAP Handbook 150-22 (2017). Regarding non-core hardware testing for this certification test campaign, this report contains data that were produced under subcontract by the following lab(s):

Table 3 – Labs Performing Hardware Testing

Laboratory	Address	Test(s)	Date(s)
NTS – EMI / EMC	1736 Vista View Drive Longmont, CO 80504	**EMC / EMI Tests:** Radiated Emissions, Conducted Emissions, ESD, Electromagnetic Susceptibility, Electrical Fast Transient, Lightning Surge, Conducted RF Immunity, Magnetic Fields Immunity, Electrical Power Disturbance	10/17/2018 – 10/23/2018 11/27/2018 1/7/19 – 1/14/19
NTS – Environmental / Dynamic	1601 Dry Creek Drive Suite 200 Longmont, CO 80503	**MIL-STD-810D Tests:** Bench Handling, Vibration, Low Temperature, High Temperature, Humidity, Temperature/Power Variation	10/16/2018 – 10/31/2018 12/11/18 – 12/14/18 1/8/19 – 1/11/19

3 Certification Test Results Summary

3.1 Source Code Review Summary

SLI has reviewed the modified software source code for each application in the **ES&S EVS 6.0.4.0** voting system to determine the code's compliance with the EAC VVSG 1.0, *Volume 1 Sections 5, 9* and *Volume 2 Section 5.4* and for compliance with **ES&S**'s internally developed coding standards. **ES&S EVS 6.0.4.0** is implemented with the C, C++, C#, Java, VB and VB.net languages.

Evaluation of Source Code

No discrepancies were observed during the review of delivered source code. All code has successfully passed all reviews.

3.2 Technical Data Package Review Summary

SLI reviewed the **ES&S EVS 6.0.4.0** TDP for compliance with the EAC VVSG 1.0 according to *Volume 2 Section 2*. The documents that are a part of the **ES&S EVS 6.0.4.0** voting system are detailed in "Attachment C – ES&S EVS6040 TDP Document List".

Evaluation of TDP

Twenty four documentation issues were written during the PCA and FCA documentation review phases. The issues were related to either incorrect or missing information. Details can be found in "Attachment H – ES&S EVS6040 Discrepancy Report".

In all instances, the issues were addressed and resolved with updated documentation prior to the writing of this report. Once all identified discrepancies were resolved, the Technical Data Package for the **ES&S EVS 6.0.4.0** voting system was found to comply with all applicable standards.

3.3 Hardware Testing Summary

SLI and their third-party certified hardware test laboratory, National Technical Systems (NTS), performed an analysis and review of the modified **ES&S EVS 6.0.4.0** voting system hardware components. During execution of testing performed at NTS, an SLI representative was present to oversee the testing.

The test methodologies for all tests are identified in the hardware test plans and hardware test reports, as listed in section 1.1 "Certification Test Report Attachments".

SLI also conducted a review on the **ES&S EVS 6.0.4.0** Safety Report, no issues were found, all components were found to be compliant according to EAC VVSG 1.0 *Volume 1 Section 4.3.8.*

Hardware testing conducted specifically for this test campaign involved the **DS200** and **DS450**. The testing consisted of:

- Electromagnetic Emissions / Immunity Tests:
    - Radiated Emissions – FCC, Part 15 Class B ANSI C63.4.
    - Conducted Emissions – FCC, Part 15 Class B ANSI C63.4.
    - ESD – IEC 61000-4-2 (2008) Ed. 2.0.
    - Electromagnetic Susceptibility – IEC 61000-4-3 (1996).
    - Electrical Fast Transient – IEC 61000-4-4 (2004-07) Ed. 2.0.
    - Lightning Surge – IEC 61000-4-5 (1995-02).
    - Conducted RF Immunity – IEC 61000-4-6 (1996-04).
    - Magnetic Fields Immunity – IEC 61000-4-8 (1993-06).
    - Electrical Power Disturbance – IEC 61000-4-11 (1996-06).
- Non-Operating Environmental Tests:
    - Bench Handling - MIL-STD-810D, Method 516.3, Procedure VI
    - Vibration - MIL-STD-810D, Method 514.3, Category 1- Basic Transportation, Common Carrier.

- Low Temperature - MIL-STD-810D, Methods 502.2, Procedure I-Storage.
- High Temperature - MIL-STD-810D, Methods 501.2, Procedure I-Storage.
- Humidity (85%) Soak - MIL-STD-810D, Method 507.2, Procedure I-Natural Hot-Humid.

- Operating Environmental Tests:
  - Temperature/Power Variation - similar to the low temperature and high temperature tests of MIL-STD-810-D, Method 502.2 and Method 501.2.
  - Reliability – Vol. 1, Section 4 for the acceptable Mean Time Between Failure (MBTF).

Evaluation of Hardware Testing

As this test campaign was a modification of an EAC certified voting system, only modified hardware components of the **ES&S EVS 6.0.4.0** voting system were evaluated against applicable hardware requirements.

Seven hardware discrepancies were written during this test campaign for issues encountered during hardware testing. Details can be found in "Attachment H – ES&S EVS6040 Discrepancy Report". **ES&S** appropriately resolved each issue and subsequently passed all hardware tests.

3.4 Functional Testing Summary

SLI performed tests designed to functionally verify the modifications listed in section 1.8 of this report. The testing incorporated end-to-end election scenarios testing the functionality supported by **ES&S**. The following sections detail the test suites that were executed.

3.4.1 Accuracy Test Suite

Accuracy testing was performed to verify the ability of the system to capture, record, store, consolidate and report the specific selections and absence of selections, made by the voter for each ballot position, without error. Additionally, the system was exercised to validate that the accumulation, tallying and reporting mechanisms at the system level accurately perform their functions.

Accuracy testing was conducted at both the device level and the system level. The **ExpressVote HW1.0, ExpressVote HW2.1,** and **ExpressVote XL** were utilized to mark and print vote summary cards, which were then scanned into the **DS200, DS450,** and **DS850** devices. Vote counts were tabulated from **DS450, DS850, ExpressVote HW2.1, ExpressTouch, ExpressVote XL,** and **DS200**. Results were processed through **Electionware** and examined for completeness and correctness.

3.4.2 Integration Test Suite

An Integration Test Suite designed to verify proper integration of system components was conducted using General and Open Primary elections. These elections were utilized multiple times to ensure each EMS operating system, standalone, and server-client configuration was covered.

- The General election definition focused on N of M voting, Partisan offices, Non-Partisan Offices, precincts and districts, write-ins, tally, results loading, and reporting functionality.
- The Open Primary election definition utilized three partisan parties.

Integration testing was conducted at both the device level and the system level. The **ExpressVote HW1.0**, **ExpressVote HW2.1,** and **ExpressVote XL** were utilized to mark and print vote summary cards, which were then scanned into the **DS200, DS450,** and **DS850** devices. Vote counts were tabulated from **DS450, DS850, ExpressVote HW2.1, ExpressTouch, ExpressVote XL,** and **DS200**. Results were processed through **Electionware** and examined for completeness and correctness.

3.4.3 Modification Test Suite

Modification test cases were executed to focus on the specific changes incorporated into the system at the device level, and in conjunction with the **EMS** as applicable. Various elections were used to exercise the **EMS** and devices such that each specific modification was functionally verified, with an appropriate quantity of regression testing performed as determined by analysis of the modifications.

3.4.4 Pennsylvania Straight Party Method Test Suite

A General Election designed to test all variations of the Pennsylvania Straight Party Method was performed to ensure all modifications and performance related enhancements are working correctly as documented, and in accordance with the VVSG 1.0 requirements.

3.4.5 Security Test Suite

A Security Test Suite was designed and executed to examine all the various security related modifications to the system configuration. Included in the assessment was a comprehensive examination of the in-place physical security mitigation measures of the new **DS200** collapsible ballot box. The physical examination comprised of verification of security seal placement and the ability to quickly detect tampering. Attempts to easily bypass ballot box design to introduce untallied ballots or access internal contents of the ballot box were included in the physical examination.

The Security examination also included review of a new version of the endpoint protection software. Utilizing industry defined Anti-virus and Malware test definitions, alongside vulnerability assessment to determine if the machines were susceptible to malicious software and network attacks.

A review of a new EMS configuration Windows® 7 Enterprise operating system, including BitLocker drive encryption, was performed. This configuration was examined to determine if BitLocker drive encryption was successfully implemented utilizing a TPM 1.2 chip and required security keys. In addition, testing confirmed that the BitLocker drive encryption was properly configured and that all storage drives were successfully encrypted utilizing AES-256-bit encryption.

Evaluation of Functional Testing

In this test campaign, **ES&S EVS 6.0.4.0** was subjected to examination for changes, updates, and modifications made from the previously certified system, **ES&S EVS 6.0.2.0**, against applicable requirements within the EAC VVSG 1.0.

Through the duration of testing, six functional issues were written. Details can be found in "Attachment H – ES&S EVS6040 Discrepancy Report". Issues found were reported, resolved, and re-tested as applicable. Once all discrepancies have been addressed, no violation of conformance to EAC VVSG 1.0 requirements was observed. All components of the **ES&S EVS 6.0.4.0** voting system have successfully passed all tests.

4 Recommendations

SLI has successfully completed the testing of the **ES&S EVS 6.0.4.0** voting system. It has been determined that the **ES&S EVS 6.0.4.0** voting system meets the required acceptance criteria of the Election Assistance Commission Voluntary Voting System Guidelines, version 1.0.

This recommendation reflects the opinion of SLI Compliance based on testing scope and results. It is SLI's recommendation based on this testing effort that the EAC grant certification of the **ES&S EVS 6.0.4.0** voting system.

5 APPROVAL SIGNATURES

SLI:

Traci Mapps
VSTL Director
April 10th, 2019

6 Appendix A – Ancillary Products

Ancillary systems represent products and utilities that are not part of the EAC certified configuration, however, they may be used to facilitate testing.

Ancillary systems include:

- Ballot Production
    - **Balotar** is a product that receives ballot artwork PDFs and ballot on demand files from **Electionware**. **Balotar** is specifically designed to automatically generate and print ad hoc ballots.
- Ranked Choice Voting
    - **ExpressRunoff** is a software utility for automating ranked choice voting for single-seat contests. Ranked Choice Voting (RCV) is an electoral system used to elect a single winner from a field of more than two candidates, where voters rank the candidates in order of preference. After results have been loaded into **Electionware**, **ExpressRunoff** uses the Cast Vote Record (CVR) data exported from **Electionware** to create RCV rounds, and produces customizable reports showing the outcome of each round.
- Electronic Pollbook
    - **ExpressPoll** electronic pollbook stores registered voter information for precincts, districts, or entire jurisdictions. The voter registration data can be shared with the **ExpressLink** application to print a voter's activation card for use in an **ExpressVote** or **ExpressVote XL**.
- **ExpressLink** System
    - **ExpressLink** is a Windows PC application that can run in either a standalone mode, or in a monitor mode, where the application monitors requests from a voter registration (VR) system over a shared network folder. The application imports an election definition from **Electionware**, accepts requests to print a voter's activation card for use in an **ExpressVote** or **ExpressVote XL**, determines the voter's ballot style and then prints the activation card on the **ExpressVote Activation Card Printer**. Separately, this application is used to program vote session activator cards for use with **ExpressTouch**.
    - **ExpressVote Activation Card Printer**, a thermal, on demand printer, is used to print the ballot activation code on the activation card for use with **ExpressVote** or **ExpressVote XL**.
    - **ExpressTouch Smart Card Writer** is a device used to program the ballot activation code on the **ExpressTouch** vote session activator card.
- **Electionware Toolbox** is a set of utilities that can be integrated into the **Electionware** EMS to enhance the software usability experience and streamline various processes. These add-on utilities include **Test Deck**, **Text to Speech** and **Media Restore**.

- **Test Deck** provides a means for the election official to test the election on each machine that will be used for voting. Vote patterns can be created with automatic ballot marking, and then the ballots can be printed and scanned through the **ES&S** ballot tabulators to test logic and accuracy of the counting. Additionally, a test pattern file can be created for the **ExpressTouch**, **ExpressVote** or **ExpressVote XL** that allows automated logic and accuracy testing on the universal voting machine.
- **Text to Speech** provides a simplified method for creating the audio wave files that make up the audible ballot.
- **Media Restore** is used to prepare ES&S-certified USB media flash drives for use with **Electionware** by securely clearing all data and then restoring to the FAT32 format.

End of Certification Test Report