Certification Test Report - Modification

Report Number: **ESY-009-CTR-01**

ES&S

EVS 5.2.3.0

Test Report Rev 3.0

January 22nd, 2018

Prepared for:

Vendor Name	ES&S
Vendor System	EVS 5.2.3.0
EAC Application No.	EVS5230
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NVLAP TESTING
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Accredited by the National Institute of Standards and Technology (NIST) National Voluntary Lab Accreditation Program (NVLAP), and accredited by the Election Assistance Commission (EAC) for VSTL status.

Revision History

Date	Release	Author	Revision Summary
12/05/2017	1.0	J. Panek	Initial Release
01/04/2018	2.0	J. Panek	Updates per EAC comments
01/17/2018	3.0	J. Panek	Updates per EAC comments

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.

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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, except as noted under Recommendations.

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1 Introduction, System Identification and Overview

SLI Compliance is submitting this report as a summary of the certification testing efforts for the **ES&S EVS 5.2.3.0** voting system, modified from **ES&S EVS 5.2.2.0** as detailed in the section **System Identification**. The purpose of this document is to provide an overview of the certification testing effort and the findings of the testing effort for **ES&S EVS 5.2.3.0** voting system.

This effort included documentation review of the Technical Data Package, source code review, and testing of the **ES&S EVS 5.2.3.0** voting system. Testing consisted of the development of a test plan, managing system configurations, executing test suites of functional and system levels tests based on the system's functionality, and analysis of results. The review and testing was performed at SLI's Wheat Ridge, Colorado facility.

1.1 References

1. Election Assistance Commission Voluntary Voting System Guidelines (EAC VVSG 2005), Version 1.0, 2005.
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, Revision 2.4, prepared by SLI, dated October 20th 2017.

1.2 Document Overview

This document contains the following sections:

- The Introduction discusses the application tested/reviewed
- The Certification Test Background discusses the testing process
- The Test Findings and Recommendation section contains the results and analysis of the testing effort
- Attachments:
    - Attachment A - EVS 5.2.3.0 Implementation Statement
    - Attachment B - ESS EVS5230 EAC Certification Test Plan v2.0
    - Attachment C - ESS EVS 5230 TDP Docs 2017
    - Attachment D - Record of EVS5230 ExpressVoteUVS-v1 Trusted Build
    - Attachment E - List of Source Code Reviewed and Results

- Attachment F - Discrepancy Report EVS 5.2.3.0_v2.0
- Attachment G1 - PCA Doc - Configuration Management Plan Rev02
- Attachment G2 - PCA Doc - System Change Notes Rev02

1.3 System Identification

The **ES&S EVS 5.2.3.0** was submitted for certification testing with the documentation, hardware and software listed below. No other **ES&S** product was included in this test effort.

1.3.1 Documentation

The TDP User/Owner manuals that would be part of the certified system delivered to a purchaser of the system are as follows:

System Maintenance Procedures:

- EVS5230_DOC_SMM_AMVAT.pdf, v1.0
- EVS5230_DOC_SMM_DS200.pdf, v1.0
- EVS5230_DOC_SMM_DS450.pdf, v1.0
- EVS5230_DOC_SMM_DS850.pdf, v1.0
- EVS5230_DOC_SMM_ExpressVote.pdf, v1.0

System Operation Procedures:

- EVS5230_DOC_SOP_AMVAT.pdf, v1.0
- EVS5230_DOC_SOP_DS200.pdf, v1.1
- EVS5230_DOC_SOP_DS200_APPX.pdf, v1.0
- EVS5230_DOC_SOP_DS450.pdf, v1.1
- EVS5230_DOC_SOP_DS450_APPX.pdf, v1.0
- EVS5230_DOC_SOP_DS850.pdf, v1.1
- EVS5230_DOC_SOP_DS850_APPX.pdf, v1.0
- EVS5230_DOC_SOP_ELS.pdf, v1.0
- EVS5230_DOC_SOP_ERM.pdf, v1.0
- EVS5230_DOC_SOP_ERM_APPX.pdf, v1.0
- EVS5230_DOC_SOP_EW01Admin.pdf, v1.0

- EVS5230_DOC_SOP_EW02Define.pdf, v1.0
- EVS5230_DOC_SOP_EW03Design.pdf, v1.0
- EVS5230_DOC_SOP_EW04Deliver.pdf, v1.0
- EVS5230_DOC_SOP_EW05Results.pdf, v1.0
- EVS5230_DOC_SOP_EW06Appendix.pdf, v1.0
- EVS5230_DOC_SOP_ExpressVote.pdf, v1.0
- EVS5230_DOC_SOP_ExpressVote_APPX.pdf, v1.0

System Overview:

- EVS5230_C_D_0100_SysOvr.pdf, v1.2

1.3.2 Software and Firmware

The software and firmware employed by **ES&S EVS 5.2.3.0** 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.

The tables below detail each application employed by the **ES&S EVS 5.2.3.0** voting system.

Table 1 – ES&S EVS 5.2.3.0 Software and Firmware

Application	Version
Electionware	4.7.1.1
Removable Media Service	1.4.5.0
ExpressVote Previewer	1.4.1.6
VAT Previewer	1.8.6.1
Event Log Service	1.5.5.0
Election Reporting Manager (ERM)	8.12.1.1
ExpressVote 1.0	1.4.1.6
DS200	2.12.2.0
DS450	3.0.0.0
DS850	2.10.2.0
AutoMARK	1.8.6.1

Table 2 – COTS Software and Firmware

Manufacturer	Application(s)	Version
Microsoft Corporation	Window 7 Professional	SP-1 (64-bit)
Microsoft Corporation	Windows Server 2008	R2, SP-1 (64-bit)
Microsoft Corporation	WSUS Microsoft Windows Offline Update Utility	10.7.4
Symantec	Symantec Endpoint Protection	12.1.6
Symantec	Symantec Endpoint Protection Intelligent Updater	20160829-002-v5i64.exe
Adobe	Adobe Acrobat Standard	v. 11
Cerberus	Cerberus FTP Server - Enterprise	8.0.6(64-bit)
RMCOBOL	Microfocus	v. 12.06

1.3.3 Equipment (Hardware)

The hardware employed by **ES&S EVS 5.2.3.0** consists of two types, custom and commercial off the shelf (COTS). COTS hardware was verified to be pristine, or was subjected to review for analysis of any modifications and verification of meeting the pertinent standards.

The tables below detail each device employed by the **ES&S EVS 5.2.3.0** voting system.

Table 3 – ES&S EVS 5.2.3.0 Equipment

Hardware	Model
ExpressVote Universal Voting System	1.0
DS200	1.2, 1.2.3, 1.3
DS450	1.0
DS850	1.0
AutoMARK	1.3
ExpressVote Rolling Kiosk	98-00049
ExpressVote Voting Booth	87001
ADA Table	87031
DS200 Plastic Ballot Box	57521
DS200 Metal Ballot Box	N/A
DS200 Tote Bin	00074

Hardware	Model
DS450 Cart	3002
DS850 Cart	6823

Table 4 – COTS Equipment

Manufacturer	Hardware	Model	Operating System
INNO Disk	USB (1GB)	DEUF-01GI21C1/DEUH1-01GI72AC1SB-B190	N/A
MEGA -POWER WIN	Power Supply	MDS160T-P240-0618	N/A
POWER-WIN	Power Supply	PW-080A2-1Y24AP	N/A
WALL INDUSTRIES	Power Supply	DTA8021Y24ESS	N/A
Seiko	Thermal Printer	LTP9447A-S832-E	N/A
Symbol Technologies	Scanner (External)	DS9208	N/A
Zebra Technologies	Scanner (Integrated)	DS457-SR20009	N/A
OKI	Audit Printer	Microline 420	N/A
Dell	Report Printer	S2810dn	N/A
OKI	Report Printer	B431D, B431DN	N/A
SanDisk	Compact Flash Memory Card: 512 MB, 1 GB, 2 GB	N/A	N/A
SanDisk	Compact Flash Memory Card Reader/Writer	N/A	N/A
APC	Backup power supply (Uninterruptible Power Supply)	Back-UPS Pro 1500 or RS 1500	N/A
Tripp Lite	Spike Cube	SPIKECUBE	N/A
Delkin	USB Flash Drive: 1 GB, 2 GB, 4 GB, 8 GB	N/A	N/A
Delkin	Validation USB Flash Drive: 16 GB	N/A	N/A
Delkin	Compact Flash Memory Card: 1 GB max	N/A	N/A

Manufacturer	Hardware	Model	Operating System
Delkin	Compact Flash Memory Card Reader/Writer	6381	N/A
Seiko Instruments	Thermal Printer	LTPD-347B	N/A
NCR / Nashua	Paper Roll	2320	N/A
HP Inkjet	Print Cartridge	87002	N/A
AVID	Headphones	86002	N/A
Various (EMS Networked or Standalone configuration)	• Processor: Dual Core • RAM: 4 GB, 8 GB recommended • Hard Disk: 150 GB • Keyboard • Mouse • Monitor: 1280x800 resolution • CD/DVD reader: 16x min • 2 USB ports: 2.0 min • Report Printer: w/printer control language driver	N/A	Windows 7 Professional, SP-1 (64-bit)
Various (EMS Networked server configuration)	• Processor: Quad Core • RAM: 4 GB • Hard Disk: 320 GB • Keyboard • Mouse • Monitor: 1280x800 resolution • CD/DVD reader: 16x min • 2 USB ports: 2.0 min • Report Printer: Network printer w/printer control language driver • Ethernet Port • Back-up power supply: 865 Watts / 1500 VA output capacity	N/A	Windows Server 2008 R2, SP-1 (64-bit)

Manufacturer	Hardware	Model	Operating System
	• Network Switch: 1 GB throughput		

1.3.4 Engineering Changes

The following engineering changes are part of the **ES&S EVS 5.2.3.0** voting system:

Table 5 – Engineering Changes

Component	Change ID/EC#	Change Summary	Reason for Change
ExpressVote 1.0	EV1-136	Remove background compensation algorithm that was implemented to deal with colored stock to allow for improved reading of the activation barcode.	Cleanup
ExpressVote 1.0	EV1-137	Optimize imaging of activation barcode by slightly increasing the illumination to compensate for hardware behavior.	Cleanup
ExpressVote 1.0	EV1-138	Optimize EEPROM management to resolve rare issue whereby the unit serial number is incorrectly thought to be invalid and is cleared.	Cleanup
ExpressVote 1.0	EV1-139	Update copyright date on startup screen.	Cleanup

1.3.5 Materials

Items identified in the table reflect materials required to perform hardware, software, telecommunications, security, accuracy and/or integrated system tests in a manner that reflects real world use and needs.

Table 6 –Test Materials

Item	Details
Activation cards	ExpressVote card stock.
Compact Flash memory cards	Memory and data for the DS450 and DS850 central count scanner and tabulators.

Item	Details
USB flash drives	Data and election definitions for the hardware.
Printer paper rolls	Used to generate reports.

1.3.6 TDP Documents Used to Support Testing

The vendor documents used to support Certification Testing are listed in Attachment C.

1.4 System Overview

1.4.1 Scope of the ES&S EVS 5.2.3.0 Voting System

The **ES&S EVS 5.2.3.0** voting system release is a modification of features and products included in the **ES&S EVS 5.2.2.0** voting system. **ES&S EVS 5.2.3.0** provides a fully integrated suite of election management products. The system contains all functionality from **ES&S EVS 5.2.2.0** with the following added functions:

- The **ExpressVote 1.0** firmware has been modified to optimize imaging of activation barcodes by slightly increasing the illumination to compensate for hardware behavior.

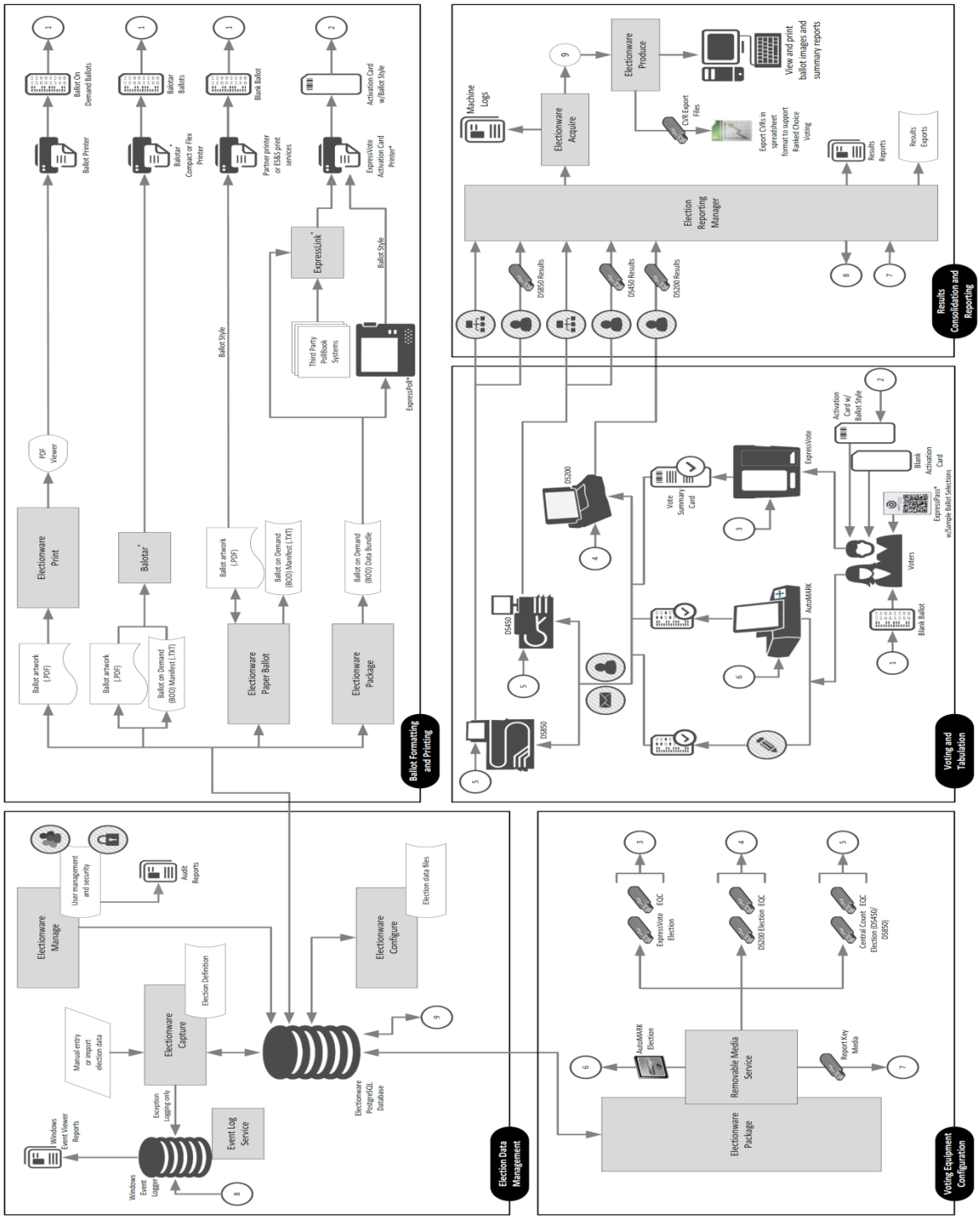
The **ES&S EVS 5.2.3.0** voting system is composed of software applications, central count location devices and polling place devices with accompanying firmware, COTS printers and COTS USB flash drives that are supported by the voting system.

- **Electionware** is an election management software application that provides election data creation, ballot formation, and equipment configuration.
    - Prior to the election, the **Electionware** interface handles all tasks that define the image of a paper ballot for that election. Then, **Electionware** converts all database information into ballot definition parameters for the **ExpressVote**, **AutoMARK, DS200**, **DS450,** and **DS850** tabulators through the Package Module by programming media for each device.
- **Election Reporting Manager (ERM)** is an election results reporting program. Post-election, **ERM** gathers and combines results from all tabulator types via USB media and/or closed network. **ERM** is used to generate election results and result reporting.
- **AutoMARK** is a ballot marking device that provides autonomy and privacy to all voters through a touch screen or accessibility interface. When the voter selections are complete and verified, the device prints the voted ballot, which can then be digitally scanned on a **DS200, DS450**, or **DS850**.

- **ExpressVote 1.0** is a polling place universal voting system that provides digital vote capture through a touch screen or accessibility interface. When the voter selections are complete and verified, the device prints the marked vote summary card, which can then be digitally scanned on a **DS200, DS450**, or **DS850**.
- **DS200** is a polling place device that scans completed printed ballots.

  After the ballot is marked, the voter inserts the ballot, the **DS200** tabulates it and the ballot is dropped into an integrated ballot box. Once the polls are closed, the poll worker can transfer results via USB media to **ERM**.
- **DS450** is a high-throughput digital processing scanner and tabulator that scans and automatically sorts ballots. Optionally, this device may be configured to transmit tabulation results to the results server through a closed network connection or through physically transported USB media.
- **DS850** is a high-speed digital processing scanner and central tabulator that scans and automatically sorts ballots. Optionally, this device may be configured to transmit tabulation results to the results server through a closed network connection or through physically transported USB media.
- **Event Log Service (ELS)** monitors and logs users' interactions with the Election Management System.
- **Removable Media Service (RMS)** is a utility which reads information from attached USB devices.

1.4.2 ES&S EVS 5.2.3.0 Voting System Block Diagram



2 Certification Test Background

2.1 Implementation Statement

Please see Attachment A for **ES&S**'s implementation statement.

2.2 Terms and Abbreviations

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

Table 7 – 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.
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.
Central Count Scanner	CCS	High Speed Optical Scanner is a mark sense-based ballot and vote counting device typically located at a central count facility and is operated by an automated multi-sheet feeding capability.
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,

Term	Abbreviation	Description
		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.
Institute of Electrical and Electronics Engineers	IEEE	A non-profit professional association for the advancement of technology.
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	The testing activities associated with the physical aspects of the system (hardware, documentation, builds, source code, etc.).
Precinct Count Scanner	PCS	A precinct-count optical scanner is a mark sense-based ballot and vote counting device located at a precinct and is typically operated by scanning one ballot at a time.
Request For Information	RFI	A means used by testing laboratories and manufacturers to request that the EAC provide an interpretation of a technical issue related to testing of voting systems.
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.

Term	Abbreviation	Description
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 of 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.
Voting System Under Test	VSUT	The designation for a voting system that is currently being tested.
Voting Test Specialist	VTS	An SLI employee within the Compliance division who has been qualified to perform EAC voting system certification testing.

2.3 PCA - Document and Source Code Reviews

The Physical Configuration Audit (PCA) review of the **ES&S EVS 5.2.3.0** documentation submitted in the Technical Data Package (TDP) was performed in order to verify conformance with the Election Assistance Commission Voluntary Voting System Guidelines (EAC VVSG) 2005. Source code was reviewed for each software and firmware application modified from **ES&S EVS 5.2.2.0** for the **ES&S EVS 5.2.3.0** voting system. Source code was not reviewed for software and firmware applications that were not modified for **ES&S EVS 5.2.3.0**.

All PCA reviews were conducted in accordance with Vol. 2 Section 2 of the EAC VVSG 2005, to demonstrate that the system meets the requirements. Results of the PCA documentation review can be found in Attachments G1 and G2 of this Certification Report. Areas where no significant changes were found between **ES&S EVS 5.2.2.0** and **ES&S EVS 5.2.3.0** were omitted from the attachments included. Inconsistencies or errors in documentation were identified to **ES&S** in a Discrepancy Report for resolution or comment. This Discrepancy Report can be found in Attachment F.

All PCA source code reviews were conducted in accordance with Vol. 1 Section 5.2 and Vol. 2 Section 5 of the EAC VVSG 2005, to demonstrate that the system meets the requirements. No inconsistencies or errors in the source code were identified.

2.4 FCA - Functional & System Testing

The Functional Configuration Audit (FCA) review of the test documentation submitted by **ES&S** in the TDP was conducted according to the VVSG 2005 Vol. 2 Section 6.7.

SLI's standard Test Suites were customized for the **ES&S EVS 5.2.3.0** voting system and conducted in accordance with VVSG 2005 Vol. 2 Section 6, in

conjunction with the functional testing. Simulations of elections were conducted to demonstrate a beginning-to-end business use case process for the **ES&S EVS 5.2.3.0** voting system.

2.4.1 Manufacturer test modules

SLI used customized functional test modules prepared by **ES&S** based on analysis of the changes incorporated into the **ES&S EVS 5.2.3.0** voting system. Functionality provided by the **ES&S EVS 5.2.3.0** voting system is exercised in order to verify that each functional component performs as expected. Accept/reject criteria are based on requirements of the VVSG and the system specification documents provided within the TDP.

2.5 Testing Performed

2.5.1 Requirements

The **ES&S EVS 5.2.3.0** system will be tested to the approved 2005 VVSG 1.0 requirements.

ExpressVote 1.0's firmware modification to optimize imaging of activation barcodes by slightly increasing the illumination to compensate for hardware behavior as detailed in section "1.1.2 Modifications". Pertinent VVSG requirements are:

- 2.1.2.c Accuracy
- 6.2.3 Testing Volume

2.5.2 Configurations Tested

After analysis of the changes incorporated into the **ES&S EVS 5.2.3.0** voting system, the following functional areas were tested:

ExpressVote 1.0 Accuracy test modules – The modification to the **ExpressVote 1.0** device was given focused testing to verify that the modification implemented, and the subsequent Trusted Build of the firmware, did not adversely affect operations.

ExpressVote 1.0 Barcode Optimization – The modification to the **ExpressVote 1.0** device was tested with a direct demonstration of a degraded barcode image that is significantly clearer following an update to the **ExpressVote 1.0** firmware.

General Election test module – The **ExpressVote 1.0** was reviewed in order to verify continued integration of the voting system and that all components continue to work as expected.

Primary Election test module – The **ExpressVote 1.0** was reviewed in order to verify continued integration of the voting system and that all components continue to work as expected.

2.5.3 Known Vulnerabilities Testing

A review of the "Known Vulnerabilities" database, maintained by SLI, has provided 49 known vulnerabilities to previous **ES&S** systems, which are already accounted for in SLI's Testing. At this time, there are no known field issues or vulnerabilities specific to this system.

2.5.4 Hardware Testing

No hardware testing was necessary for this certification project.

3 Test Findings and Recommendation

3.1 Summary Findings and Recommendation

SLI has successfully completed the testing of the **ES&S EVS 5.2.3.0** voting system. It has been determined that the **ES&S EVS 5.2.3.0** voting system meets the required acceptance criteria of the Election Assistance Commission's Voluntary Voting System Guidelines 2005.

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 **ES&S EVS 5.2.3.0** voting system.

3.1.1 Source Code Review Summary

SLI has reviewed the software source code for each application in the **ES&S EVS 5.2.3.0** voting system to determine the code's compliance with the VVSG 2005, Vol. 1 Sections 5, 9 and Vol. 2 Section 5.4 and for compliance with **ES&S**'s internally developed coding standards. Attachment E details specific information on the source code review. No inconsistencies or errors in the source code were identified.

3.1.1.1 Evaluation of Source Code

The source code was reviewed for compliance per the guidelines defined in the VVSG. The source code was written adequately in terms of the VVSG 2005. The code is modular and there is sufficient error handling. Readability is sufficient and supports maintainability.

3.1.2 Technical Data Package Review Summary

SLI has reviewed the **ES&S EVS 5.2.3.0** TDP for compliance with the VVSG 2005 Vol. 2 Section 2. The specific documents are listed in Attachment C.

3.1.2.1 Evaluation of TDP

The Technical Data Package for the **ES&S EVS 5.2.3.0** voting system was found to sufficiently comply with the standards such that a jurisdiction would be able to appropriately deploy the **ES&S EVS 5.2.3.0** voting system. Attachment F details specific deficiencies from the TDP review. This information was submitted to **ES&S** for their review during the project.

3.1.3 Functional Testing Summary

SLI performed tests on each of the system configurations identified in Section 2. The testing incorporated end-to-end election scenarios testing the functionality supported by **ES&S**.

3.1.3.1 Evaluation of Testing

The following Test Modules were created for this project:

- 11-inch Accuracy
- 14-inch Accuracy
- 17-inch Accuracy
- 19-inch Accuracy
- General Election
- Primary Election
- Field Machine Barcode Optimization

The above tests were successfully conducted using the executables delivered in the final Trusted Build, in association with the appropriate hardware versions as declared in this Test Report for the **ES&S EVS 5.2.3.0** voting system.

3.2 Anomalies and Deficiencies

All anomalies identified in functionality and discrepancies identified in source code, documentation, hardware and functionality were documented and appropriately corrected as detailed in Attachment F.

4 Signature

Traci Mapps
VSTL Director/Director of Operations
January 22nd, 2018

End of Certification Report