Certification Test Plan

Document Number: ESS-7005-CTP-01

Prepared for:

Vendor Name	*Election Systems and Software (ES&S)*
Vendor System	*EVS 6.2.0.0*
EAC Application No.	*EVS6200*
Vendor Address	*11208 John Galt Boulevard Omaha, Nebraska 68137*

Prepared by:

4720 Independence St.
Wheat Ridge, CO 80033
303-422-1566
www.SLICompliance.com

NVLAP TESTING
NVLAP Lab Code 200733-0

Accredited by the Election Assistance Commission (EAC) for Selected Voting System Test Methods or Services

Revision History

Date	Version	Author	Revision Summary
July 24th, 2017	1.0	*M. Santos*	Initial Draft

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1 INTRODUCTION

This Certification Test Plan outlines the test approach SLI Compliance (SLI) will follow when performing Certification Testing on the ***ES&S EVS 6.2.0.0*** voting system against the 2005 Voluntary Voting System Guidelines (VVSG). 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 Certification Test Report that details all test results and findings from the Certification Test effort, as well as a recommendation to the EAC.

1.1 Certification Test Plan Attachments

The following attachments apply to this Certification Test Plan:

1. Attachment A - Elec_NTS_Longmont_A2LA_0214-43_022818
2. Attachment B - ENV_NTS_Longmont_A2LA_0214-44_022818
3. Attachment C - ESS EV6000 Electrical Hardware Test Plan v1.0
4. Attachment D - ESS EV6000 Environmental Hardware Test Plan v1.0

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: 2008.
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, 2.3, prepared by SLI, dated January 20, 2017.

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.
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 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.

Term	Abbreviation	Description
Functional Configuration Audit	FCA	The testing activities associated with the functional testing of the system.
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.
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 Specialist	VTS	An SLI employee within the Compliance division who has been qualified to perform EAC voting system certification testing.

1.4 Project Overview

This test plan outlines the approach SLI will implement to perform testing of the **ES&S EVS 6.2.0.0** voting system against the requirements of the federal 2005 Voluntary Voting System Guidelines (VVSG), Volumes 1 and 2. This project is for an initial certification effort.

1.5 Purpose

The purpose of this EAC Test Plan is to create clear and precise documentation of the processes that SLI, as an EAC VSTL, will implement throughout the course of voting system verification testing.

This Test Plan:

- Defines the overall test approach.
- Identifies required voting system hardware and software to be tested, and in what configurations.
- Identifies required hardware, software, and tools to be used to support the testing efforts.
- Defines the types of tests to be performed and against what declared functionality.
- Defines the types of election and vote data required for effective testing.
- Defines the types of voting system threats and vulnerabilities against which the voting system will be tested.
- Serves as a foundation for the development of **ES&S EVS 6.2.0.0** test suites
- Defines the process for recording and reporting test results.

1.6 Testing Responsibilities

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 6.2.0.0** voting system.

1.6.1 Project Schedule

The project schedule consists of the components listed in the following subsections:

1.6.1.1 Owner Assignments

- System Analysis and Review will be conducted by Source Code Review, Security and Voting Test Specialists, with oversight by the Test Manager

- Source code review will be conducted by Source Code Review Specialists, with oversight by the Test Manager
- Documentation review will be conducted by Security and Voting Test Specialists, with oversight by the Test Manager
- Test Module Development and Validation will be conducted by Security and Voting Test Specialists (VTS), with oversight provided by the Test Manager
- Test Suite Development and Validation will be conducted by Security and Voting Test Specialists, utilizing SLI's formal Test Methods, with oversight provided by the Test Manager
- Formal Test Execution will be conducted by Security and Voting Test Specialists, with oversight by the Test Manager
- 3rd Party testing will be conducted by the subcontracting 3rd Party Hardware Laboratories, with oversight by the Hardware Specialist

1.6.1.2 Test Module Development and Validation

Test Modules will be developed to provide repeatable detailed test steps. The Modules are designed for use in any suite that employs their functionality. 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 contribute directly to the "Exhaustive verification of every system function and combination of functions cited in the vendor's documentation", as defined by the VVSG's definition of the Functional Configuration Audit (FCA). Under the 2005 VVSG, this portion of the certification is considered to be part of the FCA.

1.6.1.3 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. Various system configurations will be identified within the suites. Under the 2005 VVSG, this portion of the certification is considered to be part of the FCA.

1.6.1.4 Formal Test Execution

Formal Test Execution of the validated Test Suites will be conducted against the declared voting system, utilizing Compliance/Trusted Build software and firmware components, in order to test to determine whether or not the system is compliant with the VVSG requirements. Under the 2005 VVSG, this portion of the certification is considered to be part of the FCA.

1.6.1.5 3rd Party Hardware Testing

Hardware testing will be conducted by 3rd Party certified hardware test laboratories to verify the voting system devices are in compliance 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 NIST NVLAP Handbook 150-22 (2005). The labs listed below will perform non-core hardware testing for this certification test campaign.

Table 2 – 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	7/7/2017 – 8/7/2017
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	7/7/2017 – 8/24/2017

1.6.1.6 EAC & Manufacturer Dependencies

The Test Plan will require EAC approval prior to finalization.

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

The source code must have all discrepancies 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.

1.7 Scope of Testing

SLI will provide testing on the **ES&S EVS 6.2.0.0** voting system based on the guidelines established for voting system verification testing as defined by the EAC's 2005 VVSG. This effort will include all required levels of software, firmware, system and hardware testing required to demonstrate that the **ES&S EVS 6.2.0.0** voting system is tested against the requirements of the 2005 VVSG.

SLI's major task categories for voting system verification testing, as defined by SLI's NVLAP audited and approved Quality System Manual, as well as the 2005 VVSG, include:

- Physical Configuration Audit (PCA)
    - Iterative documentation review and assessment
    - Iterative source code review
    - Trusted Builds/Compliance Builds. Identify the Trusted Build process to establish the system version and components being tested and ensure that the qualified executable release is built from the reviewed components.
    - Software and Hardware Configuration Audit. Verification of software and hardware physical and functional configurations.

      Note that Documentation and Source Code Review are denoted as "Iterative". When either Documentation or Source Code is reviewed, and items that do not meet the VVSG requirements are found, discrepancy reports are generated and sent to the manufacturer. Next, the manufacturer is allowed to resolve the issue and re-submit the item in question. SLI then re-reviews to verify that the requirement is met. (SLI also validates that nothing else has been modified; if something else was modified, it is also re-reviewed.)

- Functional Configuration Audit (FCA)
    - Review of other relevant state verification testing or risk analysis results.
    - Review of prior hardware testing results.
    - Testing of voting system components and fully integrated systems to validate functionality, logic processing, system performance, security, and system level integration. This testing includes the formal test execution, utilizing customized iterations of SLI's formal Test Methods for the **ES&S EVS 6.2.0.0** voting system. Regression testing will be done when issues are found in testing and source code is modified, re-reviewed and re-built.
    - Accuracy testing and validation of a voting system's ability to accurately read and tally a large number of ballot marking positions within the requirements allowed by the 2005 VVSG.

  - Security testing and validation that a voting system is tested against all security related requirements as well as assessing the effectiveness of a voting system's security controls.
  - Verification of every system function cited in the vendor's documentation.

- Management of **ES&S EVS 6.2.0.0** supplied deliverables, SLI's test artifacts, and software, firmware, hardware and system test configurations.
- Generation of detailed and repeatable test modules based on SLI's formal Test Methods, to ensure the voting system is tested against all applicable requirements of the 2005 VVSG and associated **ES&S EVS 6.2.0.0** specific requirements.
- Generation of test data required for all test modules.
- Traceability of test modules to the requirements of the 2005 VVSG.
- Reporting of all test results.

SLI will develop and submit to the EAC a final test report for the **ES&S EVS 6.2.0.0** voting system.

1.8 Scope of the ES&S EVS 6.2.0.0 Voting System

1.8.1 System Overview

This section provides a description of the scope of **ES&S EVS 6.2.0.0** voting system and components:

- The **ES&S EVS 6.2.0.0** voting system represents a set of software applications for pre-voting, voting and post-voting election project activities for jurisdictions of various sizes and political division complexities. **ES&S EVS 6.2.0.0** functions include:
  - Defining the political divisions of a jurisdiction and organizing the election with its hierarchical structure, attributes and associations.
  - Defining the election events with their attributes such as the election name, date and type, as well as contests, candidates, referendum questions, voting locations and their attributes.
  - Preparing and producing ballot for polling place and absentee voting.
  - Preparing media for precinct voting devices and central count devices.
  - Configuring and programming the **DS200** digital scanners.
  - Configuring and programming the **ExpressVote HW1.0** and **ExpressVote HW2.1** Universal Voting System devices.
  - Producing the election definition and auditing reports.

- Providing administrative management functions for user, database, networking and system management.
- Import or manual data entry of the Cast Vote Records from **DS200, DS450**, and **DS850**. Preview and validation of the election results.
- Producing election results tally according to voting variations and election system rules.
- Producing a variety of reports of the election results in the desired format.
- Publishing of the official election results.
- Auditing of election results including ballot images and log files.

The **ES&S EVS 6.2.0.0** voting system is composed of software applications, central count location devices and polling place devices with accompanying firmware, and COTS that are supported by the voting system.

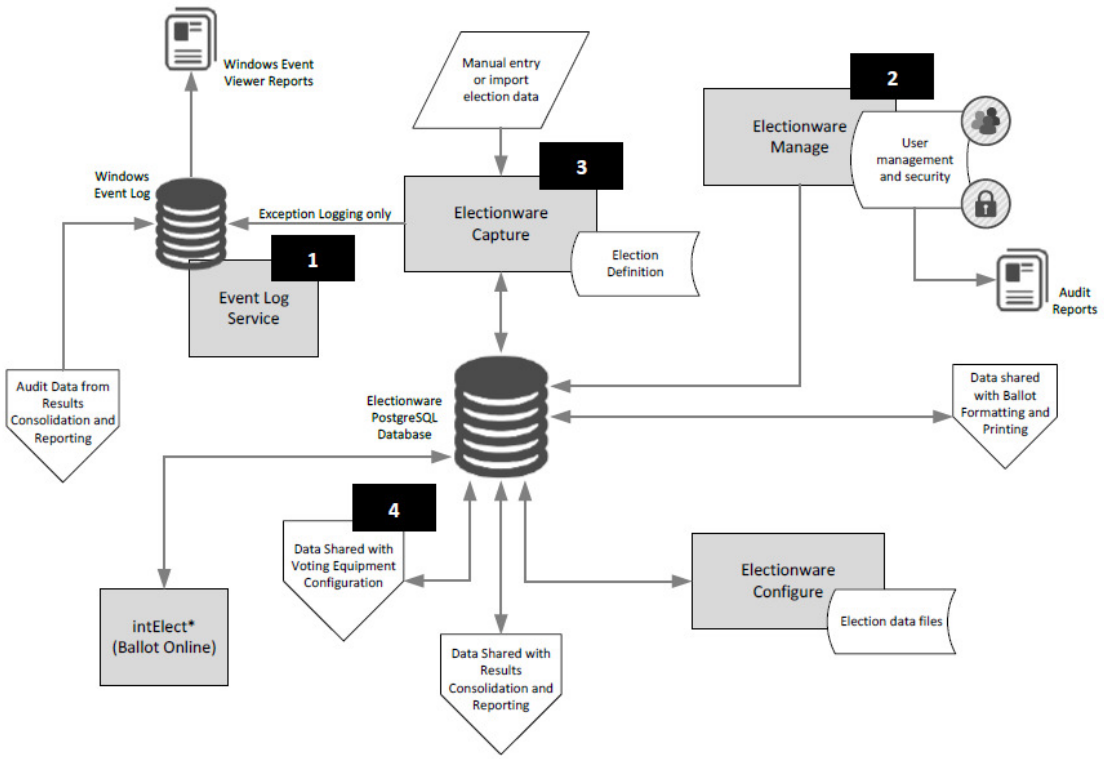
- **Electionware** is an end-to-end election management software application that provides election data creation, ballot formation, equipment configuration, result consolidation, adjudication and report creation.
  - Prior to the election, the **Electionware** interface handles all tasks that define the image of a paper ballot of an election including: contests, parties and options. Then, **Electionware** converts all database information into ballot definition parameters for **ExpressVote HW1.0** and **ExpressVote HW2.1 Universal Voting Systems, as well as**, **DS200**, **DS450**, and **DS850** tabulators through the **Removable Media Service** by programming media for each device.
  - Post-election, **Electionware** gathers and combines results from all tabulator types and generates reports. Ballot images for adjudication are also able to be collected and reviewed.
- **ExpressVote Hardware 1.0** is a polling place Universal Voting System that provides digital vote capture through a touch screen or accessibility interface using a detachable ADA keypad or ADA support peripheral such as sip-and-puff device or two-position switch. When the voter selections are complete a vote summary screen requires voters to confirm or revise their selections prior to printing. Once printed, the voter-verifiable paper record is ready to be scanned on any ES&S tabulator.
- **ExpressVote Hardware 2.1** is a polling place Universal Voting System and precinct tabulator that provides digital vote capture through a touch screen or accessibility interface using a detachable ADA keypad or ADA support peripheral such as sip-and-puff device or two-position switch.
  When the voter selections are complete a vote summary screen requires voters to confirm or revise their selections prior to printing. Once printed, the voter-verifiable paper record is digitally scanned on a compatible **ES&S**

tabulator. When mounted on a rolling kiosk the device can tabulate printed vote summary cards.

- **DS200** is a polling place scanner and tabulator that scans completed printed ballots and/or vote summary cards. After the voter marks a paper ballot either manually or digitally, their ballot is inserted into the unit and tabulated to a USB memory device and internal vote counter. Once the ballot is tabulated, the ballot is dropped into an integrated ballot box. An integrated printer prints zero reports, log reports, and polling place totals upon the official closing of the polls.
- **DS450** is a central scanner and tabulator that simultaneously scans the front and back of a paper ballot and/or vote summary card in any of four orientations. The **DS450** sorts tabulated ballots into discrete output bins without interrupting scanning, based on pre-defined sort criteria. Optionally, this device may be configured to transmit tabulation results to the results server through a closed network connection rather than using physically transported media.
- **DS850** is a high-speed digital processing scanner and central tabulator that scans and automatically sorts paper ballots and/or vote summary cards in all four orientations. Optionally, this device may be configured to transmit tabulation results to the results server through a closed network connection rather than using physically transported media.
- **Event Log Service (ELS)** monitors user's interactions with the Election Management System.
- **Removable Media Service (RMS)** is a utility which reads information from attached USB devices.

1.8.2 Block Diagram

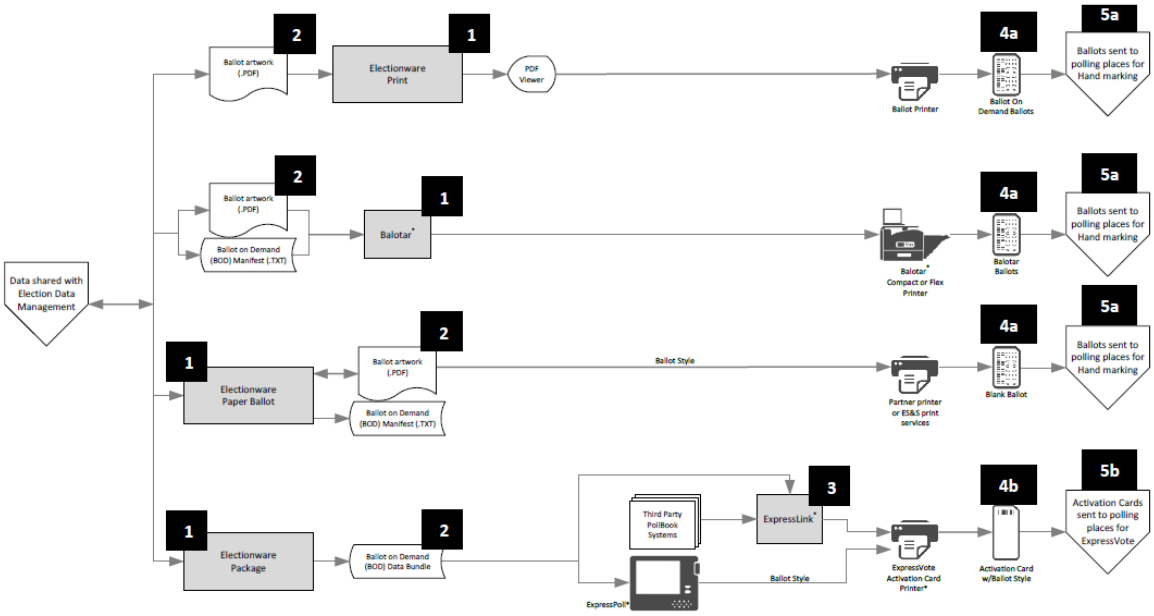
Election Management Diagram



Election Data Management Diagram Description

Function Name	Description
1. **Event logging**	The users' interactions with the Election Management System are primarily logged to the Electionware Postgres database. Events that happen when a connection to the database is not available are logged to the Windows Operating System log through the Event Log Service.
2. **Configuring users and Electionware security**	Administrators use Electionware Manage to control user accounts and passwords, enter initial jurisdiction setup. Security passwords for Electionware are added during installation.
3. **Configuring and editing election data**	EMS programmers use Electionware Capture to enter ballot languages (including audio) and language groups; enter parties, precincts and registered voters; add district types and districts, assign precincts to districts; add headings, contests and poll places, assign precincts to polling places and generate ballot styles from the Manage menu bar. Capture's Tools menu bar imports election data, imports and export ballot translations, edits election options, sets user preferences and more.
4. **Setting equipment security and configurations**	This module configures settings and security for ES&S voting equipment. After finalizing equipment settings, election coders use commands from the Tools menu to create equipment configuration files.

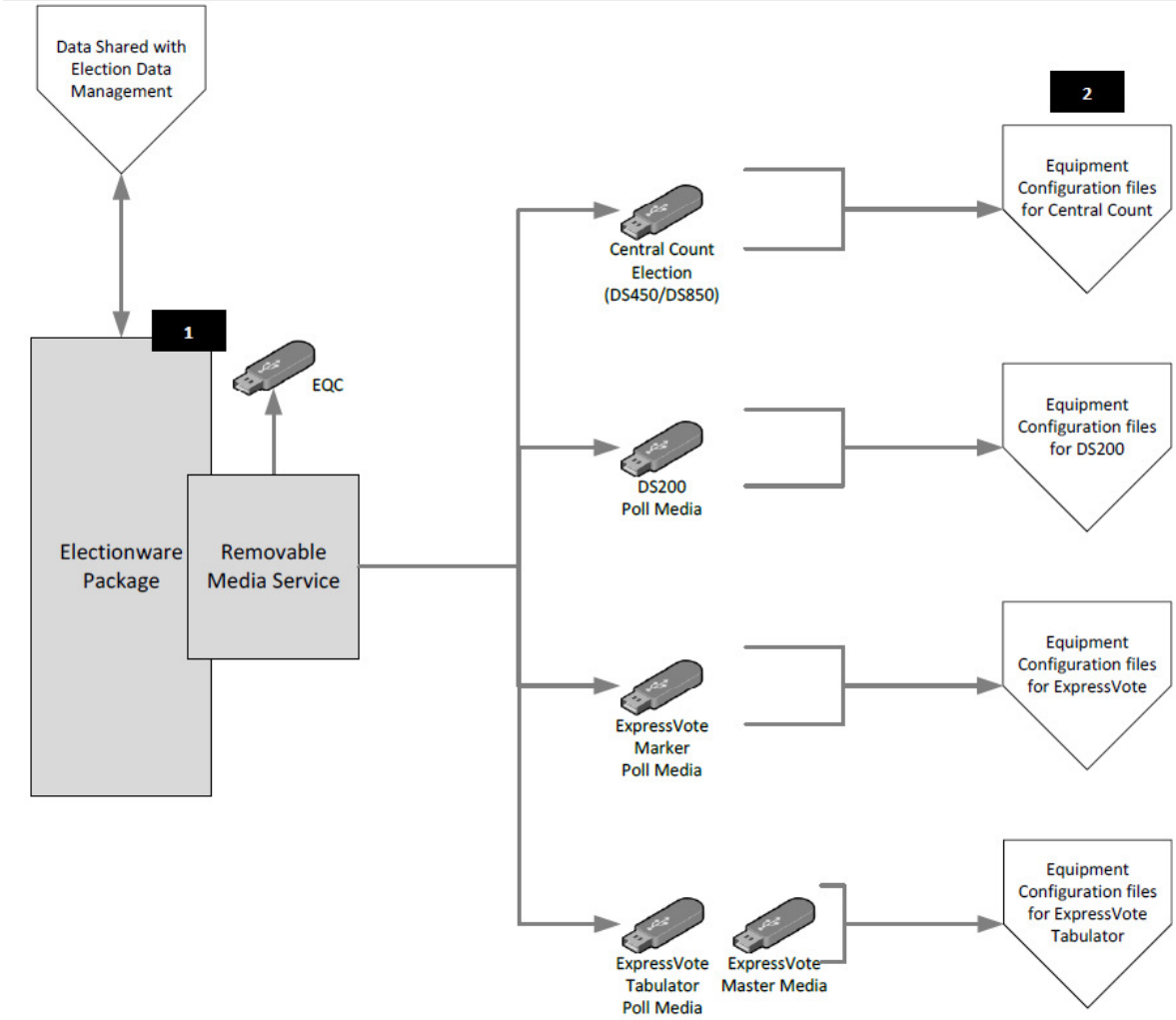
Ballot Formatting and Printing Diagram



Ballot Formatting and Printing Diagram Description

Function Name	Description
1. Formatting Ballot Layouts	Depending on the ballot's destination, either Electionware Print, Balotar, Electionware Paper Ballot or Electionware Package uses information configured in a jurisdiction's election database (created in Capture) to format finished ballot layouts.
2. Ballot Artwork and Data Files	PDF ballot artwork files and/or ballot on demand data files are used for ballot production. • **Ballot Artwork:** PDF ballot files are sent to ES&S ballot services, or a third party ballot printer for production. • **Ballot on Demand Files:** Electionware Package uses ballot layout information generated in Paper Ballot to create Ballot on Demand files.
3. ExpressLink Application	ExpressLink receives Ballot on Demand files from Electionware Package and electronic Pollbook systems. ExpressLink uses this information to format the ballot style code for an ExpressVote activation card. This code on the activation card activates the correct ballot the voter is authorized to vote.
4. Ballot / Activation Card Printing	a. **Ballot Printing**: ES&S Print Services, a ballot printer, a Balotar printer or a certified partner printer, convert ballot artwork to paper ballots. b. **Activation Card Printing**: ExpressLink sends the ballot activation code information to the ExpressVote Activation Card Printer. The ExpressVote Activation Card Printer produces the ExpressVote activation card with ballot style.
5. Ballot / Activation Card	a. **Ballot Distribution**: Ballots are distributed to live elections for hand marking use. b. **Activation Card Distribution**: Blank activation cards or activation cards with ballot styles are distributed to live elections for ExpressVote use.

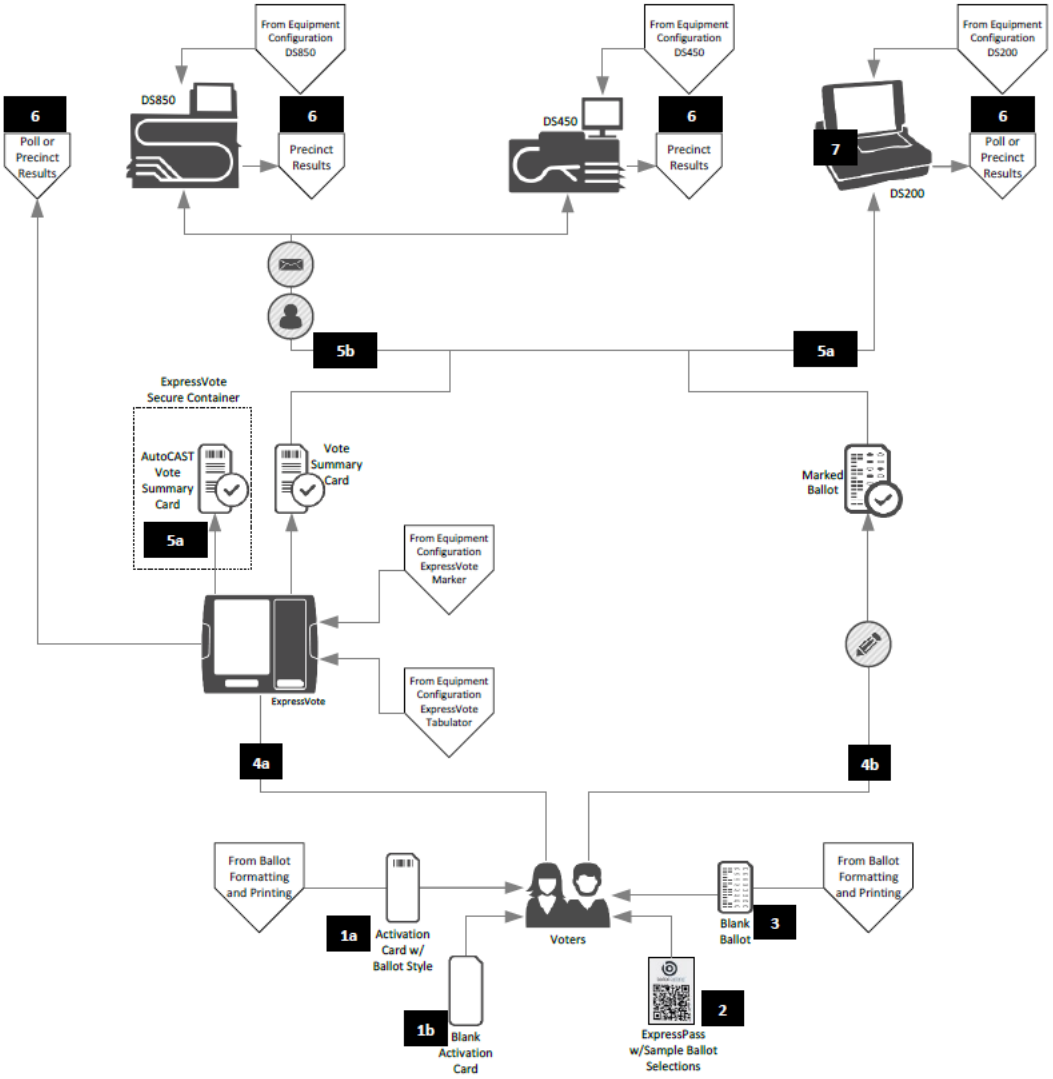
Voting Equipment Configuration Diagram



Voting Equipment Configuration Diagram Description

Function Name	Description
1. **Create media files**	The Electionware Package module creates election media. Once created, election media can be used to test the generated election through logic and accuracy testing.
2. **Program equipment media**	Equipment configurations, including election, precinct and security information write to poll media from the Electionware Package module.

Voting and Tabulation Diagram

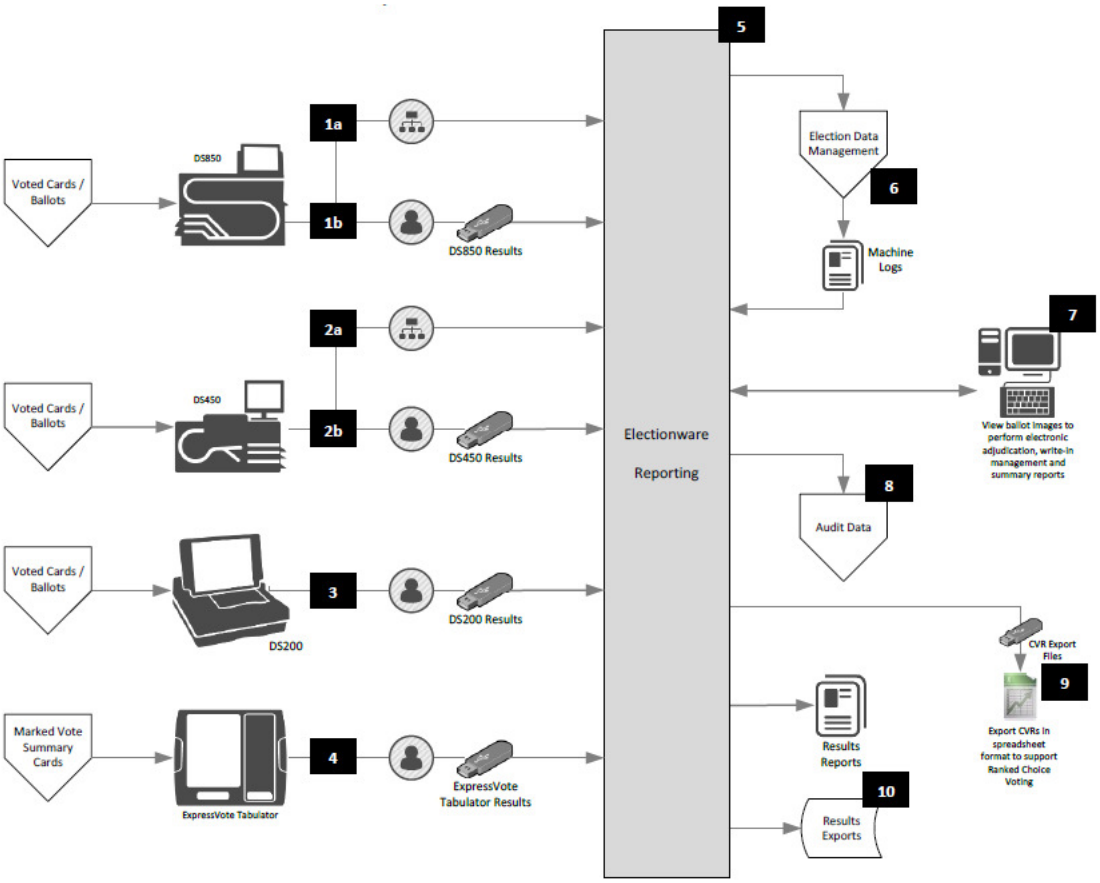


Voting and Tabulation Diagram Description

Function Name	Description
1. Voter receives activation card	Activation cards may be used in either ExpressVote or ExpressVote XL devices. a. **Activation card with ballot style from ExpressLink:** ExpressLink captures the voter's correct ballot style from a poll worker or a supported electronic Pollbook and prints the correct ballot style code on the voter's card using the ExpressVote Activation Card Printer. This is similar to the code channel on a paper ballot. b. **Blank activation card:** The voter's ballot style is manually selected by a poll worker from the ExpressVote terminal.
2. Voter brings ExpressPass	The voter uses the ExpressVote to scan, review and validate vote selections from their printed or electronic ExpressPass sample ballot selections. The resulting vote summary card may then be submitted for tabulation on an ES&S tabulator: ExpressVote as a Tabulator, DS200, DS450 or DS850.

Function Name	Description
3. Voter receives blank ballot	The jurisdiction distributes ballots for Election Day use.
4. Ballot marking	a. **ExpressVote as a Marker or Tabulator:** Vote input/processing with the ExpressVote device b. **Manual Marking:** Hand marking a paper ballot
5. Ballot scanning	a. **Precinct Scanning:** Ballots and/or vote summary cards are scanned for tabulation at the polling place using the ExpressVote as a Tabulator or the DS200. b. **Absentee or Central Scanning:** The DS450 and DS850 process absentee mail ballots or ballots and/or vote summary cards manually transported from polling places.
6. Results collection	The tabulators save poll or precinct level results to election media for consolidation and reporting. Poll workers can transfer precinct level results to the reporting subsystem using an optional network connection with the DS450 or DS850.

Results Consolidation, Adjudication and Reporting Diagram



Results Consolidation, Adjudication and Reporting Diagram Description

Function Name	Description
1. **Results collection – DS450**	a. **Local Network Transfer**: Results transfer to Electionware Reporting over an optional DS450 local area network connection. b. **Manual Transfer**: Manual transfer of a USB flash drive containing election results from the DS450 to Electionware Reporting.
2. **Results collection – DS850**	a. **Local Network Transfer**: Results transfer to Electionware Reporting over an optional DS850 local area network connection. b. **Manual Transfer**: Manual transfer of a USB flash drive containing election results from the DS850 to Electionware Reporting.
3. **Results collection – DS200**	Manual transfer of a USB flash drive containing election results from the DS200 to Electionware Reporting.

Function Name	Description
4. Results collection – ExpressVote Tabulator	Manual transfer of a results media USB flash drive containing election results from one or more ExpressVote as a Tabulator devices on a single master media flash drive to Electionware Reporting.
5. Results data consolidation	Electionware Reporting consolidates vote totals by reading physical results media to generate consolidated election reports.
6. Results processing in Electionware	Electionware Reporting reads results and ballot images from a monitored data folder. Electionware Reporting can print machine audit logs and results media status reports.
7. Results processing in Electionware	Electionware Reporting can be used to: • View, filter and adjudicate ballots included in loaded results • View write-in images, assign write-in names, report and tally write-in results • View, save, and print PDF, RTF, TXT, HTML, XML, XLSX and CSV versions of the Election Summary Results reports • Update registered voter totals • Track precinct status for Election Night reporting
8. Audit Logging	The users' interactions with the Election Management System are primarily logged to the Electionware Postgres database. Events that happen when a connection to the database is not available are logged to the Windows Operating System log through the Event Log Service.
9. Export Cast Vote Record (CVR) data for Ranked Choice Voting (RCV) processing.	Electionware Reporting generates and exports a Cast Vote Record data file as a spreadsheet formatted to match jurisdiction specifications. The jurisdiction can apply Ranked Choice Voting logic to the spreadsheet data, using a system developed independently, to determine Ranked Choice Voting results.
10. Results exports generation	Electionware Reporting outputs reports in paper and electronic format for distribution to election workers, candidates and the media.

1.8.3 System Limits

This section details various limits within the **ES&S EVS 6.2.0.0** voting system. Limits will be reviewed and verified for accuracy.

- Max precinct allowed in an election: 9,900
- Max candidate allowed per election: 30,000
- Max contests allowed in an election: 30,000
- Max contests allowed per ballot style: 500 or number of positions on ballot
- Max candidate (ballot choices) allowed per contest: 230
- Max number of parties allowed in General Election: 75
- Max number of parties allowed in Primary Election: 30
- Max 'vote for' per contest: 500
- Max ballot styles: 15,000
- Max district types/groups: 25

- Max district of a given type: 250
- Max reporting groups: 14
- Electionware
    - Electionware Export Ballot Images function is limited to: 250 districts per export
- ExpressVote, Hardware 2.1
    - Secure Card Container Capacity: 300 vote summary cards
- DS200
    - Early voting station does not support precinct level results reporting
    - Storage limitation for write-in ballot images is 3,600 images
    - Write-in image review requires min 1 GB of onboard RAM.
    - Plastic Ballot Box Capacity
        - Standard compartment: 1,250 ballots
        - Removable tote bin: 1,500 ballots
        - Auxiliary compartment: 100 ballots
    - Metal Ballot Box Capacity
        - Main compartment: 1,500 ballots
        - Write-in compartment: 1,500 ballots
        - Auxiliary compartment: 125 ballots
- DS450
    - Approx. 5 million ballot images and related data of memory
    - Tray/Bin Capacity
        - Input tray 480
        - Output bin 480
        - Outstack bins 150
- DS850
    - Approx. 5 million ballot images and related data of memory
    - Tray/Bin Capacity
        - Input tray 480
        - Output bin 480
        - Outstack bin 150

- Number of characters allowed on a single Write-In selection: 30

1.8.4 Supported Languages

The **ES&S EVS 6.2.0.0** voting system has declared support for English, Spanish, Chinese, Korean, Japanese, Hindi, Bengali, Vietnamese, Tagalog, Creole, Russian, and French languages for this certification project.

1.8.5 Supported Functionality

The following standard VVSG functionality and manufacturer extensions are included in the voting system.

1.8.5.1 Voting Variations

The **ES&S EVS 6.2.0.0** supports the following voting variations:

- Closed primaries
- Open primaries
- Partisan offices
- Non-partisan offices
- Write-in voting
- Ballot rotation
- Straight party voting
- Cross-party endorsement
- Split precincts
- Vote for N of M
- Recall issues with options
- Ranked Choice Voting (ballot formatting and CVR export only)
- Provisional or challenged ballots

1.8.5.2 Electionware - Pre-voting Functionality

Electionware consists of four pre-voting software groups: Manage, Define, Design and Deliver, all of which allow users to prepare an election by defining election data and ballot styles that can be transferred to portable flash media for purposes of voting and vote capture.

The *Manage* group allows the election official to manage users and jurisdictions. The Setup module adds and edits users and jurisdictions and sets the strength of election codes.
The *Define* group is used to input critical election data. The Define group allows users to: create, edit and manage elections; enter election based information into database like precincts, districts, contests, candidates, and other pertinent

information; and stores graphics for ES&S equipment and for managing system translations and audio.
The *Design* group designs ballots and audio elements for an election. The Design group controls: paper ballot design for use with ES&S equipment, electronic ballot design to support multiple screen layout sizes, format ballot display options as they will appear, manage ADA audio settings, and validate data before the election files are generated.
The *Deliver* group configures equipment, packages election data and prints ballots on demand. This group provides specific access to allow users to: set parameters and access codes for election equipment, create election media files, view and print BOD (Ballot on Demand) ballots by precinct.

Importing and Managing Election Data

Electionware supports importation of and the creation and configuration of an election as follows:

- Stores all of a jurisdiction's precinct, office, and candidate information.
- Once an election database is complete, it can be recalled and edited.
- The System Event Log tracks all user and equipment actions throughout the election process.

Formatting Ballots

Electionware includes a functional subsystem providing all activities related to defining the image of a paper ballot and populating the ballot with contest, candidate and referendum information from the database in the Paper Ballot module, which prepares an election by defining ballot styles.

Proofing Election Data

Electionware provides the following proofing capabilities:

- Provides methods to validate ballot data that has been entered.
- Users can:
    - View ballot style previews through an embedded viewer.
    - Print ballot style previews.
    - Save ballot styles to image files.
    - Proof recorded audio strings.
- **Electionware** allows users to proof translations for supported languages.
- **Electionware** supports the production of various reports that allow users to proof-read and validate ballot data entry.

Ballot Content – Supported Information

Electionware supports the following types of data:

- Ballot header information, includes the election type, ballot label, jurisdiction name, election title, election date.
- Standard and customized ballot instructions.

- Election types.
- Party information and graphics.
- Contest types and associated contest options, including contest-specific instruction text and/or proposition text.
- Rotation Indices.

Electionware is capable of formatting ballots with the following information:

- Unique ballot identifying information.
- Page numbering.
- Static text strings.
- Ballot instructions with custom content.
- Ballot images.
- Multi-language data (including audio, text, and image files as appropriate).
- Election data per contest with fully detailed options/candidates and images according to the contest type. Contests include candidates and propositions.
- Voting logic per contest entry to set the voting and tabulation method per contest.
- Write-in options.

Ballot Standards

Electionware employs and supports the ballot standards as follows:

- Supports the following paper sizes:
  - 8.5” x 11”
  - 8.5” x 14”
  - 8.5” x 17”
  - 8.5” x 19”
- Supports ballot layouts in portrait and landscape orientation.
- Supports duplex ballot layouts.
- Supports the inclusion of ballot stubs on paper ballots.
- Compatible with the production of ballots on standard, commercially available white paper stock.

Ballot Layout Features

Electionware supports ballot layouts as follows:

- Supports the layout of ballots in paper-based and electronic formats.

Previewing Ballot Layouts

Electionware supports previewing ballot layouts as follows:

- Allows users to view on-screen graphic previews of exact ballot layouts.
- Allows users to specify which ballot types are previewed, according to a variety of user-defined attributes, including precinct, style, type, language, and party.
- Supports users to proof-read and validate ballot layouts.

- Supports the production of audit logs for transparency.

Configuring Ballot Handling Equipment

Configuration of ballot handling equipment includes all tasks required to convert **Electionware** database information into ballot definition parameters for tabulation and Universal Voting System equipment. Within this functional subsystem, election management software users program the ballot counting rules for a specific election – the election definition – to the memory devices used to program tabulation equipment.

Generating Election Media

Electionware employs and supports generation of election media as follows:

- Allows users to generate portable flash media that includes election data and ballot style information that the user has accepted.

Ballot Production

Electionware employs and supports ballot production as follows:

- Supports ballot production in a variety of formats, including paper ballot printing, generation of electronic ballots, and production of ballot printing files in PDF format, for use by third-party commercial printers.

1.8.5.3 DS200 – Device Functionality

DS200 provides paper ballot scanning capabilities. When scanned, the system validates the ballot according to voter marks and the associated election contests. If issues are located, the system may provide a warning or flag the scanned ballot for review. The scanned voter selections are stored to a USB memory device. The USB memory device is removable from the system for transport to a central election location where vote totals are consolidated for reporting.

General

DS200 devices support the following components:

- Scanning mechanism for all ballot sizes and vote summary cards
- Paper ballot transport path
- Plastic Ballot Box Capacity
- Metal Ballot Box Capacity
- Collapsible Ballot Box Capacity
- USB Memory Capacity
- Optional system health status in a QR two dimensional barcode that can be scanned to pass the data back to a central administration site in preparation for opening the polls.

Scanning

DS200 Devices:

- Include a bi-directional scanner.
- Accommodate duplex scanning.
- Are capable of capturing and storing the ballot image on removable media.
- Are capable of capturing and storing the digital image of a write-in vote.
- Enlist a multi-sheet scanning functionality.
- Scan paper ballots and/or vote summary cards in all portrait orientations (face up, face down, header first, footer first).
- Mechanism that allows counted ballots to be stamped and can be configured to stamp all ballots or ballots meeting criteria selected by the election administrator such as ballots containing over votes or write-ins.
- Maintains a real-time audit log printable from each terminal's integrated printer and stored on the election media.

Configurable Settings

DS200 Devices are configurable for:

- Unconditional acceptance where the **DS200** accepts and tabulates results for all ballots.
- Unconditional rejection where the **DS200** automatically rejects ballots that contain the specified condition.
- Query the voter for revision where the **DS200** displays a screen message that describes the condition and prompts the voter to either review and revise the ballot or cast the ballot as it is.
- Optional results backup media capability.
- Capturing ballot images that can be viewed in **Electionware**.

Supported Ballot Types

DS200 Devices:

- Accept vote summary cards of all lengths
- Accept ballots of all lengths
- Maintain public ballot counters that reflect the total number of ballots cast or marked for the current election configuration and the total number of sheets processed.

Scanning Device Vote process

DS200 Devices:

- Display voter instruction messages for all valid operations.
- If configured to unconditionally reject an exception ballot, the system returns the ballot to the voter and displays a message describing the exception condition.

- If configured to unconditionally accept, the inserted ballot will be tabulated as marked, which may result in the inclusion of undervotes and/or overvotes in system totals.
- If configured to query the voter prior to acceptance, the **DS200** displays a message describing the exception condition, indicates the mismarked ballot, and prompts the voter to revise the ballot.

Scanning Device Error Handling

DS200 Devices:

- When applicable, display all error messages as they occur on the LCD display.
- Provide error messages to assist operators to determine the correct action.
- Recognize multiple sheet detection where more than one sheet of paper is recognized and returns an error message to the user display indicating the error.
- Are designed to detect and record critical events in the Audit log and critical events report.

Security

DS200 uses digital signatures, encryption, and security access codes to safeguard data.

1.8.5.4 DS450 – Device Functionality

DS450 is a high-throughput central scanning component that provides paper ballot scanning functionality and conversion of voter selection marks to electronic Cast Vote Records (CVR). Once the CVR's are stored they can be transferred into **Electionware** software for vote tabulation, adjudication and reporting of election results.

General

The **DS450** central scanner:

- Is capable of operating in local network or standalone configurations.
- Loads a set of election definition files via an **ES&S** Election flash drive.
- Captures an image of the ballot to create a vote image record that is used to aggregate totals whenever the user selects to export results to the **ES&S** Results flash drive.
- Transports paper ballot to output bins.
- Has USB Memory Capacity.

Scanning

The **DS450** device scans ballots, designed by **Electionware** in the Paper Ballot module, through the paper transport mechanism. The **DS450** is able to:

- Scan bi-directionally.
- Accommodate duplex scanning.
- Analyze each possible oval location.
- Use software to determine user markings at each possible active response location and store these values along with the Election Definition to determine the voter's choices.
- Scan multiple precincts using the precinct selection option.
- Tabulate ballots at a central scanning location.
- Capture and store ballot images on removable media.
- Capture and store the digital image of a write-in vote.
- Support Multi-Sheet scanning functionality.
- Scan paper ballots and/or vote summary cards in all portrait orientations (face up, face down, header first, footer first).
- Provide system audit log records all error conditions and corrective actions.

Configurable Settings

DS450 devices are configurable:

- To scan vote summary cards printed by the **ExpressVote HW1.0 and ExpressVote HW2.1**.
- To use the ballot tracking option to visually show the user which ballots are not processed and which ballots can remain in the output bin.

Supported Ballot Types

DS450 devices:

- Accept vote summary cards of all lengths.
- Accept ballots of all lengths.
- Maintain public ballot counters that reflect the total number of ballots cast or marked for the current election configuration and the total number of sheets processed.

Scanning Device Operator process

DS450 devices:

- Allow the operator to preview/print the election Zero Report once the election definition is loaded.
- Allow the operator to save and export the results and ballot images, after each batch is scanned, continue scanning additional batches, change sort options, delete the current unsaved batch, or generate election reports.

Scanning Device Error Handling

DS450 devices check:

- If any problems occur during the scanning process or if the ballot is not identified in the Election Definition, the ballot may be diverted to an exception bin for further analysis.
- If the precinct on the ballot does not match the selected precinct for that stack of ballots, that ballot will be out stacked.
- If a jam occurs and stops processing ballots and identifies which ballots were counted and which need to be returned to the input tray for scanning.
- If exceptions occur, the Master Control Program handles exceptions by logging the event through the Audit ID, which contains the error. The error is logged using the built-in operating system logging functionality.

1.8.5.5 DS850 – Device Functionality

DS850 is a high speed central scanning component that provides paper ballot scanning functionality and conversion of voter selection marks to electronic Cast Vote Records (CVRs). Once the CVRs are stored they can be transferred into **Electionware** software for vote tabulation, adjudication and reporting of election results.

General

The **DS850**:

- Is capable of operating in local network or stand-alone configurations.
- Loads a set of election definition files via an **ES&S** Election flash drive.
- Captures an image of the ballot to create a vote image record that is used to aggregate totals whenever the user selects to export results to the **ES&S** Results flash drive.
- Transports paper ballot to output bins.
- Has USB Memory Capacity.

Scanning

The **DS850** device scans ballots and/or vote summary cards, designed by **Electionware** in the Paper Ballot module, through the paper transport mechanism. The **DS850** is able to:

- Scan both the front and back sides of the ballot.
- Analyze each possible oval location.
- Use software to determine user markings at each possible active response location and store these values along with the Election Definition to determine the voter's choices.
- Scan multiple precincts using the precinct selection option.
- Tabulate ballots at a central scanning location.

- Capture and store ballot images on removable media.
- Capture and store the digital image of a write-in vote.
- Support Multi-Sheet scanning functionality.
- Scan paper ballots and/or vote summary cards in all portrait orientations (face up, face down, header first, footer first).
- Provide system audit log records of all error conditions and corrective actions.

Configurable Settings

DS850 devices are configurable:

- To scan vote summary cards printed by the **ExpressVote HW1.0 and ExpressVote HW2.1**.

Supported Ballot Types

DS850 devices:

- Accept vote summary cards of all lengths.
- Accept ballots of all lengths.
- Maintain public ballot counters that reflect the total number of ballots cast or marked for the current election configuration and the total number of sheets processed.

Scanning Device Operator process

DS850 devices:

- Allow the operator to preview/print the election Zero Report once the election definition is loaded.
- Allow the operator to save and export the results and ballot images, after each batch is scanned, continue scanning additional batches, change sort options, delete the current unsaved batch, or generate election reports.

Scanning Device Error Handling

DS850 devices check:

- If any problems occur during the scanning process or if the ballot is not identified in the Election Definition, the ballot may be diverted to an exception bin for further analysis.
- If the precinct on the ballot does not match the selected precinct for that stack of ballots, that ballot will be out stacked.
- If a jam occurs and stops processing ballots and identifies which ballots were counted and which need to be returned to the input tray for scanning.
- If exceptions occur, the Master Control Program handles exceptions by logging the event through the Audit ID, which contains the error. The error is logged using the built-in operating system logging functionality.

1.8.5.6 ExpressVote Hardware 1.0 – Device Functionality

ExpressVote HW1.0 is a vote capture device designed for all voters, with independent voter-verifiable paper record that is digitally scanned for tabulation on a compatible **ES&S** tabulator. This system combines paper-based voting with touch screen technology.

Multiple Ballot Styles
If an election has more than one ballot style:

- The initial **ExpressVote HW1.0** system prompts the user to insert an activation card, and then select the correct ballot style and precinct, in order to display the proper ballot for the voter.
- If an activation barcode has been printed on the card by a poll worker, when the voter inserts the card, the **ExpressVote HW1.0** scans the barcode and immediately displays the proper ballot for the voter.
- The **ExpressVote HW1.0** accepts both **ES&S** created activation barcodes and authorized activation barcodes from other voter identification vendors.

Accessibility Support
The **ExpressVote HW1.0** is designed for all voters, along with the ballot display and audio prompts, the device supports:

- A detachable keypad (DKB), which is used with audio prompts to vote the ballot.
- Two-position switch devices such as a sip-and-puff and rocker switch.

Configurations
The **ExpressVote HW1.0** has four configurations: ADA table, tabletop, voting booth, or rolling kiosk.

- The rolling kiosk is easily positioned for seated or standing voters and can optionally provide QR code scanning, report printing, and a secure card container.
- The **ExpressVote HW1.0** supports judge's initial and review boxes.

Telecommunications Abilities

- No telecommunication capabilities for transfer of data from the polling site.

Security
ExpressVote HW1.0 uses digital signatures, encryption, and security access codes to safeguard data.

Audio Interface
With audio election data to be loaded and headphones connected to the **ExpressVote HW1.0**, the unit's operating system and loaded firmware provide a

platform for playing audio files from the **ES&S** Election flash drive. This audio interface complements the GUI screens by helping the voter navigate the ballot contests, select their desired candidates, print their selections on the activation card, and either retrieve or automatically cast (AutoCAST) their marked vote summary card.

1.8.5.7 ExpressVote Hardware 2.1 – Device Functionality

ExpressVote HW2.1 is a vote capture device designed for all voters, with independent voter-verifiable paper record that can be configured to digitally scan marked paper vote summary cards for tabulation. This system combines paper-based voting with touch screen technology.

Multiple Ballot Styles
If an election has more than one ballot style:

- The initial **ExpressVote HW2.1** system prompts the user to insert an activation card, and then select the correct ballot style and precinct, in order to display the proper ballot for the voter.
- If an activation barcode has been printed on the card by a poll worker, when the voter inserts the card, the **ExpressVote HW2.1** scans the barcode and immediately displays the proper ballot for the voter.
- The **ExpressVote HW2.1** accepts both **ES&S** created activation barcodes and authorized activation barcodes from other voter identification vendors.

Accessibility Support
The **ExpressVote HW2.1** is designed for all voters, along with the ballot display and audio prompts, the device supports:

- A detachable keypad (DKB), which is used with audio prompts to vote the ballot.
- Two-position switch devices such as a sip-and-puff and rocker switch.

Configurations
The **ExpressVote HW2.1** has four configurations: ADA table, tabletop, voting booth, or rolling kiosk.

- The rolling kiosk can be positioned for seated or standing voters and can optionally provide QR code scanning, reporting printing, and a secure card container.
- The **ExpressVote HW2.1** supports judge's initial and review boxes.
- Optional rear-eject feature; when disabled, the printed card is returned to the voter for insertion into a tabulator or secure ballot box. When enabled, the voter makes their selections, they are given the option to either receive their printed card or have it AutoCAST.

Telecommunications Abilities

- No telecommunication capabilities for transfer of data from the polling site.

Security

ExpressVote HW2.1 uses digital signatures, encryption, and security access codes to safeguard data.

Audio Interface

With audio election data to be loaded and headphones connected to the **ExpressVote HW2.1,** the unit's operating system and loaded firmware provide a platform for playing audio files from the **ES&S** Election flash drive. This audio interface complements the GUI screens by helping the voter navigate the ballot contests, select their desired candidates, print their selections on the activation card, and either retrieve or automatically cast (AutoCAST) their marked vote summary card.

Tabulation

In addition to retaining all feature functionality as a ballot marker, the **ExpressVote HW2.1** can also be optionally configured to tabulate printed vote summary cards. The **ExpressVote HW2.1** as a tabulator uses a Master Media device for Poll Open and Poll Close functions. The tabulated vote summary card is deposited into a removable, secure container attached to the rolling kiosk.

1.8.5.8 Post Voting Functionality

The *Results* group in **Electionware** contains the post voting capability to import, manage, and report election results data from the tabulation media. This group includes all of the tools used for loading results, machine logs, cast vote records, and ballot images; creates the results reports; ballot review and adjudication; and write-in review and management.

After the election, the Reporting module can display or export detailed status information about individual flash drives, and produce machine log reports. It can clear loaded results files, in order to delete test data or to start the loading process over. The Reporting module is also used to filter, view and export ballot data, print ballot scan images and facsimiles, and review ballot images, write-ins and cast vote records.

General

The **Electionware** Reporting module:

- Is capable of tabulating and reporting results for any election
- Can display or export detailed status information about individual status information about individual flash drives and produce machine log reports.

- Only accepts elections that have been created in **Electionware** and USB media created by **Electionware**
- Encrypts the key exchange process between the EMS and the tabulators to ensure confidentiality.
- Supports 14 reporting groups that are used to categorize different groups of ballot styles for statistical reporting purposes.
- Is capable of being installed on a "standalone" PC that is not networked to other PCs.
- If configured in a standalone configuration, the component is capable of reading an election definition from portable media that is inserted into the tabulation PC.
- Is capable of being installed on a networked workstation that is connected to other **Electionware** workstations.
- Digitally signs every cast vote record and digitally signs the package of cast vote records captured by the tabulators.
- Is capable of receiving tabulation results from a network for Central Count Tabulators.
- Is capable of supporting multiple elections at the same time.
- Allows the user to manage different elections.
- Supports the following user functions in appropriate sections of the user interface:
    - Tabulation database management
    - Reading and tabulating portable election media
    - Election progress dashboard
    - Managing write-in votes
    - Reporting (including standard reports, and customized reports)
    - Audits and recounts
- Allows users to import data from external sources to facilitate tabulation database configuration.

Results Loading

Electionware:

- Will automatically load results from every connected poll media flash drive when activated, and from the network until stopped by the user.
- Checks each flash drive as it is read to verify it is both an approved **ES&S** flash drive and that it contains matching signatures and hashes.
- Authenticates the flash drive, and then proceeds to decrypt the files on the flash drive.
- Verifies that the decrypted files have not already been processed, based on the polling location and flash drive serial numbers.
- Bases its results and reporting totals on the tabulated results in the Poll Place Collection Files.
- The CVR's and Ballot Images are used for ballot review and auditing tabulated results.

Ballot Review

Electionware provides the ability for on-screen ballot review of write-in votes and unreadable marks. **Electionware** allows an election official to:

- Review images of each write-in or unreadable mark in a contest to be assigned and tallied for reporting purposes.
- Filter reviewable fields by contest type or condition
- Bulk assign write-ins to candidates

Reporting

The election results workflow in **Electionware** is used to generate paper and electronic tabulated results reports and exports. **Electionware:**

- Offers methods to protect voter privacy in instances where reported results are based on small numbers of ballots cast.
- Provides user access level reports like: system administrator only reports, administrator reports, media creator reports, system user only reports.
- Provides several reports regardless of the user access level.
- Allows users to generate reports to various formats for review and usage in third party components.

1.8.6 Excluded Requirements

*In this section VVSG requirements are identified that do not pertain to the declared system being certified. For this certification project ES&S has elected to not support their **ExpressTouch** (DRE) implementation, as such, the table below enumerates the requirements that will not be subject to verification for this project.*

DRE Related Requirements Not Under Test
1.5.2.2
1.5.2.3
2.1.2.f
2.1.4.k,l
2.3.1.3
2.3.2
2.3.3.3
3.1.2.f,g
4.1.1.b
4.1.4.3
4.1.6.2

4.3.5.b
5.4.3.b.iv
5.5
6.2.5
7.8
7.9
3.2.1.c
Vol. 2 , 4.7.4.c

1.8.7 Additional Functionality/Requirements

As per 2005 VVSG, volume 2 section 3.2.2, review of the **ES&S EVS 6.2.0.0** Technical Requirements Documentation (TRDs) resulted in SLI's determination that some functionality/requirements that are considered beyond the scope of the VVSG, but since they are in the declared system, will require review and verification.

1.9 Change Control and Configuration Management

The SLI project team follows a standard Change Control and Configuration Management (CM) process. This specifies the methods used by SLI to ensure changes are managed and controlled effectively and efficiently and defines the process for receipt, check-in, storage and disposition of hardware, source code, TDP and non-TDP Documents.

It specifies the processes and procedures used by SLI to identify, monitor, and control versions of all of the stated EAC project deliverables, ensuring that the items are constantly and reliably managed throughout the entire duration of the engagement to ensure changes are managed and will not result in invalidated or wasted testing efforts.

A summary of these tasks includes:

- Receive TDP code:
  - Delivery department will perform a code check-in on the server. Code is placed in the specific project's TDP folder with the delivery date and documentation of what was delivered.
  - Delivery department notifies Test Manager (TM) of delivery via email.
  - TM will notify the Source Code Review (SCR) team, via email, the code is ready for review.
  - TM will review the documentation of what was delivered to determine possible testing impacts.

- Source Code Reviewer updates status of delivered code as received, what code to compare it to (if this is not new code), where code has been placed, and who will do the review of the code.
- The code is checked out by the SCR who is responsible for the code review.
- When the code review is complete, the TM is notified.
- A peer review is done on the review and all written discrepancies are verified and an official Discrepancy Report is sent.
- If the Source Code Review (SCR) Team determines the code does not meet the requirements of the 2005 VVSG, the SCR team will review code impacts with the TM.
- TM determines when code is ready for a Trusted Build. When it is, the TM sends approval for a Trusted Build to the Trusted Build team.

- Receive TDP documents:
  - Delivery department will perform a check-in of the documents on the server.
  - Documents are placed in the specific project's TDP folder with the delivery date.
  - Delivery department notifies TM of delivery via email.
  - TM assigns VTS personnel to perform the documentation review.
  - VTS personnel perform a PCA on the pertinent documentation.
  - A peer review is done on the VTS personnel's review, all written discrepancies are verified and an official Discrepancy Report is sent.

- Receive Hardware
  - The HW Specialist or designee checks in equipment that is delivered by **ES&S.**
  - Operational Status Checks are performed on all delivered hardware.
  - When the equipment comes back from the hardware lab testing, the HW Specialist checks in the equipment and verifies it's the same hardware that was sent to the lab.
  - The equipment is stored in a secure room with controlled access.

- Compliance/Trusted Build:
  - The TM assigns a Trusted Build team member to review the Compliance/Trusted Build procedures and perform the build.
  - Trusted Build team member follows build procedures exactly as written.

- Trusted Build team member pulls the finalized source code from the specific folder where it was checked in.
- Once build is complete the Trusted Build team member provides the completed build to the SLI Delivery Team to be checked in.
- Trusted Build team member notifies the TM that the Compliance/Trusted Build is completed.
- TM assigns appropriate VTS(s) to load the resulting applications/installs and begin testing.
- The VTS team performs appropriated installations, and begins testing.

2 PRE-CERTIFICATION TESTING AND ISSUES

*This section addresses any pre-certification testing that has been performed on the system under review. For this certification project, no previous testing has been performed on the **ES&S EVS 6.2.0.0** voting system, as it is a newly developed and as of yet un-fielded system.*

2.1 Evaluation of prior VSTL testing

No prior VSTL testing is pertinent to the **ES&S EVS 6.2.0.0** voting system, as it is a system undergoing an Initial Certification process.

2.2 Evaluation of prior non-VSTL testing

No prior state or non-VSTL lab testing is pertinent to the **ES&S EVS 6.2.0.0** voting system, as it is a system undergoing an Initial Certification process. Review of **ES&S** internal testing is performed during the FCA review.

2.3 Known Vulnerabilities

ES&S EVS 6.2.0.0 voting system does not contain a DRE precinct voting device, nor does it support public transmissions.

Within the declared system, the public facing components are the **DS200, ExpressVote HW1.0,** and **ExpressVote HW2.1.** The **DS200** is a precinct ballot scanning and tabulation device that processes ballots and/or vote summary cards at a polling place. **ExpressVote HW1.0** is a Universal Voting System that produces an independent voter verifiable paper record. **ExpressVote HW2.1** is a Universal Voting System that produces an independent voter verifiable paper record and can be configured as a precinct tabulator for producing and processing vote summary

cards at a polling place. The **DS450** and **DS850** devices are central ballot scanning and tabulation devices, which are implemented in a secure environment.

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 PHYISCAL CONFIGURATION AUDIT

3.1 TDP Documentation Analysis & Review

SLI will complete an assessment of the deliveries of the Technical Data Package, including Functional Requirements, Specifications, End-user documentation, Procedures, System Overview, Configuration Management Plan, Quality Assurance Program, and manuals for each of the required hardware, software and firmware components of the **ES&S EVS 6.2.0.0** voting system, in order to ensure that the documentation corresponds to the configuration and operation of the system. 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.

3.1.1 Document Review

SLI conducts a PCA review of all vendor traced documents submitted for review in the delivery of the **ES&S EVS 6.2.0.0** TDP. These include the following areas:

- System configuration overview
- System functionality description
- System hardware specifications
- Software design and specifications
- System test and verification specifications
- System security specifications
- User/system operations procedures
- System maintenance procedures
- Personnel deployment and training requirements
- Configuration management plan
- Quality assurance program

Each document included in the delivery of the voting system TDP is reviewed for compliance to the pertinent 2005 VVSG, Volume 2, Sections 2.2 through 2.13 and Volume 2, Section 6.6 requirements that are applicable to that document. Results

and associated discrepancies of the documentation TDP review will be detailed in the final test report.

3.2 TDP Source Code Analysis & Review

3.2.1 Source Code Review

The certification campaign for the **ES&S EVS 6.2.0.0** voting system includes software and firmware that have been created as proprietary to **ES&S** as well as review of any COTS products. SLI has conducted a source code review of all proprietary source code, and modified COTS products, submitted in the delivery of the voting system TDP for compliance to the VVSG, version 2005, Volume 2, Section 6.6. The coding languages involved in the vendor's applications include:

- C
- C++
- C#
- Java
- VB
- VB.net

Source Code Review Tools utilized by SLI include:

- LocMetrics Line Counter: a commercial application used to determine the counts of executable and comment lines;
- 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;
- Understand: a commercial application to perform automated review of source 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 will be verified as authentic and unmodified, otherwise reviewed as is applicable.

3.3 QA & CM Process Review

The review processes employed are designed to verify that the manufacturer not only has written processes and procedures in both the Quality Assurance and Configuration Management arenas, but that those processes and procedures are

actually implemented within the software development life cycle that is used to produce the **ES&S EVS 6.2.0.0** version that is submitted for certification.

The QA portion of the review focuses on the testing performed by **ES&S**. The scope of the testing performed is reviewed in order to verify that **ES&S** has verified that all VVSG requirements are met. SLI reviews the test case design documents and data as provided by **ES&S**. In evaluating each module, with respect to flow control parameters and data on both entry and exit, SLI assesses discrepancies between the Software Specifications and the test case design. Surveys addressing Quality Assurance aspects as implemented by **ES&S** will be sent to **ES&S** QA personnel. Additionally, interviews of key Quality Assurance staff may be conducted to verify that the QA processes and procedures are known, understood and implemented by the appropriate personnel within the organization. The interviews will be conducted if issues are seen with either project artifacts or survey responses.

The CM portion of the review focuses on the organizations understanding and implementation of the declared configuration management processes, procedures and policies. Initial deliverables will be reviewed against all pertinent CM processes employed by **ES&S**. Any and all subsequent deliveries will also be reviewed to determine that appropriate processes are employed. Surveys addressing Configuration Management aspects as implemented by **ES&S** will be sent to **ES&S** CM personnel. Additionally, interviews of pertinent staff, with regard to configuration management, may be conducted to verify that processes, procedures and policies are known, understood and implemented within the organization. The interviews will be conducted if issues are seen with either project artifacts or survey responses.

3.4 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:

- Build environment images at various key points
- Build environment and file hashes at various key points
- Build environment hardware characteristics
- Build results from code compilation and file hashes
- Final software install files and file hashes

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

- Final Record Keeping and Archiving Procedures – At the conclusion of the 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 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 these materials that are required.

4.1 Software/Firmware

All software and firmware that is 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 hardware, software, telecommunications, and security 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.

4.1.1 Manufacturer Software/Firmware

The **ES&S EVS 6.2.0.0 voting** system consists of the following software and firmware components:

- **Electionware (Client and/or Server)** Election database creation, media programming and tally/reporting software
- **DS450** Central Tabulator firmware, Central Count scanner and tabulator
- **DS850** Central Tabulator firmware, Central Count scanner and tabulator
- **DS200** Precinct Tabulator firmware, Precinct scanner and tabulator
- **ExpressVote HW1.0** UVS firmware, Precinct Universal Voting System
- **ExpressVote HW2.1** UVS firmware, Precinct Universal Voting System and/or tabulator
- **ExpressVote HW1.0 Previewer** ballot preview firmware
- **ExpressVote HW2.1 Previewer** ballot preview 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

Note: Versions for each will be available after execution of the Trusted Build, and will be listed in the Test Report.

Table 3 – ES&S EVS 6.2.0.0 Software/Firmware

Application	Version
Electionware – Client/Server	5.0.0.0
Event Log Service	1.6.0.0
Removable Media Service	1.5.0.0
ExpressVote HW2.1 Previewer	2.4.0.0
ExpressVote HW1.0 Previewer	1.5.0.0
ExpressLink	1.4.0.0

4.1.2 COTS Software/Firmware

This section details the COTS software and firmware utilized within the **ES&S EVS 6.2.0.0** voting system.

Table 3 – COTS Software/Firmware

Manufacturer	Application	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	10.9.2
Symantec	Symantec Endpoint Protection	14.0.0 (64-bit)
Symantec	Symantec Endpoint Protection Intelligent Updater (File-Based Protection)	20170523-003-v5i64.exe
Symantec	Symantec Endpoint Protection Intelligent Updater (Network-Based Protection)	20170522-011-IPS_IU_SEP.exe
Symantec	Symantec Endpoint Protection Intelligent Updater (Behavior-Based Protection)	20170516-001-SONAR_IU_SEP.exe
Cerberus	Cerberus FTP Server – Enterprise	8.0.12 (64-bit)
Adobe	Adobe Acrobat Standard	XI
Microsoft Corporation	Visual C++ Redistributable	vc_redist.x64.exe (64-bit) vc_redist.x86.exe (86-bit)

4.1.3 Additional Supporting Test Software

This section outlines any and all test specific software that will be used in the certification campaign.

Table 3 – Additional Supporting Test Software

Manufacturer	Application	Version
Riverbed	WireShark	1.10.6

4.2 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.

4.2.1 ES&S EVS 6.2.0.0 Equipment

The following manufacturer equipment will be used in testing:

Table 4 – ES&S EVS 6.2.0.0 Equipment

Hardware	Model
ExpressVote Activation Card Printer	--
ExpressVote Universal Voting System	HW1.0
ExpressVote Universal Voting System	HW2.1
DS200	v1.2
DS200	v1.3
DS450	v1.0
DS850	v1.0
ExpressVote Rolling Kiosk	98-00049
ExpressVote Voting Booth	87001
ExpressVote ADA Table	87031
DS200 Collapsible Ballot Box	N/A
DS200 Plastic Ballot Box	57521
DS200 Metal Ballot Box	N/A
DS200 Tote Bin	00074
DS450 Cart	3002
DS850 Cart	6823

4.2.2 COTS Equipment

The following COTS equipment will be used in testing:

Table 5 – COTS Equipment

Manufacturer	Hardware	Model	Operating System
Innodisk	USB EDC H 2SE	DEEUH 1-01GI72AC1SB	N/A
Symbol	Scanner (External)	DS9208	N/A
Zebra Technologies	Scanner (Integrated)	DS457-SR20009	N/A

Manufacturer	Hardware	Model	Operating System
OKI	Audit Printer	Microline 420	N/A
Dell	Report Printer	S2810dn	N/A
OKI	Report Printer	B431DN B431D	N/A
Tripp Lite	Spike Cube	SPIKECUBE	N/A
APC	Backup power supply (Uninterruptible Power Supply)	Back-UPS Pro 1500 Back-UPS RS 1500	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: Dual Core or Quad Core • RAM: 4 GB, 8 GB recommended • Hard Disk: 150 GB or 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 /		Windows Server 2008 R2, SP-1 (64-bit)

Manufacturer	Hardware	Model	Operating System
	1500 VA output capacity • Network Switch: 1 GB throughput		
Delkin	USB Flash Drive: 512 MB, 1 GB, 2 GB, 4 GB, 8 GB, 16 GB	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	N/A	N/A
Delkin	Compact Flash Memory Card Reader/Writer	6381	N/A

4.3 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
- Ballot pens
- Compact Flash memory cards
- USB flash drives
- Printer paper rolls

4.4 Deliverable Materials

The following are documents and materials to be delivered as a part of the **ES&S EVS 6.2.0.0 voting** system.

- System Overview
- System Functionality Description
- DS200 Operator's Guide
- DS450 Operator's Guide
- DS850 Operator's Guide
- EVS Event Log Service User's Guide
- Electionware Vol. I: Administrator Guide

- Electionware Vol. II: Define User Guide
- Electionware Vol. III: Design User Guide
- Electionware Vol. IV: Deliver User Guide
- Electionware Vol. V: Results User Guide
- Electionware Vol. VI: Appendices
- ExpressVote Operator's Guide (HW1.0)
- ExpressVote Operator's Guide (HW2.1)
- Requirements of the 2005 VVSG Trace to Vendor Testing
- Requirements of the 2005 VVSG Trace to Technical Data Package
- DS200 Hardware Specification
- DS450 Hardware Specification
- DS850 Hardware Specification
- ExpressVote Hardware Specification HW1.0
- ExpressVote Hardware Specification HW2.1
- System Development Program
- Coding Standards
- License Agreements for Procured Software
- DS200 – Software Design Specification
- DS450 – Software Design Specification
- DS850 – Software Design Specification
- Electionware – Software Design Specification
- Event Log Service – Software Design Specification
- ExpressVote (HW1.0) Software Design Specification
- ExpressVote (HW2.1) Software Design Specification
- Electionware PostSQL Table and Field Descriptions
- Electionware XML Diagrams
- System Test Plan
- Usability Test Report: DS200 Precinct-Based Scanner and Tabulator
- Usability Test Report: ExpressVote Universal Voting System (HW1.0)
- Usability Test Report: ExpressVote Universal Voting System (HW2.1)
- EMS Client Workstation Secure Setup & Configuration Guide
- EMS Server Secure Setup & Configuration Guide
- Standalone EMS Workstation Secure Setup & Configuration Guide
- Voting System Security Specification
- Security Script Description
- Verification Procedure: DS200 Precinct Scanner and Tabulator
- Verification Procedure: DS450 High-Throughput Scanner & Tabulator
- Verification Procedure: DS850 High-Speed Scanner & Tabulator
- Verification Procedure: Election Management System Workstation and Server
- Verification Procedure: ExpressVote Hardware 1.0
- Verification Procedure: ExpressVote Hardware 2.1

- Verification Procedure: Verification PC Setup
- Validation File List: DS200
- Validation File List: DS450
- Validation File List: DS850
- Validation File List: Event Log Service
- Validation File List: ExpressVote HW1.0
- Validation File List: ExpressVote HW2.1
- Validation File List: ExpressVote HW1.0 Previewer
- Validation File List: ExpressVote HW2.1 Previewer
- Validation File List: Electionware
- Validation File List: Removable Media Service
- DS200 Maintenance Manual
- DS450 Maintenance Manual
- DS850 Maintenance Manual
- ExpressVote Maintenance Manual (HW1.0)
- ExpressVote Maintenance Manual (HW2.1)
- Personnel Deployment and Training Program
- Configuration Management Program
- Technical Documentation Program
- Manufacturing Quality Assurance Program
- Software Quality Assurance Program
- Ballot Production Guide for EVS
- Conformity Statement: 2005 VVSG
- COTS Production Implementation Plan
- EAC Application Requirements Trace

5 TEST SPECIFICATIONS

The following are the specifications for testing to be conducted on **ES&S EVS 6.2.0.0** voting system. The specifications contain details on the focus of testing, configuration(s), and the functions to be tested.

5.1 Requirements

The **ES&S EVS 6.2.0.0** will be tested to the approved 2005 VVSG requirements.

All requirements within the VVSG are verified against the **ES&S EVS 6.2.0.0** voting system unless noted otherwise in the “Excluded Requirements” section below.

ES&S has not declared a DRE for the **ES&S EVS 6.2.0.0** voting system. As such, VVSG 1.0 DRE specific requirements are not scheduled to be evaluated, as listed in the "Excluded Requirements" section.

To evaluate the system test requirements, each section of the EAC 2005 VVSG shall be analyzed to determine the applicable tests, EAC 2005 VVSG Volume I sections, as well as the accompanying strategy for evaluation, are described below:

- **Section 2: Functional Requirements –** The requirements in this section shall be tested during the FCA, utilizing the SLI test suites specially designed for the **ES&S EVS 6.2.0.0** voting system. The data input during these tests shall be the predefined election definitions.
- **Section 3: Usability and Accessibility** – The requirements in this section shall be tested during the Usability Test, utilizing SLI test suites developed to cover the applicable requirements of this section.
- **Section 4: Hardware Requirements** – The requirements in this section shall be tested and/or overseen by SLI personnel, per Sections 4.4.2 and 6.3.1.
- **Section 5: Software Requirements** – The requirements in this section shall be tested during source code review, TDP review, and FCA. A combination of review and functional testing shall be performed to verify these requirements are met. The functional testing will occur if the source code review reveals potential areas of issue within the code that are not explicitly covered by the VVSG source code requirements. The functional test team will work with the source code review team to determine what testing will need to be done in order to verify no issue is resident within the inspected code.
- **Section 6: Telecommunication** – The requirements in this section shall be tested during source code review, FCA, and Security Tests, utilizing SLI test suites custom designed for the **ES&S EVS 6.2.0.0** voting system.
- **Section 7: Security Requirements** – The requirements in this section shall be tested during source code review, FCA, and Security Tests, utilizing SLI test suites custom designed for the **ES&S EVS 6.2.0.0** voting system.
- **Section 8: Quality Assurance (QA) Requirements** – The requirements in this section shall be tested throughout the test campaign via various methods. The TDP review shall be performed on **ES&S** QA documentation to determine compliance to EAC 2005 VVSG requirements and the requirements stated in the **ES&S** QA Program document. All source code shall be checked to ensure that proper QA documentation has been completed. All equipment received for initial testing and follow-up testing shall be checked against **ES&S** documentation to ensure their QA process

is being followed. SLI personnel will complete the requirements of EAC 2005 VVSG Vol. 2, Section 7, Quality Assurance Testing and Section 1.3.1.5, Focus of Vendor Documentation that requires SLI personnel to examine documents or conduct an external evaluation utilizing equipment, documents and support information provided by **ES&S** during the test campaign. SLI may also choose to interview **ES&S**'s QA staff for further evaluation.

- **Section 9: Configuration Management (CM) Requirements** – The requirements in this section shall be tested throughout the test campaign. The TDP review shall be performed on the **ES&S** configuration management documentation to determine EAC 2005 VVSG compliance and to further determine whether **ES&S** is following its documented CM requirements. Any discrepancies shall be formally reported to **ES&S** and the EAC. SLI personnel may conduct an audit of the **ES&S** CM Program at the **ES&S** facility, if deemed necessary.

5.2 Hardware Configuration and Design

The **ES&S EVS 6.2.0.0** as declared in the application for certification submitted to the EAC, consists of:

- An **Electionware** workstation with minimum requirements of 150 GB hard disk, 8 GB of recommended memory and Dual Core processing speed. The networked workstation with minimum requirements of 150 GB hard disk, 8 GB of recommended memory and Dual Core processing speed includes a server with minimum requirements of 320 GB hard disk, 4 GB of memory and Quad Core processing speed.
- At the precinct level, **DS200** tabulators and **ExpressVote HW2.1** Universal Voting Systems are employed.
- The central count location employs scanners, in combination with workstations that utilizes the **DS450** and **DS850** software and hardware for tabulation of ballots.
- The consolidation, tally and reporting location employs a workstation with **Electionware** software, with minimum requirements of 150 GB hard disk, 8 GB of recommended memory and Dual Core processing speed, as well as a printer. The networked workstation with minimum requirements of 150 GB hard disk, 8 GB of recommended memory and Dual Core processing speed includes a server with minimum requirements of 320 GB hard disk, 4 GB of memory and Quad Core processing speed, as well as either a direct connect or a network printer.

5.3 ES&S EVS 6.2.0.0 Voting System Review

This section describes the workings of the **ES&S EVS 6.2.0.0** voting system and will assist the reader with understanding the flow of the voting system.

5.3.1 Define

The Define group is used to input critical data for your election. The Define group modules are Home, Capture, and Element Library.

5.3.1.1 Home Module

The Home module is where election management, template management, and equipment selection options take place. New elections are created within the Home module as well. Use the Create New Election feature to create a new election, give it a name, and set some basic parameters. A county must be selected to create an election. Enter the election information. This includes data about the jurisdiction and jurisdiction ID (such as county number), this particular election (election type), any alternate names/IDs, and the rules profile (state-specific rules that apply to this election).

Existing elections created in Electionware will appear under the Home module and can be reopened from here for editing and management. Additional functionality includes backing up, restoring, and deleting elections.

5.3.1.2 Capture Module

The Capture module is where the election data is entered. Items such as languages, audio files, precincts, districts, contests, candidates, and ballot sets are in this module.

The Capture Status screen opens when the Capture module is opened. This screen is split into two sections.

Election Properties displays general information about the current election, including the template, jurisdiction information, election date, description, type, management of languages, audio, parties, precincts, districts, contests, candidates, polling place and ballot styles.

Capture Status displays the current status and last time/date stamp for captured election information, including Election Data Last Imported and Ballot Styles Last Generated.

5.3.1.3 Elements Module

The Element Library module is where electronic elements (such as system translations, audio and graphics, and equipment screen definitions) are managed and customized. These features include both system files (instructional text and audio displayed/played for the user) and screen graphics.

The Element Library module enables you to manage files and support data for ADA accessible voting equipment. These functions include the management of system audio files and translations. System audio and translations are used to instruct voters on audio and on-screen ballot navigation.

The Export ExpressVote System Translations Script feature is used to export system prompt translations for editing. The ExpressVote can support voting in multiple languages. The Element Library module is used to export system translations in the form of a spreadsheet for editing.

The Import ExpressVote System Translations feature is used to import the system translations from the spreadsheet you exported previously and incorporate them into your election.

The Export ExpressVote System Audio Script feature is used to export the instructional system script for audio recording purposes only, for voters using the ExpressVote accessible equipment.

The Import ExpressVote System Audio Recordings feature is used to import recorded instructional audio file sets for the ExpressVote accessible equipment.

The Import Election Header Graphic feature imports election headers for the ES&S equipment.

5.3.2 Design

The Design group is for designing ballot and audio elements for an election. The Design group modules are Paper Ballot and Accessible Ballot.

5.3.2.1 Paper Ballot Module

The Paper Ballot module incorporates the data in your election database (created in the Capture module) with finished ballot layouts. Paper Ballot can produce four distinct ballot layout types, depending on the needs of your jurisdiction: Column Portrait, Grid-Landscape, Grid-Portrait, Paper Flexible Grid.

5.3.2.2 Accessible Ballot Module

The Accessible Ballot module is used to format and manage display options and ADA audio settings, and validate data before generating election files for ES&S accessible voting equipment.

The Export Ballot Audio Scripts feature is used to export the ballot audio script for the current election, for audio recording purposes only, for voters using accessible equipment.

Validate Data is used to verify the status of the election and system translations and audio for accessible equipment.

5.3.3 Deliver

The Deliver group is used to configure equipment, package election data and print ballots on demand. The Deliver group modules are Configure, Package, and Print.

5.3.3.1 Configure Module

In the Configure module, you can manage election equipment and security settings and generate election files for your **ES&S** digital ballot scanning and vote tabulation equipment, and voter-assistive devices.

Election Properties displays general information about the current election, including the template, jurisdiction information, election date, description, and type.

The DS/ExpressVote Equipment Security feature is for setting up the security codes for your digital scanner and ExpressVote equipment. When an election is loaded onto election equipment, the user must enter the correct code on the device to access the control screens.

DS200 Settings is used to set up poll place options, configure ballot images and handling, and select report options for the **DS200**.

Use **ExpressVote** Settings to configure vote session, audio, card printing/handling, and terminal properties, poll place options, and reporting options, for the **ExpressVote**.

5.3.3.2 Package Module

The Package module is for creating Qualification, Election, and Reporting media (election files saved on an **ES&S** portable flash drive or compact flash card).

Qualification Media contains the election qualification code (EQC), election keys, and security codes required by the **DS200**, **ExpressVote** equipment, and Central Count tabulator.

The **DS200** election media contains the election definition required by the **DS200**, including election-related images, and folders for result collections. Election Qualification Media must be created before creating **DS200** Election Media.

The Central Count election media device is a flash drive containing the election definition required by the Central Count tabulator, including election related images, and folders for result collections.

The **ExpressVote** election media device is a flash drive containing the election definition required by the **ExpressVote**, including election-related images, and folders for result collections.

5.3.4 ExpressVote Universal Voting System, HW1.0

The **ExpressVote® Universal Voting System, HW1.0**, is a vote capture and marking device designed for all voters, including non-native English speakers, non-English speakers, and those who need special assistance.

ExpressVote HW1.0 uses a touch screen, an optional external barcode scanner, and/or assistive technology to capture a voter's contest choices. The system prevents overvotes and can alert voters about undervotes.

The **ExpressVote**'s integrated printer marks a voter's contest selections on a verifiable hardcopy vote summary card in human-readable format. The vote summary card enables a voter to confirm that the **ExpressVote HW1.0** captured all votes correctly, alleviating potential concerns about system accuracy and integrity. Marked vote summary cards can be tabulated using the **ES&S DS200**, **DS450**, **DS850** tabulators or the **ExpressVote HW2.1** if it is configured as a tabulator.

Voters with visual impairments can use headphones to hear audio instructions and can make selections using an audio-tactile keypad with Braille legends. Voters with other physical requirements can make selections using a rocker switch device or a sip-and-puff device. Voters can use zoom and contrast display settings to make on-screen text more readable. Jurisdictions can include multiple language support for non-English speakers.

5.3.5 ExpressVote Universal Voting System, HW2.1

The **ExpressVote® Universal Voting System, HW2.1**, is a vote capture and marking device designed for all voters, including non-native English speakers, non-English speakers, and those who need special assistance.

The election definition controls whether the **ExpressVote HW2.1** functions as a tabulator or as a vote summary card marker only. If you use the **ExpressVote** as a marker, marked vote summary cards can be tabulated using the **ES&S DS200**,

DS450, or **DS850** tabulators. If you use the **ExpressVote HW2.1** as a tabulator, the system saves a digital image of the marked vote summary card after a voter verifies all contest choices. The system tabulates all captured votes after the polling location closes.

ExpressVote HW2.1 uses a touch screen, an optional external barcode scanner, and/or assistive technology to capture a voter's contest choices. The system prevents overvotes and can alert voters about undervotes.

The **ExpressVote**'s integrated printer marks a voter's contest selections on a verifiable hardcopy vote summary card in human-readable format. The vote summary card enables a voter to confirm that the **ExpressVote HW2.1** captured all votes correctly, alleviating potential concerns about system accuracy and integrity. Marked vote summary cards can be tabulated using the **ES&S DS200**, **DS450**, or **DS850** tabulators or the **ExpressVote HW2.1** if it is configured as a tabulator.

Voters with visual impairments can use headphones to hear audio instructions and can make selections using an audio-tactile keypad with Braille legends. Voters with other physical requirements can make selections using a rocker switch device or a sip-and-puff device. Voters can use zoom and contrast display settings to make on-screen text more readable. Jurisdictions can include multiple language support for non-English speakers.

5.3.6 DS200

The **DS200** is a precinct-based ballot scanner and vote tabulator that is part of a jurisdiction-wide election system. Voters insert their ballots directly into the **DS200** at the polling place. The **DS200** scans ballots, tabulates votes and feeds inserted ballots into an attached, secure ballot box.

The **DS200** reads marks on both one- and two-sided ballots. The **DS200** can discriminate between valid marks (pen) within the ballot target locations and extraneous marks, perforations, smudges, and folds.

The **DS200** can generate paper reports produced from the unit's internal thermal printer. The **DS200** stores election results on a removable USB flash drive that can be used to transfer scanner results to **Electionware** after the polls are closed.

The **DS200** operates in three separate modes, each of which provides access to different types of functions. The administration mode provides access to diagnostic and testing functions to calibrate and test the scanner.

In the polls open mode, the **DS200** actively scans ballots and tabulates results.

In the polls closed mode, the **DS200** prints poll reports and prepares voting results for transfer to election headquarters. Election officials or poll workers close the polls at the assigned time.

5.3.7 DS450

The **DS450** is a high-throughput central count scanner and tabulator with ballot sorting capabilities. The **DS450** is designed to process a wide variety of ballot types and lengths, including folded ballots and printed **ExpressVote** vote summary cards.

The **DS450** reads marks on both one- and two-sided ballots. The **DS450** can discriminate between valid marks (pen marks within the ballot target locations) and extraneous marks, perforations, smudges, and folds.

Voter accumulation records are saved on the machine's hard drive and can be transferred from the hard drive to a USB flash drive.

5.3.8 DS850

The **DS850** is a high-speed central-count scanner and tabulator with ballot sorting capabilities. The DS850 is designed to process a wide variety of ballot types and lengths, including folded ballots and printed **ExpressVote** vote summary cards.

The **DS850** reads marks on both one- and two-sided ballots. The **DS850** can discriminate between valid marks (pen marks within the ballot target locations) and extraneous marks, perforations, smudges, and folds.

Voter accumulation records are saved on the machine's hard drive and can be transferred from the hard drive to a USB flash drive.

5.3.9 Electionware Reporting Module

After the election, the Reporting module is used to import tabulated results, machine logs, cast vote records, and ballot images by reading the election media from the **ExpressVote HW1.0, ExpressVote HW2.1, DS200, DS450** and **DS850**, media; review, export, and report election results and media device-related data; and review/adjudicate ballot images.

The Reporting module can display or export detailed status information about individual flash drives, and produce machine log reports. It can also clear loaded results files, in order to delete test data or to start the loading process over.

The Ballot Review provides the adjudicator for listing scanned ballot images based on configurable filter criteria and adjudicating ballot exceptions

In the Reporting module, use the Reports menu to generate precinct status, machine log file, media load, Central Count networked results, double vote, write-ins, and manual entry status reports.

5.4 Testing Strategies

This section looks at the voting system and the individual components in order to determine testing strategies at the component level as well as the system level.

5.4.1 How each Polling Place Device will be tested

- How the **ExpressVote HW1.0** will be tested
  - **ExpressVote HW1.0** will be tested first as an individual component in order to verify that all declared functionality is present and working as documented, with **Electionware** produced media and data, then as an integrated piece of the voting system where it will accept user input instructions, prior to producing marked vote summary cards that mirror user intent.
- How the **ExpressVote HW2.1** will be tested
  - **ExpressVote HW2.1** will be tested first as an individual component in order to verify that all declared functionality is present and working as documented, with **Electionware** produced media and data, then as an integrated piece of the voting system where it will accept user input instructions, prior to producing marked vote summary cards that mirror user intent.
- How **DS200** will be tested
  - **DS200** will be tested first as an individual component in order to verify that all declared functionality is present and working as documented, then as an integrated piece of the voting system where it will input **Electionware** produced media and data, then accept user filled out ballots as well as vote summary cards, prior to producing all defined output medias.

5.4.2 How each Application will be tested

- How **Electionware** will be tested
  - **Electionware** will be tested first as an individual component in order to verify that all declared functionality is present and working as documented, then as an integrated piece of the voting system where it will output **Electionware** produced media and data, which will feed into **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450, DS850** and **Electionware Reporting**.
- How the **DS450** and **DS850** will be tested
  - **DS450** and **DS850** will be tested first as individual components in order to verify that all declared functionality is present and working as documented, then as an integrated piece of the voting system where it will input **Electionware** produced media and data, then accept user

filled out ballots as well as vote summary cards, prior to producing all defined output medias.

- How **Electionware Reporting** will be tested
  - **Electionware Reporting** will be tested first as an individual component in order to verify that all declared functionality is present and working as documented, then as an integrated piece of the voting system where it will input **Electionware** produced media and data, then accept **media** data from **ExpressVote HW1.0, ExpressVote HW2.1, DS200, DS450** and **DS850**, prior to producing all defined output medias.

5.4.3 How different System Level Configurations will be tested

As noted earlier, **Electionware**, **DS450, DS850** and **Electionware Reporting** are each capable of being run as standalone instantiations or networked with a central database. When run as a standalone implementation, given these possible configurations, the following configurations will be exercised:

- **Electionware** will be tested in standalone mode
- **Electionware Reporting** will be tested in standalone mode
- **DS450** will be tested in standalone mode
- **DS850** will be tested in standalone mode
- **Electionware** will be tested in a networked mode
- **DS450** will be tested in a networked mode with a central repository
- **DS450** will be tested in a networked mode with Electionware
- **DS450** will be tested in a networked mode with other DS450 units
- **DS850** will be tested in a networked mode with a central repository
- **DS850** will be tested in a networked mode with Electionware
- **DS850** will be tested in a networked mode with other DS850 units
- **Electionware Reporting** will be tested in a networked mode

5.5 Software System Functions

The **ES&S EVS 6.2.0.0** voting system operations documentation has been reviewed in conjunction with the Supported Functionality Declaration provided by **ES&S**. 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 suite design.

5.5.1 Election Definition Creation

The Election Definition focus will target creation of contests, candidates, propositions, ballot formatting and instruction. All aspects of creating regional districts, jurisdictional parameters, grouping and displaying of associated election data will be analyzed and tested. In addition, the ability to support baseline election types, various other election types, voting variations and languages will be verified.

5.5.2 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.

5.5.3 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.

5.5.4 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.

5.5.5 Voting Aspects – Central Count

The focus of the central count functions is primarily the usage of a scanners to scan large quantities of absentee ballots and passing each image to **Electionware Reporting** for interpretation of the voter's markings on the ballot and/or vote summary card.

5.5.6 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.

5.5.7 Error Messaging and Recovery

This area will focus on the system's ability to generate appropriate error messaging within each system component and the system's ability to recover from error conditions in order to proceed with all election functions.

5.5.8 Auditing

This area will focus on device and system level auditing capabilities and will verify at a minimum the required audit functionally. This includes audit trail capability throughout the life cycle of the voting system and audit log content requirements.

5.5.9 Security

Overall system and device level logical and physical security aspects will be tested. Physical security will focus on the areas of integrity (ballot box doors, locks and seals) and detection (compromised ballot box doors, locks or seals). Logical security will focus on the areas of access controls, accountability, confidentiality, and integrity. These logical security areas will be applied to the OS, Database, Network and Application entities used by the EMS, Universal Voting Systems and tabulators used by the voting system under test.

5.6 Test Suite Design

5.6.1 Hardware Qualitative Examination Design

SLI will review all reports submitted by the manufacturer of previous testing conducted by acceptable hardware test labs, on the equipment contained in the **ES&S EVS 6.2.0.0** voting system. The results will be compared against the guidelines of the VVSG 2005, Section 2 to identify any additional testing required. In addition, SLI will create the following test suites to focus on Maintainability, Accessibility, and Usability of the voting system:

- **Accessibility** - Accessibility requirements for a voting system generally include both objective and observable requirements. In combination, the two types of requirements verify that the voting system components are accessible to as many eligible voters as possible, including those that have a type of challenge that creates a need for assistance of some type. The voting systems should be self-contained such that the individual voter is able to cast their vote without assistance from another party. Accessibility calls for the voting system to take into account vision, varying degrees of

vision, dexterity, mobility, aural issues, and speech and language proficiency.

- **Maintainability** - Maintainability encompasses a range of maintenance actions that examine all scheduled and unscheduled events in place for preventing failures on all hardware devices. Testing verifies the ease with which maintenance actions can be performed based on the design characteristics of the equipment and software. Non-technical election workers are able to be made aware of the problem through the equipment and software's ability to correctly self-diagnose problems.

- **Usability** – Usability is defined as a measure of the effectiveness, efficiency, and satisfaction achieved by a specified set of users with a given product in the performance of specified tasks. In the context of voting, the primary user is the voter, the product is the voting system, and the task is the correct recording of the voter ballot selections. Testing is conducted to ensure voters are able to negotiate the process effectively, efficiently and comfortably according to the requirements dictated.

5.6.2 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 as listed in "Table 2 – Labs Performing Hardware Testing". Specific hardware test plans from the subcontractor labs are included in Attachments B & C.

5.6.3 Software Module Test Design and Data

Incorporating the manufacturer's software specifications, SLI will validate that all software/firmware components of the system adhere to expected flow control parameters and specifications for data input and output.

5.6.4 Software Functional Test Design and Data

SLI will prepare functional test modules using the operator/user procedures contained within **ES&S**'s TDP. Functionality provided by **ES&S EVS 6.2.0.0** 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. As many of the individual functional components rely on preceding functionality within the system, SLI incorporates system level suites that employ modules that exercise the individual functional components of the system.

5.6.5 System-level Test Design

Testing of the voting 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.

There are various types of testing. Table 8 - *Types of Testing* provides the descriptions of these kinds of tests and their associated benefit.

Table 8 - Types of Testing

Type of Testing	Description	Benefit
Nominal Conditions	Testing all nominal functional capabilities of all components of the voting system.	Nominal conditions testing ensures that the voting system is tested against all elements.
Injection Attack	This testing is primarily for verifying the security of databases. An injection attack consists of insertion or "injection" of a SQL query via the input data from the client to the application. A successful SQL injection exploit can read sensitive data from the database, modify database data (Insert/Update/Delete), execute administration operations on the database, recover the content of a given file existing on the DBMS file system and, in some cases, issue commands to the operating system.	Injection Attack testing hardens the database against unauthorized access and manipulation of data.
Data Driven	This is testing that is based on the data that is used throughout the voting system. For example, if 'x' is input in a field, it would branch to a different part of the application than if 'y' was entered. The goal is to ensure that all branches get tested.	The tests verify that each unique data element can be accessed and used according to the voting system's user documentation. These test cases are based on the election data or vote data used and not the functional flow or work flow of the voting system.
Usability	The purpose of UI Testing is to test all of the screen and data elements that exist on each and every screen. SLI will verify responses to input, text syntax, error message content, and audit message input.	These tests verify every action will work that a user can perform on a screen. These tests will also verify that any screen or data element will not take the user by surprise.
Error Messaging and Recovery	Exercise system's ability to recover from hardware, software, and data errors.	Ensures that the system is able to successfully recover should there be a system or data error.

End-to-End	This is system testing in a true end-user environment following all pre-election day, election day, and post-election day voting rules and processes.	This is used to demonstrate that a system can be used to perform its job following the exact set of processes and steps that would be used by the target customer or end-user.
Regression	Testing that validates that existing functionality is unchanged with the introduction of new functionality and correction of defects.	This is used to verify that issues are corrected, and that no know issues are been introduced or uncovered.
Formal Execution	Final verification of the voting system in a true end-user environment, following all pre-election day, election day, and post-election day voting rules and processes.	Testing "for the record" that includes all aspects of the voting system, verifying that all VVSG requirements are met.
Volume Test	Testing the voting system's response to conditions that range from processing more than the expected number of ballots/voters per precinct to processing more than the expected number of precincts to any other similar volume conditions.	Determine if there are limits to the voting system's ability to operate under conditions that tend to overload the system's capacity to process, store, and report data.
Stress Tests	Testing the voting system's responses to transient overload conditions by subjecting polling place devices to ballot processing at high volume rates.	Evaluates the voting system and software's response to hardware-generated interrupts and wait states.
Accessibility Test	Exercises system capabilities of features for voters with disabilities.	Validates that the voting system is tested against all applicable ADA and HAVA requirements for voters with disabilities.
Performance Tests	Tests accuracy, processing rate, ballot format, handling capability and other performance attributes specified by **ES&S**.	Performance testing ensures that the voting system meets all performance elements.

5.6.6 Software Functional Test Case Design

As described in the "Testing of the System" section above, each individual component of the voting system will be reviewed independently, such that all functionality present in the component is verified to work as documented, and that all functionality is appropriately documented. For the components that are able to be networked, this will be reviewed as well. This approach corresponds to the following functional testing to be done.

5.6.6.1 Electionware – Standalone workstation

All functionality present in **Electionware**, including those covered in the "System Review" and "Supported Functionality" sections above, is verified to work as documented, and that all functionality is appropriately documented.
This test covers **Electionware**.

5.6.6.2 Electionware – Client/Server configuration

Testing of the client/server configuration, for **Electionware**, will be the focus of this testing, such that reliability of data consistency is verified.
This test covers **Electionware**, in a server and multi-workstation configuration.

5.6.6.3 DS450 and DS850 – Standalone workstation

All functionality present in **DS450**/**DS850**, including that covered in "System Review" and "Supported Functionality" sections above, is verified to work as documented, and that all functionality is appropriately documented.
This test covers **DS450**/**DS850**.

5.6.6.4 DS450 and DS850 – Client/Server configuration

Testing of the client/server configuration, for **DS450**/**DS850**, will be the focus of this testing, such that reliability of data consistency is verified.
This test covers **DS450**/**DS850**, in a server and multi-workstation configuration.

5.6.6.5 Electionware Reporting – Standalone workstation

All functionality present in **Electionware Reporting**, including that covered in "System Review" and "Supported Functionality" sections above, is verified to work as documented, and that all functionality is appropriately documented.
This test covers **Electionware Reporting.**

5.6.6.6 Reporting – Client/Server configuration

Testing of the client/server configuration, for **Electionware Reporting**, will be the focus of this testing, such that reliability of data consistency is verified.
This test covers **Electionware Reporting**, in a server and multi-workstation configuration.

5.6.6.7 DS200

All functionality present in **DS200**, including that covered in the "System Review" and "Supported Functionality sections above, is verified to work as documented, and that all functionality is appropriately documented.
This test covers **DS200.**

5.6.6.8 ExpressVote HW1.0

All functionality present in **ExpressVote HW1.0**, including that covered in the "System Review" and "Supported Functionality sections above, is verified to work as documented, and that all functionality is appropriately documented.
This test covers **ExpressVote HW1.0.**

5.6.6.9 ExpressVote HW2.1

All functionality present in **ExpressVote HW2.1**, including that covered in the "System Review" and "Supported Functionality sections above, is verified to work as documented, and that all functionality is appropriately documented.
This test covers **ExpressVote HW2.1.**

5.6.7 System-level Test Suite Design

System level test suites will include the following:

- **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. Each test suite below is explained in terms of the components of the voting system that will be addressed.
    - **GenVariation1**

      Additional definition is added, with a focus on validating N of M voting, Partisan offices, Non-Partisan Offices, Ranked Order Voting, Straight Party Voting, Ballot Rotations, Ballot Formatting, precincts and districts, and Tally and Reporting functionality.

      This test covers **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450** and **DS850** as well as **Electionware Reporting**. Vote counts will be accumulated from **DS450**/**DS850, ExpressVote HW2.1** and **DS200**.
    - **GenVariation2**

      Additional definition is added, with a focus on validating Recalls, Cross Party Endorsement, and Write-Ins.

      This test covers **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450** and **DS850** as well as **Electionware Reporting**. Vote counts will be accumulated from **DS450**/**DS850, ExpressVote HW2.1** and **DS200**.

- **GenVariation3**

  Additional definition is added, with a focus on validating HAVA concerns, as well as items such as pre-vote capabilities.

  This test covers **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450** and **DS850** as well as **Electionware Reporting**. Vote counts will be accumulated from **DS450**/**DS850, ExpressVote HW2.1** and **DS200**.

- **PriOpen**

  This suite modifies the election definition to conform to an Open Primary election with a focus on validating presidential delegation nominations.

  This test covers **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450** and **DS850** as well as **Electionware Reporting**. Vote counts will be accumulated from **DS450**/**DS850, ExpressVote HW2.1** and **DS200**.

- **PriClosed**

  This suite builds on the PriOpen Test, taking the election definition and modifying it to conform to a Closed Primary election.

  This test covers **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450** and **DS850** as well as **Electionware Reporting**. Vote counts will be accumulated from **DS450**/**DS850, ExpressVote HW2.1** and **DS200**.

- **PriOpen**

  This suite builds on the PriOpen Test, taking the election definition and modifying it to conform to a Open Primary election.

  This test covers **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450**/**DS850** as well as **Electionware Reporting**. Vote counts will be accumulated from **DS450**/**DS850, ExpressVote HW2.1** and **DS200**.

- **Error Recovery** - The VSTL will focus on Error Messaging and Recovery in key areas of the system identified from researching previous testing and voting system documentation to help identify potential failure points. Voting systems can be subject to various conditions, and when the system exceeds limitations, errors are typically found. The VSTL leverages its election experience and voting system knowledge to test the Error Messaging and Recovery of a voting system that has incurred errors caused by stressing the system. Testing of Error messaging will focus on the appropriate error messages being generated in response to a specific error and content of the message. The testing of the voting system Error Recovery capability is

incorporated into Stress testing in order to leverage the necessary range of performance impacts needed to generate system errors and force recovery.

This test covers **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450**/**DS850** as well as **Electionware Reporting**.

- **Audit Content Validations** - Audit records are used to track what system functions have been executed, what data has been modified, as well as by who and when. Additionally, audit record data content can be a key factor in identifying system anomalies and provide assistance in troubleshooting system errors. In tandem with the System Audit Validation, analysis of a voting system is performed to determine strategic points of the system that require auditing, along with the content needed to accurately depict the machinations of the system for the given situation. Tests are incorporated either into Election Validation suites or specific Audit Validation suites, as needed, such that all related requirements are explicitly validated.

  This test covers **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450**/**DS850** as well as **Electionware Reporting**.

- **System Audit** – Election audit trails provide the supporting documentation for verifying the accuracy of reported election results. They present a concrete, indestructible archival record of all system activity related to the vote tally, and are essential for public confidence in the accuracy of the tally, for recounts, and for evidence in the event of criminal or civil litigation. This testing focuses on validating system's ability to provide audit capability throughout the entire voting system, including availability, generation, integrity, and accuracy of the system's audit capability to ensure it meets the necessary requirements. Negative testing will be utilized to force the system into conditions that will trigger errors and verify the voting system captures those conditions.

  This test covers **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450**/**DS850** as well as **Electionware Reporting**.

- **Security Validations** - Test suites are created to validate and verify various aspects of system security at both the component level and the system level, as applicable. Each suite will have a particular focus to it, such that when executed successfully, a given requirement, or set of requirements, will be determined to have been successfully implemented by the voting system. Topics of Security review will include:

  - Access Control

  Access control testing verifies procedures and system capabilities that detect or limit access to system components in order to guard against loss of system integrity, availability, confidentiality, and accountability. This testing verifies that system resources such as data files, application programs and computer-related facilities

and equipment are protected against unauthorized operation, modification, disclosure, loss or impairment. Unauthorized operations include modification of compiled or interpreted code, run-time alteration of flow control logic or of data, and abstraction of raw or processed voting data in any form other than a standard output report by an authorized operator.

This test covers **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450/DS850** as well as **Electionware Reporting**.

- Software Security

Software security testing will be conducted to verify the installation procedures and ongoing foreign software detection mitigation abilities of the voting system in order to protect against the modification of the software and/or the insertion of malicious software during the installation and during ongoing operations.

This test covers **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450/DS850** as well as **Electionware Reporting**.

- Physical Security Measures.

Physical security testing verifies monitoring and control of the environment of the work place and computing facilities. It also verifies monitor and control access to and from such facilities. For *example: doors, locks,* cameras, barricades, fencing, cable locks, etc., can be utilized for implementation of physical security. Separating the network and work place into functional areas are also physical controls. Some portions of physical security are functional while other portions are procedural. Functional portions will be tested as appropriate while procedural portions will be verified to be documented as called out by the VVSG.

This test covers **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450/DS850** as well as **Electionware Reporting**.

- **Language** – Testing is conducted to ensure the voting system is capable of presenting the ballot, ballot selections, review screens and instructions in the required languages. The system's ability to handle the prescribed foreign languages that have been declared to be supported, English, Spanish, Chinese, Korean, Japanese, Hindi, Bengali, Vietnamese, Tagalog, Creole, Russian, and French will be validated.

  This test covers **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450**/**DS850** as well as **Electionware Reporting**. Vote counts will be accumulated from **DS450**/**DS850, ExpressVote HW2.1** and **DS200**.

- **Data Retention/HW Integrity** – Testing integrity requirements ensure the physical stability and function of the vote recording and counting processes, such that the system is not prone to a single point of failure that would prevent voting at a polling place. Testing will also verify prevention of failure of data input or storage, in terms of data retention, as well as confirming that appropriate audit records are maintained without modification.

  This test covers **Electionware**, **ExpressVote HW1.0ExpressVote HW2.1**, **DS200**, **DS450**/**DS850** as well as **Electionware Reporting**. Vote counts will be accumulated from **DS450**/**DS850**, **ExpressVote HW2.1** and **DS200**.

- **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.

  There are three potential stages to the accuracy test:

  - Go/no go, where after approximately 26,000 ballot positions, if any errors are found the test fails,
  - If no errors are found the test continues to the 1.55 million ballot position mark, where if 1 error is found the test may progress to approximately the 3.1 million ballot position mark where if no more errors are encountered, the test passes.
  - If more than 1 error is found at the 1.55 million ballot position mark the test fails.

This test covers **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450** and **DS850** as well as **Electionware Reporting**. Vote counts will be accumulated from **DS450**/**DS850**, **ExpressVote HW2.1** and **DS200**.

- **Mark Sensitivity** - The purpose of Ballot Mark Sensitivity testing is to determine that the system under test is able to accurately determine when a mark has been made within a ballot marking position. For this test, various marks are made within the ballot marking positions, using EVS supported colors of ink (black), as well as non-supported, in order to determine how the system handles unexpected colors.
  Marks include fully filled boxes, left and right oriented slashes, "X" markings, check marks, horizontal single line marks, and circles of various sizes. Marks also include vertical lines within the marking position that fill approximately ten percent of the designated space. Small dots down to approximately five percent of the ballot marking position are also included.

  This test covers, **DS200**, **DS450**/**DS850**. Vote counts will be accumulated from **DS450**/**DS850**, **ExpressVote HW2.1** and **DS200**.

- **Volume** – Testing a system's response when subjected to large volumes of data, "more than the expected", as called out in the standards. Volume testing is typically considered a type of non-functional testing. However, as a voting system's primary function is to accumulate, tally, and pass a volume of data (votes) the VSTL approaches volume testing as a functional test. Experience has shown that large amounts of data can slow a system, or even cause failures and loss of data due to architectural limitations. Utilizing the VSTL's experience with voting systems the testing will focus on not only passing large amounts of data but how the system operates and handles the data in key areas of functionality within the voting system.

  This test covers **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450** and **DS850** as well as **Electionware Reporting**. Vote counts will be accumulated from **DS450**/**DS850**, **ExpressVote HW2.1** and **DS200**.

- **Stress** - Testing a system's "response to transient overload conditions." Experience has shown that when passing a dataset through a system that eclipses the system architectural limitations, failures can occur and result in the loss of critical data. Utilizing the VSTL's experience with voting systems, the testing will focus on the system's ability to operate after the limitations have been exceeded and if failures occur, how the data is maintained or recovered in key areas of functionality within the voting system.

  This test covers **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450**/**DS850** as well as **Electionware Reporting**. Vote counts will be accumulated from **DS450**/**DS850**, **ExpressVote HW2.1** and **DS200**.

5.7 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.

5.8 EAC Interpretations

The test engagement described in this Certification Test Plan utilizes only standard VSTL test methods that conform to the EAC Testing and Certification Program Manual and the identified voting system standard. Additional EAC interpretations that affect the test plan and test methodology are as follows:

- EAC Decision on RFI 2007-01
- EAC Decision on RFI 2007-03
- EAC Decision on RFI 2007-04
- EAC Decision on RFI 2007-05
- EAC Decision on RFI 2007-06
- EAC Decision on RFI 2008-01
- EAC Decision on RFI 2008-02
- EAC Decision on RFI 2008-03
- EAC Decision on RFI 2008-04
- EAC Decision on RFI 2008-07
- EAC Decision on RFI 2008-08
- EAC Decision on RFI 2008-09
- EAC Decision on RFI 2008-10
- EAC Decision on RFI 2008-12
- EAC Decision on RFI 2009-02
- EAC Decision on RFI 2009-03
- EAC Decision on RFI 2009-04
- EAC Decision on RFI 2009-05
- EAC Decision on RFI 2009-06
- EAC Decision on RFI 2010-01
- EAC Decision on RFI 2010-02
- EAC Decision on RFI 2010-03
- EAC Decision on RFI 2010-04
- EAC Decision on RFI 2010-06
- EAC Decision on RFI 2010-07
- EAC Decision on RFI 2010-08
- EAC Decision on RFI 2012-01

- EAC Decision on RFI 2012-03
- EAC Decision on RFI 2012-04
- EAC Decision on RFI 2012-06
- EAC Decision on RFI 2013-01
- EAC Decision on RFI 2013-02
- EAC Decision on RFI 2013-03
- EAC Decision on RFI 2013-04
- EAC Decision on RFI 2015-05

RFI's not implemented in this test campaign include:

- EAC Decision on RFI 2009-01, VVPAT accessibility
- EAC Decision on RFI 2010-05, modifications of a certified system
- EAC Decision on RFI 2012-02, transmission of official/unofficial results
- EAC Decision on RFI 2012-05, public telecommunications and cryptography

EAC notices of clarification affecting the certification project are implemented as noted below.

- NOC 2007-005 VSTL responsibilities and Third Party Lab Oversight
- NOC 2008-003 EAC Conformance Testing Requirements
- NOC 2009-001 Test Plan NOC
- NOC 2009-002 Testing Independence
- NOC 2009-004 Test Report
- NOC 2012-02 Clarification of System ID Tool Functionality FINAL 4.19.12
- NOC 2013-01 Discrepancy Listing in Test Report-FINAL-10 17 13
- NOC 2015-01 Test Readiness Review (TRR) applies to both new certs and modifications
- NOC 2016-01 Test Readiness Review
- NOC 2016-02 Trusted Build
- NOC 2016-03 Test Case Upload

EAC notices of clarification, noted below, not affecting the certification project are not implemented:

- NOC 2007-001 Timely Submission of Application for Certification
- NOC 2007-002 VSTL work outside of voting system testing
- NOC 2007-003 State and Federal Testing
- NOC 2007-004 Manufacturing facilities
- NOC 2008-001 Use of Previous Non-core HW Testing
- NOC 2008-002 EAC Mark of Certification
- NOC 2009-003 de minimis change TDP
- NOC 2009-005 Modification Test Plan
- NOC 2011-01 de minimis data change final

- NOC 2012-01 COTS Computer Equivalency for de minimis Change
- NOC 2013-02 Detailed Description of Changes for Modifications
- NOC 2014-01 Technology Testing Agreement

5.9 Security Functions

5.9.1 Security Test

The Security Test Suites are SLI's tests for verifying that a voting system will correspond to requirements in VVSG Volume 1, Section 7. It incorporates systems security provisions, unauthorized access, deletion or modification of data, audit trail data, and modification or elimination of security mechanisms. The vendor documentation will be reviewed to ensure sufficient detail is present to operate the voting system in a secured manner. Where the vendor statements assert the voting system is secured via mechanisms and seals, procedures will test the presence and effectiveness of such controls.

In its security testing SLI identifies the specific threats that are tested for and the associated risk if a flaw or exception is identified in a voting system. SLI maintains a "Threat Matrix Database" that is updated minimally once a year as well as whenever an issue is uncovered. The tests used by SLI are designed to ensure that the voting system meets or exceeds the requirements in the VVSG. Any instance where an anomaly or possible security flaw is identified, the potential risk is reported and evaluated.

Security testing includes testing each individual component of the system and the system as a whole. As such, **Electionware**, **ExpressVote HW1.0, ExpressVote HW2.1**, **DS200**, **DS450/DS850** as well as **Electionware Reporting** will be subjected to review, as will the system as a whole and its interactions between components.

6 TEST DATA

Test data for the **ES&S EVS 6.2.0.0** voting system is compiled such that all functionality declared will be tested to determine conformance to the standards.

6.1 Data Recording

SLI has evaluated the system functionality, as described by manufacturer technical documentation, as well as requirements as listed in the EAC 2005 VVSG, and made determinations as to expected results of all data inputs into the ***ES&S EVS 6.2.0.0*** 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*.

6.2 Test Data Criteria

SLI has evaluated the system functionality as described by manufacturer technical documentation, as well as requirements as listed in the EAC 2005 VVSG, and made determinations as to expected output of all data inputs into the **ES&S EVS 6.2.0.0** 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.

6.3 Test Data Reduction

SLI processes the test data by manually recording input data into each pertinent module within the Test Suites as well as the exact output that is generated, e.g., the vote counts when the data is consolidated.

7 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 the execution of the test suites.

7.1 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 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: 25°C ± 10°C (77°F ± 18°F)
- 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.

Environmental hardware testing for hardware components of the **ES&S EVS 6.2.0.0** 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.

7.2 Test Setup

Configurations of **ES&S EVS 6.2.0.0** 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 6.2.0.0** 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.

7.3 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.

8 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 VTS explaining the reason for the result.

Issues encountered during review and testing will be documented in the Discrepancy Report as well as the EAC VRT system. Issues that do not conform to the requirements of the VVSG, version 2005 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 to be either caused by 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, which if this is the case, the review process employed during the anomaly phase will reveal, 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.

9 APPROVAL SIGNATURES

SLI:

Traci Mapps
VSTL Director
July 24th, 2017

End of Certification Test Plan