Modification Test Plan

Document Number: ESY-18004-MTP-01

Prepared for:

Vendor Name	Election Systems and Software (ES&S)
Vendor System	EVS 6.0.4.0
EAC Application No.	EVS6040
Vendor Address	11208 John Galt Boulevard Omaha, Nebraska 68137

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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
October 9th, 2018	1.0	J. Panek	Initial Draft
December 14th, 2018	2.0	J. Panek	Updates for changes in system scope and to address EAC comments
February 5th, 2019	2.1	J. Panek	Updates to address EAC comments
February 8th, 2019	2.2	J. Panek	Updates to address EAC comments
April 8th, 2019	2.3	J. Panek	As-run updates
April 26th, 2019	2.4	J. Panek	Additional as-run updates to address EAC comments

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1   INTRODUCTION

This Modification Test Plan outlines the test approach SLI Compliance will follow when performing modification, regression, and hardware testing 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 will be 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 a clear understanding of the work SLI will conduct and a detailed plan outlining the test effort.

When the testing is complete, SLI will submit a Modification Test Report that details all test results and findings from the test effort, as well as a recommendation to the EAC regarding certification.

1.1 Modification Test Plan Attachments

The following attachments apply to this Modification Test Plan:

- Attachment A - ES&S EVS6040 Electrical Hardware Test Plan v2.0
- Attachment B - ES&S EVS6040 Environmental Hardware Test Plan v2.0
- Attachment C - ES&S EVS6040 Documentation Listing
- Attachment D - ES&S EVS6040 Hardware Change Evaluation ExpressVote HW1.0, HW2.1

1.2 References

The following key documents were used in preparing this test plan.
1. Election Assistance Commission Voluntary Voting System Guidelines (EAC VVSG), 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 2.6, March 28, 2018.

1.3 Terms and Abbreviations

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

Table 1 – 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.
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.
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, precincts, languages, etc.) as well as election specific information (races, candidates, voter groups (parties), etc.). In addition, the EMS is also used to lay out 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.

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.
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.
Universal Voting System	UVS	A device designed for all voters
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 Test Engineer	VTE	An SLI employee within the Compliance division who has been qualified to perform EAC voting system certification testing.

1.4 Project Overview

This Modification Test Plan contains a description of the previously certified system, the modifications made to that system, and the approach SLI will implement to perform modification, regression, and hardware testing of the **ES&S EVS 6.0.4.0** voting system against the requirements of the federal Voluntary Voting System Guidelines 1.0 (VVSG 1.0), Volumes 1 and 2.

1.5 Description and Overview of the Certified System

This section contains a description of the previously certified system, the specific modifications to the current system version, and the impact of those modifications on the system and certification testing.

1.5.1 Definition of Baseline Certified System

This modification project builds upon the foundation established in **ES&S EVS 6.0.2.0,** which contains the applications **Electionware, Event Log Service, Removable Media Service,** the polling place devices **ExpressVote HW1.0, ExpressVote HW2.1, ExpressVote XL, ExpressTouch,** and **DS200,** as well as the central count location devices **DS450** and **DS850**.

The table below details each application employed by the **ES&S EVS 6.0.2.0** voting system.

Table 2 – ES&S EVS 6.0.2.0 Software and Firmware

Application	Version
Electionware – Client/Server	5.0.1.0
Event Log Service	1.6.0.0
Removable Media Service	1.5.0.0
ExpressVote HW1.0	1.5.0.0
ExpressVote HW1.0 Previewer	1.5.0.0
ExpressVote HW2.1	2.4.0.0
ExpressVote HW2.1 Previewer	2.4.0.0
DS200	2.17.0.0
DS200 Ancillary (used to build the DS200, but no resultant output)	6.0.0.0
DS850	3.1.0.0
DS450	3.1.0.0
ExpressVote XL	1.0.0.0
ExpressTouch	1.0.0.0

1.5.2 Modifications

ES&S EVS 6.0.4.0 is a modification of the EAC certified **ES&S EVS 6.0.2.0** voting system. The following modifications are implemented in this release:

1.5.2.1 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.

1.5.2.2 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**.
- The Delkin USB Embedded 2.0 Module and Compact Flash Memory Card COTS hardware components have been updated.
- A Trusted Platform Module (TPM) chip has been introduced to the system configuration. This chip is required to be added to any EMS workstation that doesn't have an integrated TPM when running Windows Enterprise OS with the Bitlocker feature.
- A Delkin 32.2 MB USB Flash Drive has been added to manufacturer equipment for use with the Bitlocker feature.

1.5.2.3 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 (i.e. "Approve Ballot" and "Put On-Hold") 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.
- Changes have been made to all COTS software components as listed in Table 5.
- Updates made to SecureSetup.exe hardening script.

1.5.3   Initial Assessment of Impact of the Modifications

Review of the **ES&S EVS 6.0.4.0**'s modifications listed in section 1.5.2 indicate the need for hardware testing, as well as a limited Functional Configuration Audit (FCA) to verify that the system continues to meet VVSG 1.0 requirements.

A full suite of hardware tests will be performed on the **DS200** and **DS450** due to the hardware modifications listed in section 1.5.2.2. The **DS850** includes firmware updates to accommodate end-of-life component replacements. 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, so it will not be subject to hardware testing in this system version.

The hardware modification to the **ExpressVote HW 1.0** and **ExpressVote HW 2.1** is replacement of the integrated barcode scanner that was certified with previous versions of the system, due to end-of-life for the scanner component. The replacement scanner is considered De Minimis as it is identical in form, fit, and function to the current certified version, therefore, the **ExpressVote HW 1.0** and **ExpressVote HW 2.1** will not be subject to hardware testing.

All software and firmware modifications will be verified by execution of elections that incorporate steps to verify the modifications, or via test suites designed to specifically focus on the functional changes made to the applicable devices and applications.

The limited FCA will consider not only the implemented modifications, but also functions that have not changed but may be impacted by the modifications. Updates made to this system apply to the **EMS, RMS,** and **Electionware** software, and the **DS200**, **DS450**, **DS850**, **ExpressVote HW 1.0**, **ExpressVote HW 2.1**, **ExpressVote XL,** and **ExpressTouch** devices. Each has modified source code and will require a new build. This will be subjected to FCA review at an appropriate level of scrutiny.
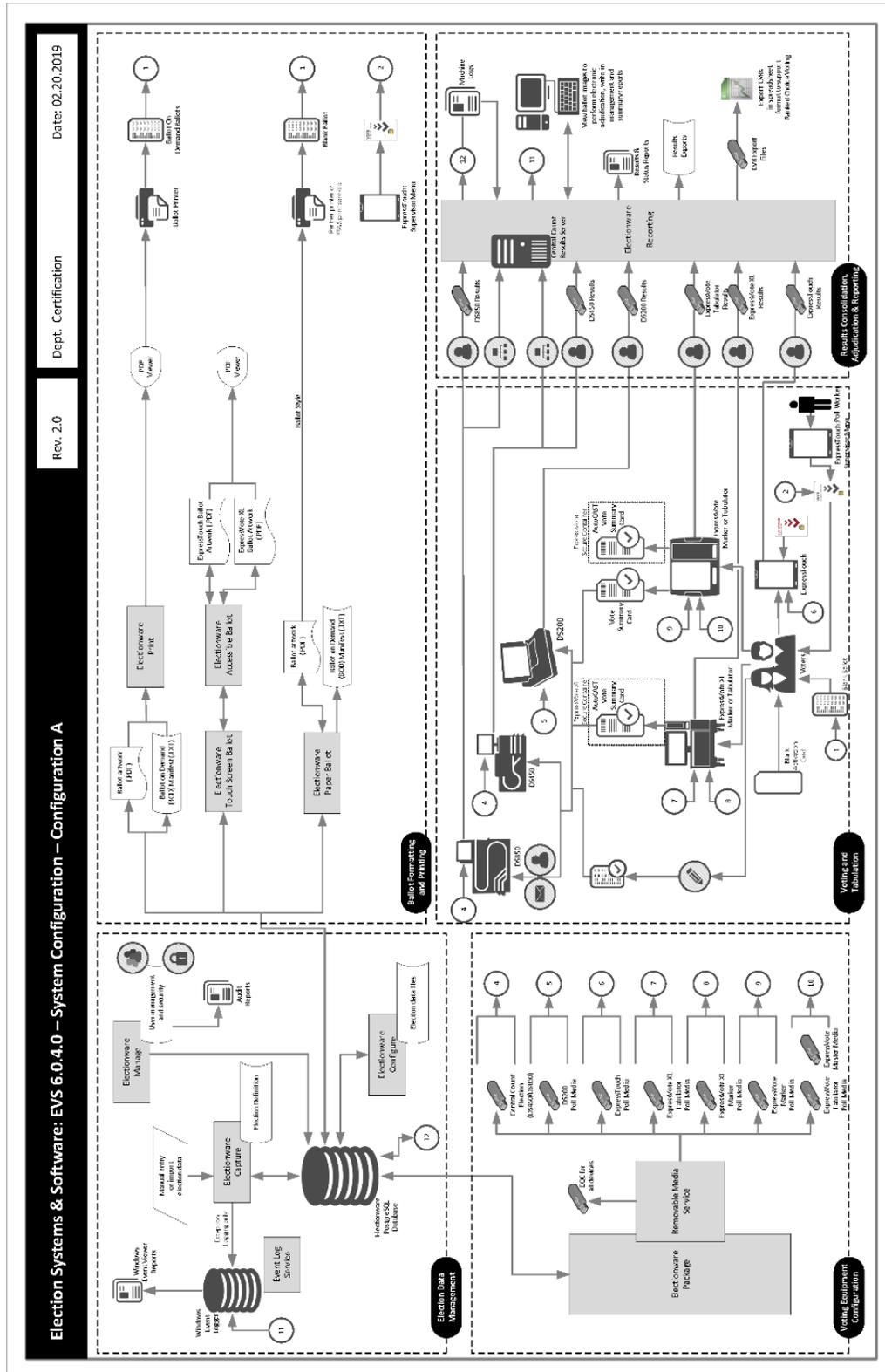
1.5.4 Block Diagrams

Figure 1: Voting System Overview – Configuration A

Figure 2: Voting System Overview – Configuration B

Figure 3: Voting System Overview – Configuration C

1.6 Project Schedule

The following schedule describes the high-level tasks and assigned personnel titles that will be involved in the Certification Test effort of the **ES&S EVS 6.0.4.0** voting system.

1.6.1 Owner Assignments

- System Analysis and Review will be conducted by the Source Code Review (SCR) team, Security and Voting Test Engineers, with oversight by the Test Manager (TM)
- Source code review will be conducted by SCR Test Engineers, with oversight by the TM
- Documentation review will be conducted by Security and Test Engineer personnel, with oversight by the TM
- Test Module Development and Validation will be conducted by Security and Test Engineer personnel, with oversight provided by the TM
- Test Suite Development and Validation will be conducted by Security and Test Engineer personnel, utilizing SLI's formal Test Methods, with oversight provided by the TM
- Formal Test Execution will be conducted by Security and Test Engineer personnel, with oversight by the TM
- Third Party testing will be conducted by the subcontracting Third Party Hardware Laboratories, with oversight by the Hardware Specialist

1.6.2 Test Module Development and Validation

Test Modules will be developed and/or modified to provide repeatable detailed test steps. The modules will be validated prior to Formal Test Execution to ensure accurate testing of the voting system. Test modules are validated by internal review and execution. The test modules and the test suites that are written by SLI provide traceability to the VVSG 1.0 requirements by referencing each VVSG 1.0 requirement addressed within the Test Module.

1.6.3 Test Suite Development

Test Suites will be developed to group and focus testing around key areas of the voting system. Each Test Suite will contain multiple test modules providing clear and traceable test scripts and information. Potentially, variations of the same suite may be run multiple times to verify different configurations.

1.6.4 Formal Test Execution

Formal Test Execution of the validated Test Suites will be conducted against the declared voting system. A Compliance Build will be performed, producing software and firmware components, in order to test to determine whether or not the system is compliant with the VVSG requirements. Once all requirements are satisfactorily met, a Trusted Build will be performed to produce the final software and firmware deliverables. Additional testing will

be performed to verify the final deliverables. Under the VVSG 1.0, this portion of the certification is considered part of the FCA.

1.6.5 Third Party Hardware Testing

Hardware testing will be conducted by 3rd Party accredited hardware test laboratories to verify the voting system devices are compliant with the VVSG hardware requirements.

Other Labs Performing Non-Core Hardware Testing

SLI Compliance is responsible for all core voting system tests as identified in the NIST NVLAP Handbook 150-22 (2017). The labs listed below will perform non-core hardware testing for this certification test campaign.

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
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, and Reliability	10/16/2018 – 11/2/2018 11/12/2018 – 11/16/2018

1.6.6 Project Timeline

The following schedule outlines the expected timeline for this project.

Task Name	Start	Finish
ES&S Project Plan for EVS 6040	**Fri 10/5/18**	**Thu 5/23/19**
6040 EAC Certification	**Fri 10/5/18**	**Thu 5/23/19**
Phase 1	**Mon 10/8/18**	**Mon 2/11/19**
Project Initiation	**Mon 10/8/18**	**Tue 10/9/18**
TDP Deliver/Receive Vendor Package	**Fri 10/5/18**	**Tue 10/16/18**
Submission - Document Check-in	**Mon 10/8/18**	**Mon 10/8/18**
TDP Deliver/Receive Vendor Package 2	**Fri 12/7/18**	**Tue 12/11/18**
Submission - Document Check-in 2	**Tue 12/11/18**	**Tue 12/11/18**
Test Plan Development	**Mon 10/8/18**	**Mon 2/11/19**
Review RFI's and NOC's as needed	Mon 10/8/18	Mon 10/8/18
Create Test Plan	Mon 10/8/18	Wed 10/10/18

Manufacturer feedback on Test Plan, if any	Thu 10/11/18	Thu 10/11/18
Submit Test Plan for EAC Review	Thu 10/11/18	Mon 10/22/18
Updates to Test Plan to Resolve EAC comments	Mon 10/22/18	Wed 10/24/18
Update Test Plan For New Project Scope	Mon 12/10/18	Wed 12/19/18
Manufacturer feedback on Test Plan, if any	Wed 12/19/18	Wed 12/19/18
Submit Test Plan for EAC Review	Thu 12/20/18	Mon 2/4/19
Updates to Test Plan to Resolve EAC comments	Tue 2/5/19	Wed 2/6/19
EAC Review	Thu 2/7/19	Fri 2/8/19
Test Plan Development Complete	Mon 2/11/19	Mon 2/11/19
TDP Review	**Mon 10/8/18**	**Wed 10/17/18**
TDP Review 2	**Fri 12/7/18**	**Thu 12/20/18**
Hardware Check In	**Fri 10/12/18**	**Wed 10/17/18**
TRR	**Mon 10/8/18**	**Tue 12/11/18**
Phase 2	**Tue 10/16/18**	**Fri 2/15/19**
Compliance Build 1	**Tue 12/11/18**	**Fri 12/14/18**
Hardware Test Execution	**Tue 10/16/18**	**Tue 2/12/19**
Environmental	**Tue 10/16/18**	**Fri 11/2/18**
Electrical	**Wed 10/17/18**	**Fri 1/11/19**
Power/Temp	**Mon 12/10/18**	**Fri 12/14/18**
Create Hardware Testing Report	Mon 1/14/19	Tue 2/12/19
Hardware Testing Complete	Tue 2/12/19	Tue 2/12/19
Safety Report Review	**Mon 11/12/18**	**Fri 2/15/19**
Phase 3	**Wed 1/2/19**	**Fri 2/8/19**
Vendor Specific Module Creation/Validation	**Wed 1/2/19**	**Fri 2/8/19**
Notify EAC of Test Suites Ready for their review	**Fri 2/8/19**	**Fri 2/8/19**
Phase 4	**Mon 1/21/19**	**Thu 3/7/19**
Review - Source Code	**Mon 1/21/19**	**Thu 1/31/19**
Compliance Build 2	**Thu 1/24/19**	**Thu 1/31/19**
Official Execution of Test Suites	**Fri 2/8/19**	**Thu 3/7/19**
Phase 5	**Fri 3/8/19**	**Mon 3/25/19**
Trusted Build	**Fri 3/8/19**	**Mon 3/18/19**
Final Execution of Test Suites	Mon 3/18/19	Mon 3/25/19
Phase 6	**Fri 3/8/19**	**Fri 5/24/19**
Create Certification Report	Fri 3/8/19	Tue 4/9/19
Final updates to Test Plan	Mon 4/8/19	Mon 4/8/19
EAC Review	Wed 4/10/19	Tue 5/7/19
Final updates to Test Report	Wed 5/8/19	Wed 5/8/19
EAC Acceptance	Thu 5/9/19	Wed 5/22/19
Report Complete	Thu 5/23/19	Thu 5/23/19
EAC Repository and Manufacturer	**Thu 5/23/19**	**Fri 5/24/19**
Phase 7	**Thu 5/23/19**	**Fri 5/24/19**
Return Equipment to Vendor	**Thu 5/23/19**	**Fri 5/24/19**
Archive Test Materials	**Thu 5/23/19**	**Fri 5/24/19**
Project Management	**Mon 10/8/18**	**Mon 3/25/19**

1.6.7 EAC & Manufacturer Dependencies

The Modification Test Plan will require EAC approval prior to finalization.

ES&S is required to provide all source code, documentation, equipment and supporting materials identified as part of the voting system.

All identified source code discrepancies must be resolved, be able to be built successfully, be installed, as well as successfully complete operational status checks prior to Formal Test Execution.

In addition, **ES&S** is required to provide training on the voting system and support throughout the life of the project.

2 PRE-CERTIFICATION TESTING AND ISSUES

2.1 Evaluation of prior VSTL testing

VSTL testing has been performed on the version previous to the **ES&S EVS 6.0.4.0** voting system. The previous version of this system, **ES&S EVS 6.0.2.0,** is EAC certified, and will serve as the source code base for this evaluation.

2.2 Evaluation of prior non-VSTL testing

No prior state or non-VSTL lab testing is pertinent to the **ES&S EVS 6.0.4.0** voting system. Review of **ES&S** internal testing is performed during the FCA review.

2.3 Known Vulnerabilities

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.

3 MATERIALS REQUIRED FOR TESTING

Any materials that are used in an election cycle must be provided to SLI to facilitate testing of the voting system. This section outlines the required materials.

3.1 Software/Firmware

All software and 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 following software/firmware is required for the execution of formal tests. This includes all supporting software such as operating systems, compilers, assemblers, application software, firmware, any applications used for burning of media, transmission of data or creation/management of databases.

3.1.1 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 4 – 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
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

3.1.2   COTS Software/Firmware

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

Table 5 – 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	B17.1116.1
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)

3.1.3   Additional Supporting Test Software

This section outlines the test specific software that will be used by SLI in the certification campaign.

Table 6 – Additional Supporting Test Software

Manufacturer	Application	Version
SLI Compliance	Module Finder	1.0
Prestosoft	ExamDiff Pro	3.0

3.2 Equipment

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

3.2.1 ES&S EVS 6.0.4.0 Equipment

The following manufacturer equipment will be used in testing:

Table 7 – ES&S EVS 6.0.4.0 Equipment

Hardware	Model	Version
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
Delkin USB Flash Drive	N/A	Bitlocker 32.2 MB

3.2.2 COTS Equipment

The following COTS equipment will be used in testing:

Table 8 – 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 Networked or Standalone configuration)	• Processor: Dual Core • RAM: 4 GB, 8 GB recommended • Hard Disk: 150 GB • Keyboard • Mouse • Monitor: 1280x800 resolution • Monitor – 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
	(Monitor needed for programming election for ExpressVote XL) 1920x1080p resolution • CD/DVD reader: 16x min (internal or external) • 2 USB ports: 2.0 min • Report Printer: w/printer control language driver • Trusted Platform Module (TPM)		
Dell (EMS Networked server 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	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)

Manufacturer	Hardware	Model	Operating System
	• Backup power supply: 865 Watts / 1500 VA output capacity • Network Switch: 1 GB throughput • Trusted Platform Module (TPM)		
Delkin	USB Flash Drive: 512 MB, 1 GB, 2 GB, 4 GB, 8 GB	N/A	N/A
Delkin	USB Flash Drive: 16 GB (Validation only)	N/A	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	N/A	N/A

3.3 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

3.4 Deliverable Materials

Please see "Attachment C - ES&S EVS6040 Documentation Listing" for the full list of documents delivered in the TDP.

4 TEST SPECIFICATIONS

The following are the specifications for testing to be conducted on **ES&S EVS 6.0.4.0** voting system. The specifications contain details on the focus of testing, configuration(s), and the functions to be tested.

4.1 Requirements

The **ES&S EVS 6.0.4.0** voting system will be tested to the approved VVSG 1.0 requirements.

Modifications made to the **ES&S EVS 6.0.4.0** voting system are detailed in section "1.5.2 Modifications" and dictate evaluation against the following pertinent VVSG requirements:

- 2.1.2 Accuracy
- 2.1.4 Integrity
- 2.1.6 Election Management System
- 2.2 Pre-Voting Capabilities
- 2.3 Voting Capabilities
- 2.4 Post-Voting Capabilities
- 4.1.2 Environmental Requirements
- 4.1.4 Vote Recording Requirements
- 5.2 Software Design and Coding Standards
- 7.4 Software Security
- 9.7.1 Physical Configuration Audit
- 9.7.2 Functional Configuration Audit

4.2 Hardware Configuration and Design

The **ES&S EVS 6.0.4.0** as declared in the application for certification submitted to the EAC, consists of:

- An **Electionware** standalone workstation with minimum requirements of 150 GB hard disk, 8 GB of recommended memory and Dual Core processing speed.
- An **Electionware** networked workstation with minimum requirements of 150 GB hard disk, 8 GB of recommended memory and Dual Core processing speed. Additionally, the network configuration includes a server with minimum requirements of 320 GB hard disk, 4 GB of memory and Quad Core processing speed.
- The precinct level employs **ExpressTouch**, **ExpressVote HW1.0**, **ExpressVote HW2.1** and **ExpressVote XL** universal voting devices, and the **DS200** tabulator.
- The central count location employs the **DS450** and **DS850** tabulators.
- The consolidation, tally and reporting process employs the workstation with either a direct connect or a network printer.

4.3 Software System Functions

The **ES&S EVS 6.0.4.0** system operations documentation has been reviewed in conjunction with the Supported Functionality Declaration provided by the manufacturer. Based on this review, the applicable system functions have been identified for testing. The following key areas of voting system functionality will be evaluated during test case design.

4.3.1 Election Media Creation

This area focuses on the creation and handling of media for the purposes of installing election data onto voting devices, as well as the creation of physical ballot layouts and creation of any/all media used to hold/transfer election data.

4.3.2 Pre-voting Aspects

Pre-voting aspects include pre-election preparatory, diagnostic, and election verification functions of a voting system. The focus will include device preparation, all required pre-voting tasks, and verification of manufacturer recommended pre-voting tasks.

4.3.3 Voting Aspects – Polling Place

Polling place aspects include all required and additional supported voting functions, including HAVA compliant requirements. This area will focus on all aspects of election functions and capabilities at the polling place from opening of the polls through closing the polls.

4.3.4 Post Voting Aspects

This area will focus on all required election post-voting functions. This includes any additional supported election functions performed after closing the polls, device auditing, transmission, and reporting aspects of the voting system.

4.3.5 Security

System and device level security aspects will be focused upon as necessary to verify COTS software updates for the system are compliant with VVSG 1.0 requirements.

4.4 Hardware Environmental Test Design

Hardware environmental testing is performed to verify conformance to Vol. 1, Section 4 of the VVSG 2005. Testing will be accomplished through a combination of testing performed by SLI and testing performed by subcontractor labs. Specific hardware test plans and test reports from the subcontractor labs are included in "Attachment A - ES&S EVS6040 Electrical Hardware Test Plan v2.0" and "Attachment B - ES&S EVS6040 Environmental Hardware Test Plan v2.0".

4.5 System-level Test Design

Testing of the System involves exercising the specific functions of each component of a voting system as well as the entire voting system. Testing will focus on the functionality of an election management system, the polling place devices, and devices required for communications and data loading and will then focus on functionality of the integrated voting system.

- **Election Validations** - Election suites are created to replicate each type of election that can be implemented by the jurisdiction. Within the election types, pertinent voting variations that are applicable to that type of election will be validated and verified. Each suite will have a particular focus in order to test the voting system's implementation of a given requirement or set of requirements.

    o **GenVariation1** - A general election with a focus on validating N of M voting, Partisan offices, Non-Partisan Offices, Ranked Order Voting, Ballot Rotations, precincts and districts, and Tally and Reporting functionality.

    o **GenVariation2** – An additional general election definition designed to test all variations of the Pennsylvania Straight Party Method, to ensure all modifications and Straight Party functionality are working correctly as documented, and in accordance with the VVSG 1.0 requirements.

    o **Open Primary** - An Integration Test Suite designed to verify proper integration of system components will be conducted using an Open Primary.

- **Accuracy** – Testing 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. Required accuracy is defined in terms of an error rate that for testing purposes represents the maximum number of errors allowed

while processing a specified volume of data.

Accuracy testing is conducted at both the device level and the system level.

Each device is subjected to scrutiny that will verify that the requirements for accuracy are met. Additionally, the system will be reviewed and exercised to validate that the accumulation, tallying and reporting mechanisms at the system level are able to accurately perform their functions.

4.6 TDP Evaluation

SLI is completing an assessment of the deliveries of the Technical Data Package for **ES&S EVS 6.0.4.0** against the **ES&S EVS 6.0.2.0** TDP. Any modification to previously reviewed documentation is being reviewed. Any subsequent re-deliveries of the TDP items will be solely the result of fixes to discrepancies identified in the remaining FCA or PCA activities.

SLI will conduct a PCA review of all vendor traced documents submitted for review in the delivery of the **ES&S EVS 6.0.4.0** TDP. Documents are verified for compliance to the VVSG 1.0, Volume 2, Sections 2.2 through 2.13 and Volume 2, Section 6.6.

Please see "Attachment C - ES&S EVS6040 Documentation Listing" for the full list of TDP deliverables that will be included in this evaluation.

4.7 Source Code Review

The certification campaign for the **ES&S EVS 6.0.4.0** voting system includes software and firmware from **ES&S EVS 6.0.2.0** that have been modified by and are proprietary to **ES&S**. SLI will conduct a source code review of all modified source code in the delivery of the voting system TDP for **ES&S EVS 6.0.4.0** for compliance to the VVSG 1.0, Volume 2, Section 6.6.

The coding languages involved in the vendor's applications include:

- C
- C++
- C#
- SQL
- VB.Net
- Java
- Visual Basic

Source Code Review Tools utilized by SLI include:

- Module Finder: an SLI proprietary application used to parse module names from C/C++ and VB code and populate the identified module names into the review documents

- ExamDiff Pro: a commercial application used to compare revised code to previously reviewed code

Any subsequent re-reviews of source code will be the result of fixes to discrepancies identified in the FCA activities.

COTS operating systems and software used in the voting system have been verified as authentic and unmodified in the **ES&S EVS 6.0.4.0** test campaign.

4.8 Compliance/Trusted Build

A Compliance Build will be conducted prior to SLI's formal test execution and will be completed on site at SLI's facility or a secure lab at the vendor's facility approved by SLI. The Trusted Build will be conducted prior to SLI's final test execution and will be completed on site at SLI's facility or a secure lab at the vendor's facility approved by SLI. SLI will use its approved standard lab procedure that details the processes for controlling, managing, and conducting the Trusted Build. This process includes the following:

- Preparation for the Compliance/Trusted Build - 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 Compliance/Trusted Build – SLI will perform the Compliance/Trusted Build by using the step-by-step build procedure, as provided by **ES&S** to create a pristine build environment. SLI records and ascertains the following items throughout the build process:
  - o Build environment images at various key points
  - o Build environment and file hashes at various key points
  - o Build environment hardware characteristics
  - o Build results from code compilation and file hashes
  - o Final software install files and file hashes

- Deliverables to Testing – Upon completion of the Trusted Build, certain items are sent to the SLI test group. The final result will be media containing the following:
  - o Final software install files
  - o Hash values to validate install files

Final Record Keeping and Archiving Procedures – At the conclusion of the Trusted Build process, SLI completes all final record keeping and archiving procedures at SLI's facility. This record keeping includes any unique identifiers, results of the build with version numbers and dates and descriptions of all hashes and images in the repository.

4.9 Standard VSTL Test Methods and Uncertainty of Test Data Measurement

This test campaign utilizes Standard VSTL test methods and election-specific type test data only.

4.10 EAC Interpretations

This Modification Test Plan and the execution of tests for the voting system identified in this plan do not include any additional EAC interpretations.

4.11 EAC Notices of Clarification

As of the date this Certification Test Plan was created, there are no additional EAC NOCs that pertain to the execution of tests for the voting system identified in this plan that are not already in effect.

5 TEST DATA

Test data for the **ES&S EVS 6.0.4.0** voting system is compiled such that all functionality declared will be tested to determine conformance to the standards.

5.1 Data Recording

SLI has evaluated the system functionality, as described by manufacturer technical documentation, as well as requirements as listed in the EAC VVSG 1.0, and made determinations as to expected results of all data inputs into the **ES&S EVS 6.0.4.0** voting system. This includes:

- Election type
- Precincts of all types
- Districts
- Offices
- Contests
- Candidates
- Parties
- Devices used
- Voting variations employed
- Issues/Referendums
- Votes cast for each candidate/issue/referendum
- Vote consolidation data from one device/level to the next

The data is contained in one master data record, including each input and each expected output. This data is incorporated into the appropriate test suite, populating test modules with exact expected data for the function being tested.

Testing information is recorded in the test suites, as well as in test notebooks, which are utilized according to SLI's standard lab procedure *SLP-VC-30 - Test Notebooks*.

5.2 Test Data Criteria

SLI has evaluated the system functionality as described by manufacturer technical documentation, as well as requirements as listed in the EAC VVSG 1.0, and made determinations as to expected output of all data inputs into the **ES&S EVS 6.0.4.0** voting system. A data matrix will be recorded into one master data record that couples data inputs to their expected output, as determined above. The system's execution shall be measured against the expected results.

6 TEST PROCEDURE AND CONDITIONS

This section describes the test conditions and procedures for execution of test suites. If a particular sequence is mandatory for the execution of suites, a rationale will be given. Additionally, this section is used to describe procedures for setting up equipment that will be utilized in test suite execution.

6.1 Facility Requirements

Testing will be performed on-site at SLI in Colorado.

Four secure labs are available with appropriate power supply and space to accommodate the various configurations defined within this Modification Test Plan. Temperature/humidity gauges will be employed in order to determine the appropriate conditions exist during testing.

Unless otherwise specified herein, all remaining tests, including system level functional testing, shall be performed at standard ambient conditions:

- Temperature: 64°F - 79°F (17.7°C - 26.1°C)
- Relative Humidity: 20 to 90%
- Atmospheric Pressure: Local Site Pressure

All TDP and test documentation is stored on-site at SLI's facility in a secure project directory on SLI's secure voting server.

Electrical and environmental hardware testing for hardware components of the **ES&S EVS 6.0.4.0** voting system will be performed at either NVLAP or A2LA accredited testing laboratories or at laboratories audited by SLI to NVLAP Handbook 150-22 requirements.

6.2 Test Setup

Configurations of **ES&S EVS 6.0.4.0** will be deployed that conform to each specific test suite's needs. Some configurations will consist of standalone implementations, while other configurations will utilize networked implementations of various applications, such

as **Electionware**, **DS450** and **DS850**. In all instances, **ES&S EVS 6.0.4.0** documentation will be followed in the setup of the configurations.

Successful completion of operational status checks will indicate that the system is ready for test execution.

6.3 Test Sequence

While there is no required sequence for performing voting system certification testing and audits, there are prerequisite tasks for some testing. Any needed prerequisites are contained within the suite for that test.

7 TEST OPERATIONS PROCEDURES

An inventory has been performed to verify the voting equipment received contains hardware and software elements as defined in the TDP prior to commencement of testing.

Throughout the testing effort, test suites and modules will be marked as follows:

- **Accept –** Test is accepted as successful.
- **Reject –** Test is rejected as unsuccessful.
- **NT –** Not Testable is used for test modules that cannot be completed. For example, if failure of one test module precludes attempting subsequent test modules, the latter will be marked as NT.

Test results **Reject** and **NT** will include comments by the Test Engineer explaining the reason for the result. Issues encountered during review and testing will be documented in the Discrepancy Report as well as reported to the EAC in an authorized manner. Issues that do not conform to the requirements of the VVSG 1.0 will be marked as **Documentation Discrepancies** or **Functional Discrepancies** (a discrepancy occurs when the software does not meet defined software requirements or specifications). SLI employs a system of checks such that any issue uncovered during testing is first designated as an "anomaly". The anomaly is then reviewed, and the cause is determined as either a flaw in the test or in the voting system itself. If the issue is determined to be a flaw in the test, the test will be re-written, re-validated and then formally re-run. If the issue is determined to be a flaw in the voting system, then a discrepancy is opened against the system. While test suites and test modules undergo a validation phase prior to formal execution, last minute code changes can possibly change the behavior from what the test module defines as expected. If this is the case, the review process employed during the anomaly phase will reveal this situation, thus reducing the chance of a false positive in terms of an unfounded discrepancy being written against the voting system.

Issues that are encountered during testing or documentation review but are not addressed by the applicable standard will be added to the Discrepancy Report and noted as **Informational**. The vendor has the option whether to address Informational issues.

8   Approval Signatures

SLI:

[signature]

Traci Mapps
VSTL Director
April 26th, 2019

9   Appendix A – Ancillary Products

Ancillary systems represent products and utilities that are not part of the EAC certified configuration.

Ancillary systems include:

- Ballot Production
    - **Balotar** is a product that allows the printing of ad hoc ballots.
- Ranked Choice Voting
    - **ExpressRunoff** is a software utility for automating ranked choice voting for single-seat contests.
- Electronic Pollbook
    - **ExpressPoll** electronic pollbook stores registered voter information for precincts, districts, or entire jurisdictions.
- **ExpressLink** System
    - **ExpressLink** is a standalone application that interfaces with voter registration (electronic pollbook) systems and the **ExpressVote Activation Card Printer** to print the ballot activation code on an **ExpressVote** activation card. 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 **ExpressVote** activation card.
    - **ExpressTouch Smart Card Writer** is a device used to program the ballot activation code on the **ExpressTouch** vote session activator card.
- **Electionware Toolbox**
    - **Test Deck** provides a means for the election official to test the election on each machine that will be used for voting.
    - **Text to Speech** provides a simplified method for creating the audio wave files that make up the audible ballot.

- o **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 Modification Test Plan