

# PRO V&V



6705 Odyssey Dr. Suite C  
Huntsville, AL 35806  
Phone (256)713-1111  
Fax (256)713-1112

---

## Test Plan for EAC VVSG 1.0 Certification Testing Election Systems & Software (ES&S) Voting System (EVS) 6.0.6.0

EAC Project Number: ESSEVS6060

Version: 04

Date: 10/25/2021

---

U.S. Election Assistance Commission

# VSTL

EAC Lab Code 1501

The NVLAP logo is a stylized, outlined font where the letters are interconnected. The 'P' has a registered trademark symbol (®) to its upper right.

NVLAP LAB CODE 200908-0

**SIGNATURES**

Approved by:

*Michael L. Walker*

Michael Walker, VSTL Project Manager

10/25/2021

Date

Approved by:

*Wendy Owens*

Wendy Owens, VSTL Program Manager

10/25/2021

Date

## REVISIONS

<b>Revision</b>	<b>Description</b>	<b>Date</b>
00	Initial Release	09/07/2021
01	Updates per EAC Comments, Rearranged and renumbered subsections in Section 4.5, corrected grammatical areas	09/22/2021
02	Updates per EAC Comments. Added additional diagrams. Updated TDP versions.	10/05/2021
03	Added second paragraph to Section 2.3.	10/18/2021
04	Updated Section 2.3	10/25/2021

## TABLE OF CONTENTS

<b>1.0</b>	<b>INTRODUCTION.....</b>	<b>1</b>
1.1	Description and Overview of EAC System Being Modified.....	1
1.1.1	Baseline Certified Systems .....	1
1.1.2	Description of Modification.....	3
1.1.3	Initial Assessment.....	8
1.1.4	Regression Test.....	9
1.2	References.....	10
1.3	Terms and Abbreviations.....	11
1.4	Project Schedule .....	11
1.5	Scope of Testing .....	12
1.5.1	VVSG .....	13
1.5.2	RFIs.....	13
1.5.3	NOCs .....	13
1.6	System Overview .....	13
1.6.1	Block Diagram.....	16
1.6.2	System Limits .....	21
1.6.3	Supported Languages.....	23
1.6.4	Supported Functionality.....	24
<b>2.0</b>	<b>PRE-CERTIFICATION TESTING AND ISSUES .....</b>	<b>24</b>
2.1	Evaluation of Prior VSTL Testing.....	24
2.2	Evaluation of Prior Non-VSTL Testing.....	24
2.3	Known Field Issues.....	25
<b>3.0</b>	<b>MATERIALS REQUIRED FOR TESTING.....</b>	<b>25</b>
3.1	Software .....	25
3.2	Equipment .....	25
3.3	Test Materials .....	26
3.4	Proprietary Data .....	26
<b>4.0</b>	<b>TEST SPECIFICATIONS .....</b>	<b>26</b>
4.1	Requirements (Strategy of Evaluation).....	27
4.1.1	Rationale for ‘Not Applicable’ requirements.....	29
4.2	Hardware Configuration and Design .....	29
4.3	Software System Functions.....	29

4.4	Test Case Design .....	30
4.4.1	Hardware Qualitative Test Case Design .....	30
4.4.2	Hardware Environmental Test Case Design .....	31
4.4.3	Software Module Test Case Design and Data .....	31
4.4.4	Software Functional Test Case Design and Data.....	31
4.4.5	System-Level Test Case Design .....	32
4.5	Test Specifications .....	32
4.5.1	TDP Evaluation.....	32
4.5.2	Source Code Review.....	37
4.5.3	Physical Configuration Audit (PCA).....	37
4.5.4	System Level Testing.....	38
4.5.4.1	Functional Configuration Audit (FCA) .....	39
4.5.4.2	System Integration .....	39
4.5.4.3	Accuracy .....	40
4.5.4.4	Volume & Stress.....	41
4.5.4.5	Regression.....	41
4.5.5	Security Functions .....	41
4.5.6	Usability & Accessibility.....	41
<b>5.0</b>	<b>TEST DATA .....</b>	<b>41</b>
5.1	Test Data Recording .....	41
5.2	Test Data Criteria.....	42
<b>6.0</b>	<b>TEST PROCEDURES AND CONDITIONS .....</b>	<b>42</b>
6.1	Facility Requirements .....	42
6.2	Test Set-Up .....	42
6.3	Test Sequence .....	43
6.4	Test Operations Procedure.....	43
	<b>PROJECT SCHEDULE.....</b>	<b>A-1</b>

## 1.0 INTRODUCTION

The purpose of this Test Plan is to document the procedures that Pro V&V, Inc. will follow to perform certification testing during a system modification campaign for the Election Systems & Software (ES&S) Voting System 6.0.6.0 (EVS 6.0.6.0) to the requirements set forth for voting systems in the U.S. Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (VVSG), Version 1.0. Prior to submitting the voting system for testing, ES&S submitted an application package to the EAC for certification of the EVS 6.0.6.0. The application was accepted by the EAC and the project was assigned the unique Project Number of ESSEVS6060.

At test conclusion, the results of all testing performed as part of this test campaign will be submitted to the EAC in the form of a national certification test report.

### 1.1 Description and Overview of EAC Certified System Being Modified

*The EAC Certified System that is the baseline for the submitted modification is described in the following subsections. All information presented was derived from the previous Certification Test Report, the EAC Certificate of Conformance and/or the System Overview.*

The EVS 6.0.6.0 system is a modification to the previously EAC-certified EVS 6.0.4.0 (EVS 6.0.4.0). The DS450 and DS850 components are modifications of the previously EAC-certified EVS 6.1.0.0 (EVS 6.1.0.0). The following paragraphs provide a brief description of each baselined system. A detailed description of the EVS 6.0.4.0 test campaign is contained in SLI Compliance Report No. ESY-18004-CTR-01. A detailed description of the EVS 6.1.0.0 test campaign is contained in Pro V&V Report No. TR-01-01-ESS-006-01.02. These reports, along with associated test documentation, are available for viewing on the EAC's website at [www.eac.gov](http://www.eac.gov).

#### 1.1.1 Baseline Certified Systems

##### EVS 6.0.4.0

EVS 6.0.4.0 is composed of software applications, central count location devices and polling place devices with accompanying firmware, and COTS hardware and software. EVS 6.0.4.0 is comprised of the following components: ExpressVote Universal Voting System Hardware 1.0 (ExpressVote HW1.0), ExpressVote Universal Voting System Hardware 2.1 (ExpressVote HW2.1); DS200 precinct-based scanner and tabulator (DS200); DS450 high-throughput central scanner and tabulator (DS450); DS850 high-speed central scanner and tabulator (DS850); ExpressVote XL Full Face Universal Voting System (ExpressVote XL); ExpressTouch Electronic Universal Voting System (ExpressTouch); Electionware Election Management Software (Electionware); ES&S Event Log Service (ELS); and Removable Media Service (RMS).

##### EVS 6.1.0.0

EVS 6.1.0.0 is composed of software applications, central count location devices and polling place devices with accompanying firmware, and COTS hardware and software. EVS 6.1.0.0 is

comprised of the following components: ExpressVote Universal Voting System Hardware 1.0 (ExpressVote HW1.0), ExpressVote Universal Voting System Hardware 2.1 (ExpressVote HW2.1); DS200 precinct-based scanner and tabulator (DS200); DS450 high-throughput central scanner and tabulator (DS450); DS850 high-speed central scanner and tabulator (DS850); ExpressVote XL Full Face Universal Voting System (ExpressVote XL); ExpressTouch Electronic Universal Voting System (ExpressTouch); Electionware Election Management Software (Electionware); ES&S Event Log Service (ELS); and Removable Media Service (RMS).

Descriptions of the EVS 6.0.4.0 and EVS 6.1.0.0 system components are provided below:

#### ExpressVote Hardware 1.0 (ExpressVote HW1.0)

ExpressVote HW1.0 is a hybrid paper-based polling place voting device that provides touch screen vote capture that incorporates the printing of the voter's selections as a cast vote record, to be scanned for tabulation in any one of the ES&S precinct or central scanners.

#### ExpressVote Hardware 2.1 (ExpressVote HW2.1)

ExpressVote HW2.1 is a hybrid paper-based polling place voting device that provides touch screen vote capture that incorporates the printing of the voter's selections as a cast vote record, to be scanned for tabulation in any one of the ES&S precinct or central scanners.

There are two separate versions of ExpressVote HW2.1: version 2.1.0.0 and version 2.1.2.0 (6.4 & 6.8).

#### DS200 Precinct-based Scanner and Tabulator (DS200)

DS200 is a polling place paper-based voting system, specifically a digital scanner and tabulator that simultaneously scans the front and back of a paper ballot and/or vote summary card in any of four orientations for conversion of voter selection marks to electronic Cast Vote Records (CVR).

#### DS450 High-Throughput Scanner and Tabulator (DS450)

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 for conversion of voter selection marks to electronic Cast Vote Records (CVR).

#### DS850 High-Speed Scanner and Tabulator (DS850)

DS850 is a central scanner and tabulator that simultaneously scans the front and back of a paper ballot and/or vote summary card in any of four orientations for conversion of voter selection marks to electronic Cast Vote Records (CVR).

#### Electionware Election Management Software (Electionware)

Electionware election management software is an end-to-end election management software application that provides election definition creation, ballot formation, equipment configuration, result consolidation, adjudication and report creation. Electionware is composed of five software groups: Define, Design, Deliver, Results and Manage.

### ExpressVote XL Full-Face Universal Voting System (ExpressVote XL)

ExpressVote XL is a hybrid paper-based polling place voting device that provides a full-face touch screen vote capture that incorporates the printing of the voter's selections as a cast vote record, and tabulation scanning into a single unit.

### ExpressTouch Electronic Universal Voting System (ExpressTouch)

ExpressTouch is a DRE voting system which supports electronic vote capture for all individuals at the polling place.

*Note: This component has been removed for the EVS 6.0.6.0 configuration.*

### ES&S Event Log Service (ELS)

ELS monitors and logs users' interactions with the Election Management System. Events that happen when a connection to the database is not available are logged to the Windows Operating System log through the ELS.

### Removable Media Service (RMS)

RMS is a utility that runs in the background of the Windows operating system. RMS reads specific information from any attached USB devices so that ES&S applications such as Electionware can use that information for media validation purposes.

## **1.1.2 Description of Modification**

EVS 6.0.6.0 is a modified voting system configuration that includes upgrades to the components of the baselined systems, new hardware configuration options, and modifications to existing components. The list below includes specific changes between the current EVS 6.0.6.0 and the baseline of the EVS 6.0.4.0, as taken from the *ES&S Voting System 6.0.6.0 System Change Notes*:

### HARDWARE CONFIGURATION CHANGES

- New Hardware
  - DS950 High-Speed Scanner and Tabulator (DS950). The DS950 is a central scanner and tabulator that simultaneously scans the front and back of a paper ballot and/or vote summary card in any of four orientations for conversion of voter selection marks to electronic Cast Vote Records (CVR).
  - USB Flash Drives (USB 3.0):
    - Introduced modernized USB 3.0 capabilities (4GB, 8GB, 16GB, and 32GB).
    - Introduced a flash drive with high capacity for central count results export capability (256GB)



- New Configuration Options
  - **ExpressVote Dual Express Cart.** The Dual Express Cart is a rolling cart with four locking caster wheels. It is capable of holding up to two ExpressVote units securely in place. One unit is positioned for standing voters while the other is ADA-compliant to accommodate a seated voter. Each of the stations on this cart include deployable privacy screens.
  - **ExpressVote Ben Franklin Voting Booth.** The ExpressVote Ben Franklin Booth is a convenient ADA-compliant way to deploy the ExpressVote for use as marker. The voting booth can be positioned to accommodate both standing and seated voters.
  - **DS200 Ballot Trolley.** The DS200 ballot trolley is a convenient and secure way to transport scanned ballots after the close of voting. The ballot trolley is designed to be used with the collapsible ballot box configuration.
  - **DS200 Ballot Tote Bag.** The DS200 ballot tote bag allows secure transportation of scanned ballots after the close of voting. The ballot tote bag is designed to be used with the plastic ballot box configuration.
- Hardware Modifications
  - **ExpressVote HW2.1:** updated the following components to replace end-of-life parts:
    - Main battery pack
    - CMOS battery

## SOFTWARE/FIRMWARE CHANGES

### Cross-Product Changes

- Operating System
 

Upgraded the operating system from Microsoft Windows 7 to Microsoft Windows 10 Enterprise LTSC and from Microsoft Windows Server 2008 R2 to Microsoft Windows Server 2016. This upgrade moves the voting system to a 64-bit architecture.

Impacted products: Electionware
- Dual Factor Authentication
 

Implemented YubiKey USB keys for dual factor authentication (optional).

Impacted products:

  - Election Management System
- Increased RAM Potential
 

Provided the option for increased physical RAM on the EMS in the client, server and/or standalone configurations (optional).

Impacted products:

- Election Management System

- Arial fonts

Included the recommended Arial fonts, which allows states to have better flexibility for ballot/election layout. This font is optional and is obtained via customer purchase.

Impacted products:

- Election Management System

- Add Option to Present Voter Instructions to All Voters

Provide a configurable option to present all voters with voting instructions (on-screen and audio) at the beginning of each ExpressVote vote session in the voter-selected language.

Impacted products:

- Electionware
- ExpressVote HW1.0
- ExpressVote HW2.1

- Add Option to Present Election Name, Date, and Ballot Style to All Voters

Provide a configurable option to the Election Name, Election Date, and Ballot Style to voter instructions (on-screen and audio) that are available to the voter at the beginning of each vote session or on-demand when the Help feature is invoked.

Impacted products:

- Electionware
- ExpressVote HW1.0
- ExpressVote HW2.1

- Add option to always front eject cards for review on ExpressVote Tabulator

Provide configurable option for the ExpressVote Tabulator to eject the printed card to all voters for review before casting.

Impacted products:

- Electionware
- ExpressVote HW2.1

- Synchronization

Incremented firmware version to remain synchronized with common code stack changes.

Impacted products:

- DS450
- DS850

- New USB Flash Drives

Added support for new USB flash drives (4GB, 8GB, 16GB, 32GB).

Impacted products:

- All products

- Windows 10 Flash Drives

Added support for exporting files on a USB flash drive formatted on Windows 10.

Impacted products:

- All products

- Imprinted Ballots

Enhanced the imprinted ballot number with the ability to include the last four digits of the machine serial number.

Impacted products:

- DS450
- DS850

- Credentials

Changed log in credentials so all central count equipment uses the same username and password rather than requiring different user credentials for each central count model.

Impacted products:

- DS450
- DS850

### DS200

- Write-in Snippets

- On the DS200 results tape the write in snippets are all grouped together regardless of precinct. The Snippets should be sorted on the tape by precinct.

- Write-in Support

- Revised the Write-In Review report to suppress contests with no entered write-in votes. This will save space on the report and avoid wasting report tape.

- Security

- Integrated support for Security CF Cards.

### DS450

- Threshold Settings

- Set the DS450 black threshold default setting to 135 per engineering recommendation.

## Electionware

- Performance Improvement
  - Migrated Electionware from a 32-bit to a 64-bit application. This allows increased memory allocation and improves system performance.
- Performance Improvement
  - Provided an additional internal Postgres system logging message to enhance the security and performance of the database. This additional logging is included within the internal Postgres logging for analytical, internal traceability and allows for further indexing for added performance. Shortened the ballot finalization process in Touch Screen Ballot.
- Adjudication
  - Provided an additional user logging message to enhance the transparency and security of the database. This additional logging is included within the Reporting module to assist users during ballot adjudication.
- Security
  - Updated user rights to require system administrator credentials to access functionality to clear results media.
- Exports
  - Updated the Enhanced XML export file to handle Party Preference contests.
- Navigator
  - Updated the Reporting module Load Results Navigator, requiring the user to manually refresh for updates.
- Write-In Snippets
  - Enhanced ExpressVote and ExpressVote XL write-in snippet loading and display in the Reporting module.

## Event Logging Service

- 64-bit Architecture
  - Convert Event Log Service to the new 64-bit architecture.

## ExpressVote Universal Voting System, HW1.0

- Incorrect Copyright Date on Splash Screen
  - Included the sysload.bmp file on the USB update application in order to properly update the copyright date.

## ExpressVote Universal Voting System, HW2.1

- Audit Log
  - Addressed a scenario where a log file entry is written to the log file in the USB media before the unit password has been entered.
- Application Update

- Addressed an issue that required re-entry of the serial number when doing application updates.

#### ExpressVote XL Full-Face Universal Voting System

- Ballot Activation
  - Enhanced firmware so customers can use ExpressVote XL activation cards pre-printed with a designated party barcode.
- Polls Close Process
  - Enhanced firmware to prevent ExpressVote XL from automatically printing results reports at poll closing unless the poll worker inserts the removable collection media or manually enters an override code. This enhancement is to encourage best practices by reducing the opportunity to remove the media before the poll collection process is complete.
- Screen Calibration
  - Overall improvements to the screen calibration feature to address feedback from customer sites and field service technicians. Added a screen calibration test utility to the admin menu.
- L&A Test Data checks
  - Added additional checks to identify and remove test data from logic and accuracy testing on the election media.
- Access code required to silence media door alarm
  - Added an access code challenge to silence the alert when the media door is opened in an unauthorized manner.
- Security
  - Improved device security by updating handling of cards that are the wrong length to require poll worker intervention.

#### Removable Media Service

- 64-bit Architecture
  - Convert Removable Media Service to the new 64-bit architecture.

### **1.1.3 Initial Assessment**

An initial assessment on the submitted modifications was performed to determine the scope of testing. Testing from the previous test campaigns was used to establish the baseline. Based on the assessment, it was determined execution of the System Integration Test, as well as the tasks listed below would be required to verify compliance of the identified modifications:

- Source Code Review, Compliance Build, Trusted Build, and Build Document Review
- System Level Testing
  - System Integration

- Accuracy
- Volume & Stress
- Technical Documentation Package (TDP) Review
- Functional Configuration Audit (FCA)
- System Loads & Hardening
- Physical Configuration Audit (PCA)
- Regression Testing
- Usability & Accessibility Testing
- Maintainability
- Security Review (SCAP)
- Electrical Supply
- Hardware Testing

*Note: Due to the introduction of the DS950 as a new system component and the submitted modifications to the ExpressVote HW2.1, it was determined that hardware testing would be required. The full suite of hardware electrical testing and all applicable environmental tests for the DS950 as well as select electrical tests for the modified ExpressVote HW2.1 was successfully performed as part of a previous state level test campaign. The Pro V&V test report and associated hardware test reports of this testing were submitted to the EAC for evaluation and approved for reuse in this test campaign.*

#### **1.1.4 Regression Test**

EVS 6.0.6.0 is a modified voting system configuration that includes upgrades to the components of the baselined systems, new hardware configuration options, and modifications to existing components. Modified system testing is an abbreviated testing campaign built upon a regression review of the modifications against the baseline-system and requirements. Modifications, alone and collectively, are reviewed (tested) to see if they fall under any requirement(s), or functionally impact the ability of the modified system to continue to meet requirements. Regression reviews consist of targeted investigations to determine if further testing is necessary based on the nature and scope of the communicated modifications (whether activated or deactivated), and any other submitted information. The objective of regression testing is to establish assurance that the modifications have no adverse impact on the compliance, integrity, or performance of the system.

Regression testing for this test campaign will consist of the execution of the System Integration Test, as described in Section 4.5.4.2 of this Test Plan.

## 1.2 References

- Election Assistance Commission 2005 Voluntary Voting System Guidelines (VVSG) Version 1.0, Volume I, “Voting System Performance Guidelines”, and Volume II, “National Certification Testing Guidelines”
- Election Assistance Commission Testing and Certification Program Manual, Version 2.0
- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 2.0
- National Voluntary Laboratory Accreditation Program NIST Handbook 150, 2020 Edition, “NVLAP Procedures and General Requirements (NIST HB 150-2020)”
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2017 Edition, “Voting System Testing (NIST Handbook 150-22-2017)”
- United States 107<sup>th</sup> Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Pro V&V, Inc. Quality Assurance Manual, Revision 1.0
- Election Assistance Commission “Approval of Voting System Testing Application Package” letter dated May 6, 2016
- EAC Requests for Interpretation (RFI) and Notices of Clarification (NOC) (listed on [www.eac.gov](http://www.eac.gov))
- Pro V&V Certification Test Report TR-01-01-ESS-006-01.02
- Certificate of Conformance ES&S EVS 6.1.0.0, dated September 24, 2019
- EAC Grant of Certification, ESSEVS6100, dated September 24, 2019
- EAC Certificate of Conformance ES&S EVS 6.0.4.0, dated May 3, 2019
- EAC Grant of Certification, ESSEVS6040, dated May 3, 2019
- ES&S Technical Data Package (*A listing of the EVS 6.0.6.0 documents submitted for this test campaign is listed in Section 4.5.1 of this Test Plan*)
- Pro V&V Test Report TR-01-02-ESS-027-01.00, “Election Systems & Software (ES&S) Voting System (EVSFL) 6.0.6.0 Hardware Testing” which includes the following National Technical Systems (NTS) Test Reports as attachments: ETR-PR120980-00 Revision 0, ITR-PR120980-00 Revision 0, TR-PR120980-1 Revision 1, and TR-PR120980 Revision 2

### **1.3 Terms and Abbreviations**

*This subsection lists terms and abbreviations relevant to the hardware, the software, or this Test Plan.*

“ADA” – Americans with Disabilities Act 1990

“CM” – Configuration Management

“COTS” – Commercial Off-The-Shelf

“DISA-STIG” – Defense Information Systems Agency Security Technical Implementation Guide

“EAC” – United States Election Assistance Commission

“ELS” – Election Log Service

“EMS” – Election Management System

“ES&S” – Election Systems and Software

“FCA” – Functional Configuration Audit

“HAVA” – Help America Vote Act

“NOC” – Notice of Clarification

“PCA” – Physical Configuration Audit

“QA” – Quality Assurance

“RMS” – Removable Media Service

“RFI” – Request for Interpretation

“SCAP” – Security Content Automation Protocol

“TDP” – Technical Data Package

“UVC” – Universal Voting Console

“VSTL” – Voting System Test Laboratory

“VVSG” – Voluntary Voting System Guidelines

### **1.4 Project Schedule**

The Project Schedule for the test campaign is located in Appendix A. The dates on the schedule are not firm dates but planned estimates based on the anticipated project work flow.



## 1.5 Scope of Testing

The scope of testing focused on evaluating the modifications detailed in Section 1.1.2 of this Test Plan.

To determine the EVS 6.0.6.0 test requirements, the submitted modifications were evaluated against each section of the EAC VVSG 1.0 to determine the applicable tests to be performed. Based on this assessment, it was determined that multiple areas within the EAC VVSG 1.0 will be evaluated to encompass the required tests.

A breakdown of the areas and associated tests is listed below:

- EAC VVSG 1.0 Volume 1, Section 2: Functional Requirements
  - System Integration Testing
  - Functional Configuration Audit (FCA)
  - Physical Configuration Audit (PCA), including System Loads & Hardening
  - Technical Documentation Package (TDP) Review
  - Accuracy Testing
- EAC VVSG 1.0 Volume 1, Section 3: Usability & Accessibility
  - Usability & Accessibility Testing
  - Technical Documentation Package (TDP) Review
- EAC VVSG 1.0 Volume 1, Section 4: Hardware Requirements

*Note: Applicable hardware electrical and environmental testing approved for reuse from previous test campaigns.*

  - Technical Documentation Package (TDP) Review
- EAC VVSG 1.0 Volume 1, Section 5: Software Requirements
  - Source Code Review, Compliance Build, Trusted Build, and Build Document Review
  - Technical Documentation Package (TDP) Review
  - Functional Configuration Audit (FCA)
- EAC VVSG 1.0 Volume 1, Section 7: Security Requirements
  - Security Review
  - Technical Documentation Package (TDP) Review

### 1.5.1 VVSG

The EVS 6.0.6.0 shall be evaluated against the relevant requirements contained in the EAC VVSG 1.0. To evaluate the EVS 6.0.6.0 test requirements, the submitted modifications were evaluated against each section of the EAC VVSG 1.0 to determine the applicable tests to be performed. Details of this evaluation are contained in Section 4.1 of this Test Plan.

### 1.5.2 RFIs

There are no RFIs released by the EAC as of the date of this Test Plan that pertain to this test campaign that were not in effect at the time of the baseline system certification.

### 1.5.3 NOCs

There are no NOCs released by the EAC as of the date of this Test Plan that pertain to this test campaign that were not in effect at the time of the baseline system certification.

## 1.6 System Overview

EVS 6.0.6.0 includes the following: ExpressVote Universal Voting System Hardware 1.0 (ExpressVote HW1.0), ExpressVote Universal Voting System Hardware 2.1 (ExpressVote HW2.1); DS450 high-throughput central scanner and tabulator (DS450); DS200 precinct-based scanner and tabulator (DS200); DS850 high-speed central scanner and tabulator (DS850); DS950 high-speed central count scanner and tabulator (DS950); and ExpressVote XL Full Face Universal Voting System (ExpressVote XL).

EVS 6.0.6.0 system components submitted for testing are listed in the following tables.

**Table 1-1. EVS 6.0.6.0 System Components - Proprietary**

System Component	Software or Firmware Version	Hardware Version(s)	Description
Electionware	5.0.6.0	---	Election management software that provides end-to-end election management activities
ES&S Event Log Service (ELS)	2.0.0.0	---	Logs users' interactions with EMS
Removable Media Service (RMS)	2.0.0.0	---	Utility that runs in the background of the Windows operating system
DS200	2.21.0.0	1.2, 1.3	Precinct Count Tabulator that scans voter selections from both sides of the ballot simultaneously
DS200 Ballot Box	---	1.0, 1.1	Collapsible Ballot Box (Model 98-00009)
DS200 Ballot Box	---	1.2, 1.3, 1.4, 1.5	Plastic Ballot Box (Model 57521)
DS200 Tote Bin	---	1.0	Tote Bin Ballot Box (Model 00074)

**Table 1-1. EVS 6.0.6.0 System Components – Proprietary (continued)**

<b>System Component</b>	<b>Software or Firmware Version</b>	<b>Hardware Version(s)</b>	<b>Description</b>
DS200 Ballot Trolley	---	N/A	Ballot Trolley Ballot Box (60)
DS200 Metal Ballot Box	---	1.0, 1.1, 1.2	Metal Ballot Box (76245)
DS200 Ballot Tote Bag	---	N/A	Ballot Tote Bag (212516)
DS450	3.5.0.0	1.0	Central Count Scanner and Tabulator
DS450 Cart	---	---	Model 3002
DS850	3.5.0.0	1.0	Central Count Scanner and Tabulator
DS850 Cart	---	---	Model 6823
DS950	3.5.0.0	1.0	Central Count Scanner and Tabulator
DS950 Cart	---	---	Model 3002
ExpressVote XL	1.3.0.0	1.0	Hybrid full face paper-based vote capture and selection device and precinct count tabulator
ExpressVote HW1.0	1.5.4.0	1.0	Hybrid paper-based vote capture and selection device
ExpressVote HW1.0 Previewer	1.5.4.0	---	Ballot preview software
ExpressVote HW2.1	2.6.0.0	2.1.0.0 2.1.2.0	Hybrid paper-based vote capture and selection device
ExpressVote HW2.1 Previewer	2.6.0.0	---	Ballot preview software
ExpressVote Rolling Kiosk	---	1.0	Portable Voting Booth (Model 98-00049)
Voting Booth	---	---	Stationary Voting Booth (Model 98-00051)
ExpressVote Ben Franklin Booth	---	---	Sitting and Standing Voting Booth (Model 00380)
ExpressVote Dual Express Cart	---	---	Portable Voting Booth (Model 41402)
Quad Express Cart	---	---	Portable Voting Booth (Model 41404)
Voting Booth Workstation	---	---	Stationary voting booth (Model 87035)
MXB ExpressVote Voting Booth	---	---	Sitting and Standing Voting Booth (Model 95000)
ExpressVote Single Table	---	---	Voting Table for One Unit (Model 87033)
ExpressVote Double Table	---	---	Voting Table for Two Units (Model 87032)
ADA Table	---	---	Voting Table for One Unit (Model 87031)
Universal Voting Console (UVC)	---	2.0	Detachable ADA support peripheral (Model 98-00077)
SecureSetup	6.0.6.0	---	Proprietary Hardening Script

**Table 1-2. EVS 6.0.6.0 System Components – COTS Software**

<b>Manufacturer</b>	<b>Application</b>	<b>Version</b>
ES&S/Microsoft Corporation	Windows 10 Enterprise LTSC (ISO)*	WIN10_6060.iso
ES&S/Microsoft Corporation	Windows Server 2016 (ISO)*	WIN2016_6060.iso
Microsoft Corporation	Windows Updates (Software updates included in the OS image)	Package date: WIN10_6060.iso-4/16/2021 WIN2016_6060.iso-4/16/2020
Microsoft Corporation	Windows Defender Antivirus (Configured within the OS image)	N/A
Dell	TPM Utility	DellTpm2.0_Fw1.3.2.8_V1_64.exe
Cerberus	Cerberus FTP Server – Enterprise	11.3.4 (64-bit)
Adobe	Adobe Acrobat	11.0.07
Yubico Login for Windows	Dual Factor Authentication YubiKey USB keys for dual factor authentication (optional)	2.0.3
PostgreSQL	PostgreSQL11	11

*\*These ISOs were constructed by Pro V&V per ES&S-provided procedures utilizing COTS software components.*

**Table 1-3. EVS 6.0.6.0 System Components – COTS Hardware**

<b>Manufacturer</b>	<b>Hardware</b>	<b>Model/Version</b>
Dell	EMS Server	PowerEdge T430, T440, T630
Dell	EMS Client or Standalone Workstation	Latitude 5580 (32GB Ram), OptiPlex 5040, 5050, 7020
Dell	Trusted Platform Module (TPM) Chip 1.2 and 2.0 (optional)	N/A
Toshiba	EMS Standalone	Tecra A50-C
Innodisk	USB EDC H2SE (8GB) for ExpressVote 1.0	DEEUH1-01GI72AC1SB
Innodisk	USB EDC H2SE (16GB) for ExpressVote 2.1	DEEUH1-16GI72AC1SB
Delkin	2.0 USB Flash Drive (512MB, 1GB, 2GB, 4GB, 8GB)	N/A
Delkin	3.0 USB Flash Drive (4GB, 8GB, 16GB, 32GB, 256GB)	N/A
Delkin	USB Embedded 2.0 Module Flash Drive	MY16TNK7A-RA042-D/ 16 GB
Delkin	Compact Flash Memory Card (1GB)	CE0GTFHHK-FD038-D
Delkin	USB Embedded 2.0 Module Flash Drive (8GB)	MY08TQJ7A-RA000-D / 8GB
Delkin	Secure CF Card (2GB)	CE02TLQCK-FD000-D

**Table 1-3. EVS 6.0.6.0 System Components – COTS Hardware** *(continued)*

<b>Manufacturer</b>	<b>Hardware</b>	<b>Model/Version</b>
Delkin	Compact Flash Memory Card Reader/Writer	DDREADER48
Delkin	CFAST Card (2GB, 4GB)	N/A
Delkin	CFAST Card Reader/Writer	6381
Delkin USB Flash Drive	BitLocker 32.2 MB	Storage for security key (optional)
YubiKey USB drive	Dual Factor Authentication	12649173 (optional)
Lexar	CFAST Card Reader/Writer	LRWCR1TBNA
Avid	Headphones	86002
Zebra Technologies	QR code scanner (Integrated)	DS457-SR20009, DS457-SR20004ZZWW
Symbol	QR Code scanner (External)	DS9208
Dell	DS450 Report Printer	S2810dn
OKI	DS450, DS850, and DS950 Report Printer	B431dn, B431d, B432DN
OKI	DS450 and DS850 Audit Printer	Microline 420
APC	DS450 UPS	Back-UPS Pro 1500, Smart-UPS 1500
APC	DS850 UPS	Back-UPS RS 1500, Pro 1500
CyberPower	DS950 UPS	OR1500PFCLCD
Tripp Lite	DS450 Surge Protector	Spike Cube
Seiko Instruments	Thermal Printer	LTPD-347B
NCR/Nashua	Paper Roll	2320
Fujitsu	Thermal Printer	FTP-62GDSL001, FTP-63GMCL153
HP Inkjet	Ink cartridge for DS450/DS850 ballot number imprinting	87002
TDS	Ink cartridge for DS200 ballot number imprinting	2278

**1.6.1 Block Diagram**

Figure 1-1 illustrates the end-to-end functionality of EVS 6.0.6.0. As stated in the EVS 6.0.6.0 technical documentation, in order to fully demonstrate all supported functionality, multiple configurations are required. These configurations are depicted in Figures 1-2, 1-3, and 1-4. *Reference the System Overview for detailed information.*



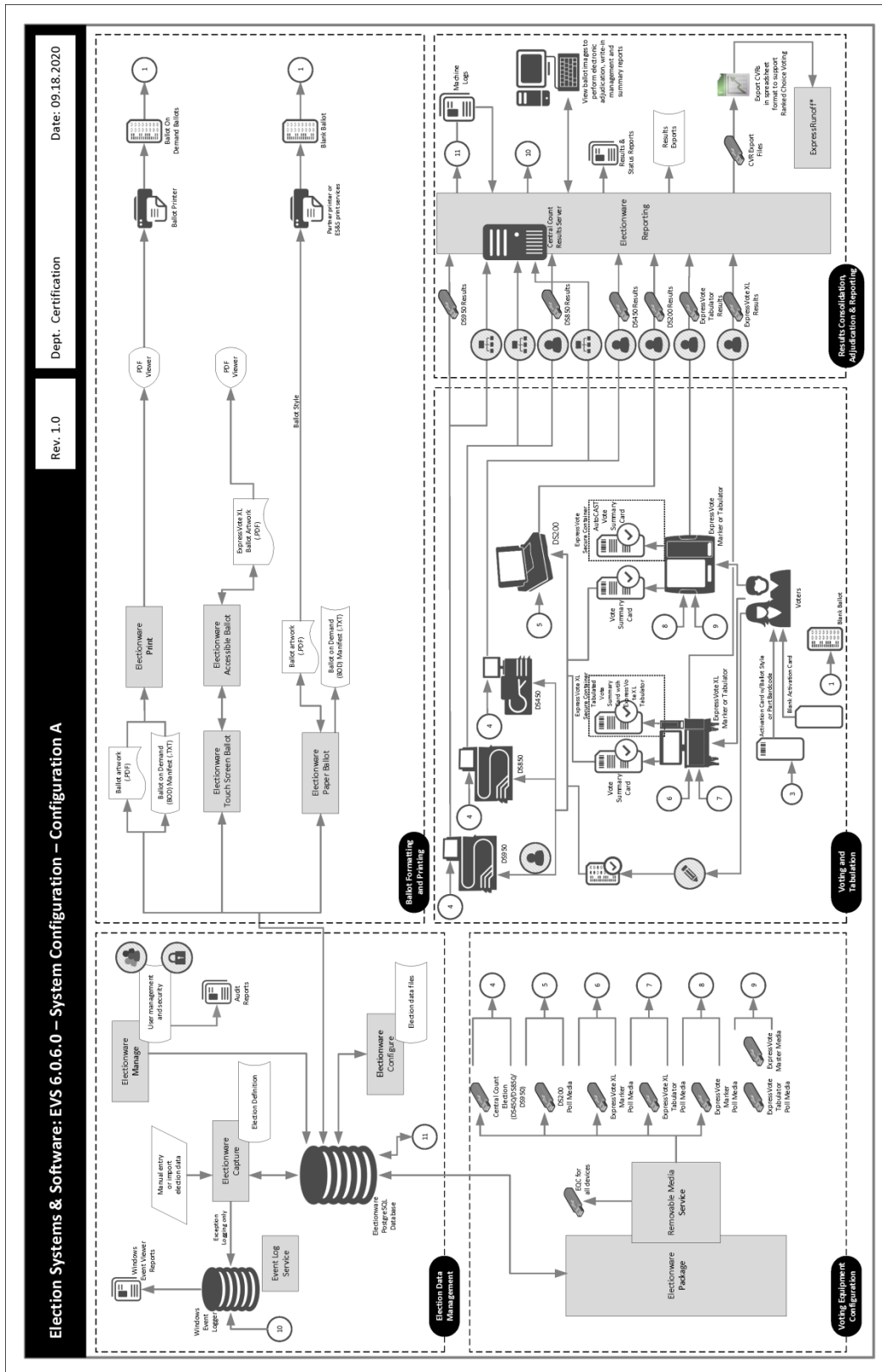


Figure 1-2. EVS 6.0.6.0 Configuration A Overview

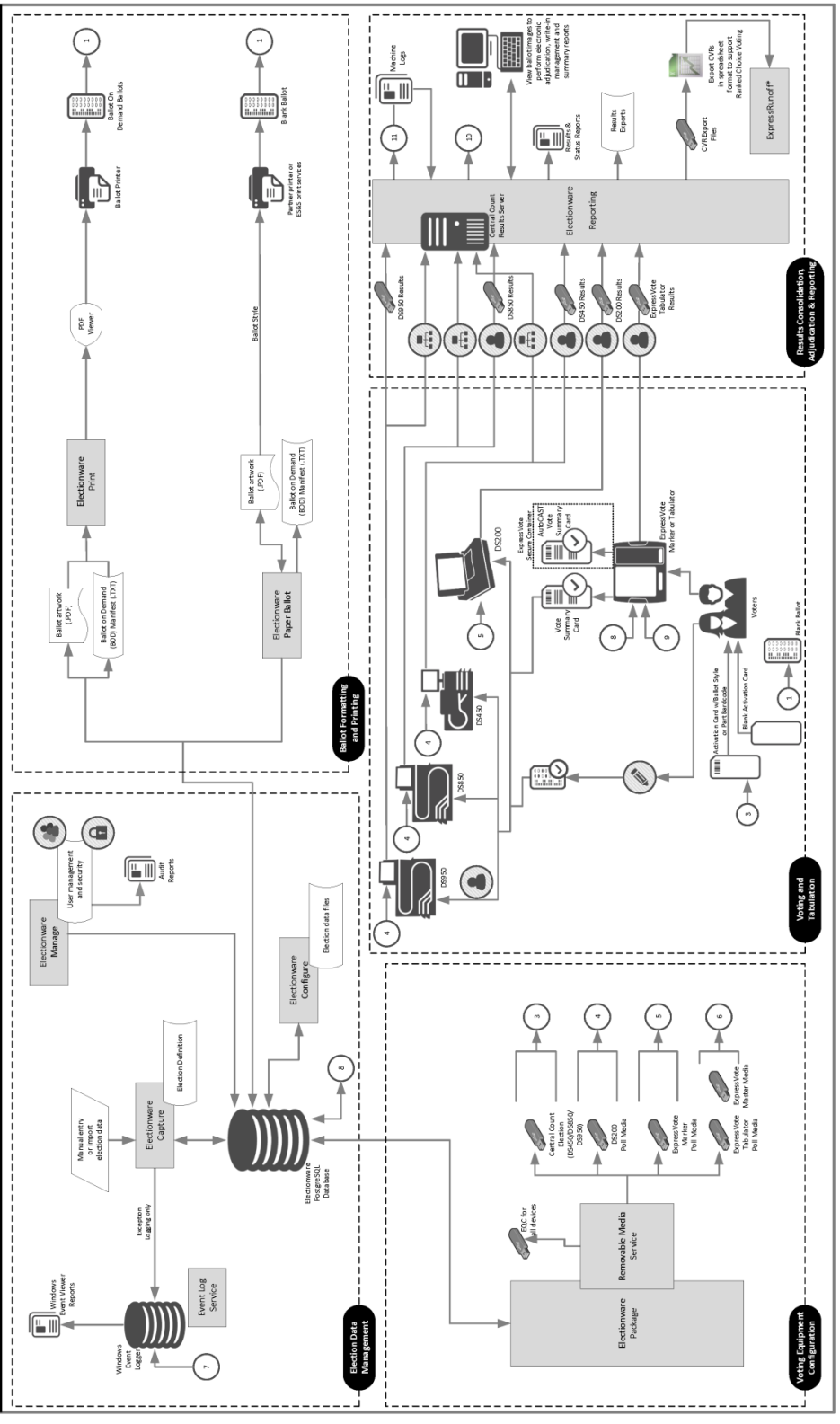


Figure 1-3. EVS 6.0.6.0 Configuration B Overview



Election Systems & Software: EVS 6.0.6.0 – System Configuration – Configuration C

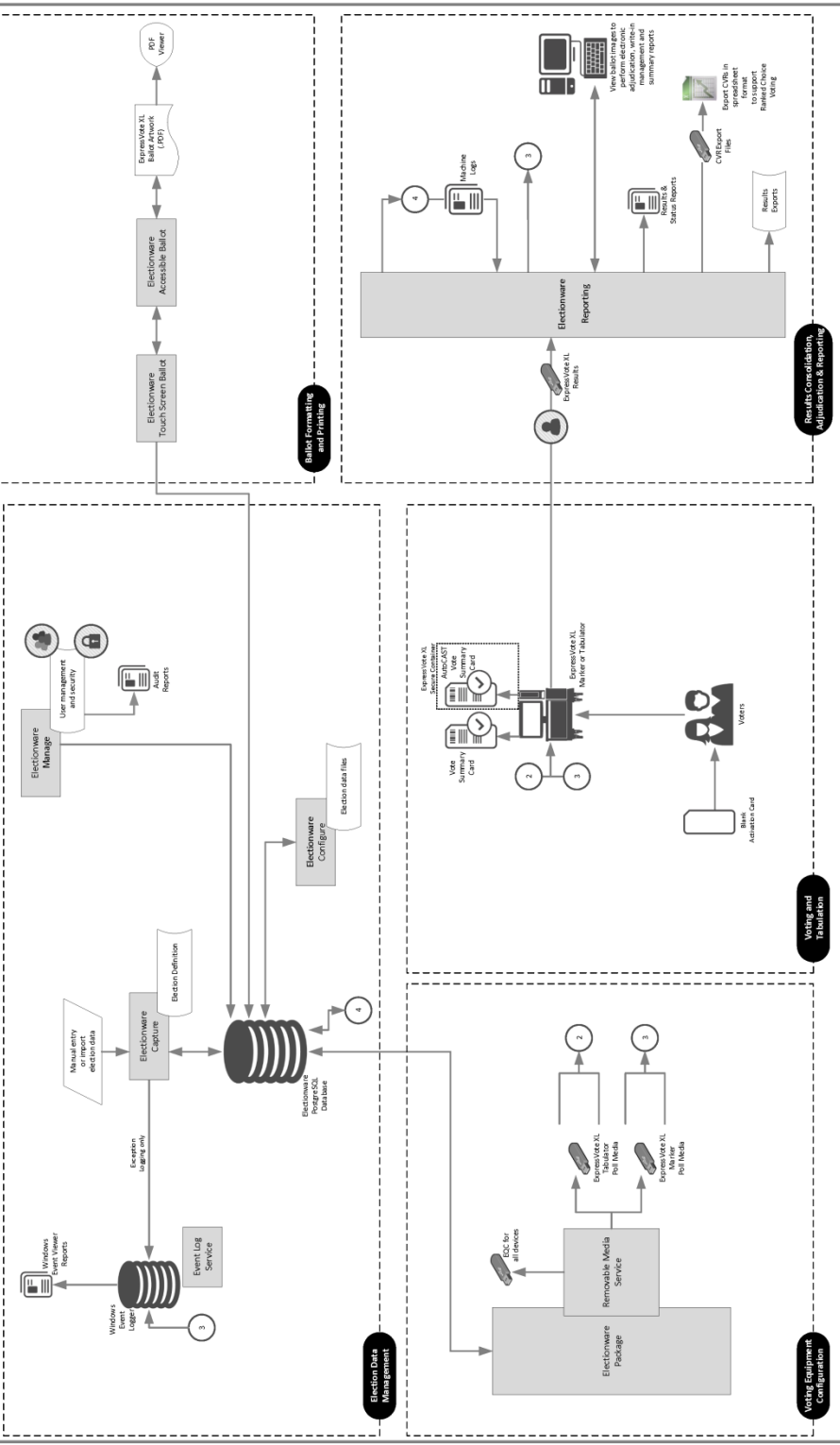


Figure 1-4. EVS 6.0.6.0 Configuration C Overview

## 1.6.2 System Limits

The system limits that ES&S has stated to be supported by the EVS 6.0.6.0 are provided in the table below.

**Table 1-4. EVS 6.0.6.0 System Limits**

<b>System Characteristic</b>	<b>Boundary or Limitation</b>	<b>Limiting System Component</b>
Max. precincts allowed in an election	9,900	Electionware
Max. candidates allowed per election	10,000	Electionware
Max. contests allowed in an election	10,000	Electionware
Max. contests allowed per ballot style	500 or # of positions on ballot	N/A
Max. candidates (ballot choices) allowed per contest	230	Electionware
Max. number of parties allowed	General election: 75 Primary election: 30 (including nonpartisan party)	Electionware
Max. 'vote for' per contest	230	Electionware
Ballot formats	All paper ballots used in an election must be the same length. Votable paper ballots must contain the same number of rows	Ballot scanning equipment
Max. Ballot Styles	15,000	Electionware
Max. ballots per batch	1,500	DS450/DS850/DS950
Max. precinct types/groups	25 (arbitrary)	Electionware
Max. precincts of a given type	250 (arbitrary)	Electionware
Max. reporting groups	13	Electionware

Additionally, the following EVS 6.0.6.0 component limitations have been identified:

### ExpressVote Limitations

1. ExpressVote capacities exceed all documented limitations for the ES&S election management, vote tabulation and reporting system. For this reason, Election Management System and ballot tabulator limitations define the boundaries and capabilities of the ExpressVote system as the maximum capacities of the ExpressVote are never approached during testing.

### ExpressVote XL Limitations

1. ExpressVote XL capacities exceed all documented limitations for the ES&S election management, vote tabulation and reporting system. For this reason, Election Management System and ballot tabulator limitations define the boundaries and capabilities of the ExpressVote XL system as the maximum capacities of the ExpressVote XL are never approached during testing.
2. ExpressVote XL does not offer open primary support based on the ES&S definition of Open Primary, which is the ability to select a party and vote based on that party.
3. ExpressVote XL does not support Massachusetts Group Vote.
4. ExpressVote XL does not support Universal Primary Contest.
5. ExpressVote XL does not support Reviewer or Judges Initials boxes.
6. In a General election, one ExpressVote XL screen can hold 32 party columns if set up as columns or 16 party rows if set up as rows.
7. ExpressVote and ExpressVote XL do not support Team Write-In.
8. ExpressVote XL does not support multi-card ballots.

### Electionware Limitations

1. Electionware software field limits were calculated based on an average character width for ballot and report elements. Some uses and conditions, such as magnified ballot views or combining elements on printed media or ballot displays, may result in field limits (and associated warnings) lower than those listed. Check printed media and displays before finalizing the election.
2. Electionware Export Ballot Images function is limited to 250 districts per export.
3. Electionware supports the language special characters listed in the System Overview document. Language special characters other than those on this list may not appear properly when viewed on equipment displays or reports.
4. The Straight Party feature must not be used in conjunction with the Single or Multiple Target Cross Endorsement features.

### Electionware Paper Ballot Limitations

1. The paper ballot code channel, which is the series of black boxes that appear between the timing track and ballot contents, limits the number of available ballot variations depending on how a jurisdiction uses this code to differentiate ballots. The code can be used to differentiate ballots using three different fields defined as: Sequence (available codes 1-16,300), Type (available codes 1-30) or Split (available codes 1-18).
2. For paper ballots, if Sequence is used as a ballot style ID, it must be unique election-wide and the Split code will always be 1. In this case the practical style limit would be 16,300.

3. The ExpressVote activation card has a ballot ID consisting of three different fields defined as: Sequence (available codes 1-16,300), Type (available codes 1-30) or Split (available codes 1-18).
4. Grid Portrait and Grid Landscape ballot types are New York specific and not for general use.

#### DS200 Limitations

1. The DS200 configured for an early vote station does not support precinct level results reporting. An election summary report of tabulated vote totals is supported.
2. The DS200 storage limitation for write-in ballot images is 3,600 images. Each ballot image includes a single ballot face, or one side of one page.
3. Write-in image review requires a minimum 1GB of onboard RAM.
4. To successfully use the write-in report, ballots must span three or more vertical columns. If the column is greater than 1/3 of the ballot width (two columns or less), the write-in image will be too wide to print on the tabulator report tape.

### **1.6.3 Supported Languages**

The following languages are supported by the EVS 6.0.6.0:

- English
- Spanish
- Chinese
- Korean
- Japanese
- Hindi
- Bengali
- Vietnamese
- Tagalog
- Creole
- Russian
- French
- Gujarati (*one configuration only*)
- Punjabi (*one configuration only*)

Support for all stated languages will be verified; however, only English and Spanish language ballots will be cast during the performance of functional testing. Additionally, one character based language (Chinese) will be tested during System Integration Testing.

#### **1.6.4 Supported Functionality**

The EVS 6.0.6.0 is designed to support the following voting variations:

- General Election
- Closed Primary
- Early Voting
- Partisan/Non-Partisan Offices
- Write-In Voting
- Split Precincts
- Vote for N of M
- Ballot Rotation
- Provisional or Challenged Ballots
- Straight Party Voting
- Cross-party Endorsement

### **2.0 PRE-CERTIFICATION TESTING AND ISSUES**

This section describes previous testing performed prior to submitting the voting system to the EAC.

#### **2.1 Evaluation of Prior VSTL Testing**

Pro V&V evaluated to the published Final EAC-certification Test Reports for the EVS 6.0.4.0 and the EVS 6.1.0.0 in order to baseline the current system under test. Additionally, previous hardware testing performed as part of state level testing was reviewed and submitted for reuse to determine hardware test requirements for the DS950 and the modified ExpressVote HW2.1. The results of this testing are contained in Pro V&V Test Report TR-01-02-ESS-027-01.00, “Election Systems & Software (ES&S) Voting System (EVSFL) 6.0.6.0 Hardware Testing” which includes the following National Technical Systems (NTS) Test Reports as attachments: ETR-PR120980-00 Revision 0, ITR-PR120980-00 Revision 0, TR-PR120980-1 Revision 1, and TR-PR120980 Revision 2.

#### **2.2 Evaluation of Prior Non-VSTL Testing**

No prior non-VSTL testing of the EVS 6.0.6.0 modifications were considered for this test campaign.

### **2.3 Known Field Issues**

EVS 6.0.6.0 is a modification to a previously certified system and has not yet been fielded. An issue was discovered during state testing of the previously certified baseline EVS systems in which the sysload.bmp file was not part of the USB update function. This caused the copyright screen to display the incorrect year and in turn generated a hash value mismatch during the verification process. This issue is addressed in EVS 6.0.6.0 with an update to the ExpressVote UVS, HW 1.0 firmware (*Reference Change ID EVI-939 in the Change Notes*) where the sysload.bmp is now part of the USB update function. During testing, Pro V&V will verify the issue has been remedied.

A second issue which related to the system verification script was also discovered during a state examination of previously certified EVS systems that share common components with EVS 6.0.6.0. This issue occurred when the examiner incorrectly ran the system validation script causing the older SHA-256 hash values to remain cached by the system. ES&S stated this issue is addressed in EVS 6.0.6.0 by updating the verification script to include additional checks to the verification process. Pro V&V will verify the issue has been remedied by running the system verification scripts correctly and incorrectly to verify the issue no longer exists. *Note: This issue originates with an ES&S verification script that is provided as a tool with the technical documentation and is not related to the system; therefore it is not listed on change notes.*

### **3.0 MATERIALS REQUIRED FOR TESTING**

*The following sections list all materials needed to enable the test engagement to occur.*

The materials required for testing of the EVS 6.0.6.0 include all materials to enable the test campaign to occur. This includes the applicable hardware and software as well as the TDP, test support materials, and deliverable materials, as described in the following subsections.

#### **3.1 Software**

*This subsection lists the proprietary and COTS software to be provided by the manufacturer as part of the test campaign.*

All software required for testing is identified in Section 1.6 of this test plan. Pro V&V will perform a comparison on the submitted source code against the previously certified versions. Pro V&V will review the submitted modified source code to the EAC VVSG 1.0 and the manufacturer-submitted coding standards.

#### **3.2 Equipment**

*This subsection lists the proprietary and COTS equipment to be provided by the manufacturer as part of the test campaign.*

For COTS equipment, every effort will be made to verify that the COTS equipment has not been modified for use. This will be accomplished by performing research using the COTS equipment manufacturer's websites based on the serial numbers and service tag numbers for each piece of equipment. Assigned test personnel will evaluate COTS hardware, system software and

communications components for proven performance in commercial applications other than voting. For PCs, laptops, and servers, the service tag information will be compared to the system information found on each machine.

Physical external and internal examination will also be performed when the equipment is easily accessible without the possibility of damage. Hard drives, RAM memory, and other components will be examined to verify that the components match the information found on the COTS equipment manufacturer's websites.

### **3.3 Test Materials**

*This subsection lists the test materials required to execute the required tests throughout the test campaign.*

- ExpressVote Activation Card Printer
- Security Seals/Locks/Sleeves
- CF Card Reader/Writer
- CFast Card Reader/Writer
- Headphone Covers
- Ethernet Switch
- Printer Paper
- Ballots and blank ballot grade paper
- Activation cards
- Ballot pens
- CF memory cards
- CFast memory cards
- USB flash drives

### **3.4 Proprietary Data**

All data and documentation considered by the manufacturer to be proprietary will be identified and documented in an independent submission along with a Notice of Protected Information.

## **4.0 TEST SPECIFICATIONS**

Certification testing of EVS 6.0.6.0 submitted for evaluation will be performed to ensure the applicable requirements of the EAC VVSG 1.0 and the EAC Testing and Certification Program Manual, Version 2.0 are met. Additionally, all EAC Request for Interpretations (RFI) and Notices of Clarification (NOC) relevant to the system under test will be incorporated in the test campaign. A complete listing of the EAC RFIs and NOCs is available on the EAC website.

## 4.1 Requirements (Strategy of Evaluation)

To evaluate the EVS 6.0.6.0 test requirements, the submitted modifications were evaluated against each section of the EAC VVSG 1.0 to determine the applicable tests to be performed. Based on this assessment, it was determined the following evaluations would be required to verify compliance of the modifications:

### Section 1: Technical Documentation Package (TDP) Review

A TDP Review will be performed to ensure that all submitted modifications are accurately documented and that the documents meet the requirements of the EAC VVSG 1.0. The preliminary TDP review is performed to gather information concerning the system under test and its capabilities or design intentions. Additionally, a TDP review will be performed throughout the test campaign. The TDP Review includes the Initial Review, the Regulatory/Compliance Review, and the Final Review. This review is conducted to determine if the submitted technical documentation meets the regulatory, customer-stated, or end-user requirements and includes reviewing the documents for stated functionality and verification.

### Section 2: Functional Requirements

The requirements in this section shall be tested during the FCA, Accuracy Test, and System Integration Test. This evaluation will utilize baseline test cases as well as specifically designed test cases and will include predefined election definitions for the input data.

The FCA targets the specific functionality claimed by the manufacturer to ensure the product functions as documented. This testing uses both positive and negative test data to test the robustness of the system. The FCA encompasses an examination of manufacturer tests, and the conduct of additional tests, to verify that the system hardware and software perform all the functions described in the manufacturer's documentation submitted in the TDP (such as system operations, voter manual, maintenance, and diagnostic testing manuals). It includes a test of system operations in the sequence in which they would normally be performed. These system operations and functional capabilities are categorized as follows by the phase of election activity in which they are required:

- Overall System Capabilities: These functional capabilities apply throughout the election process. They include security, accuracy, integrity, system audit ability, election management system, vote tabulation, ballot counters, telecommunications, and data retention.
- Pre-voting Capabilities: These functional capabilities are used to prepare the voting system for voting. They include ballot preparation, the preparation of election-specific software (including firmware), the production of ballots, the installation of ballots and ballot counting software (including firmware), and system and equipment tests.
- Voting System Capabilities: These functional capabilities include all operations conducted at the polling place by voters and officials including the generation of status messages.



- Post-voting Capabilities: These functional capabilities apply after all votes have been cast. They include closing the polling place; obtaining reports by voting machine, polling place, and precinct; obtaining consolidated reports; and obtaining reports of audit trails.
- Maintenance, Transportation and Storage Capabilities: These capabilities are necessary to maintain, transport, and store voting system equipment.

The system integration testing addresses the integration of the hardware and software. This testing focuses on the compatibility of the voting system software components and subsystems with one another and with other components of the voting system. During test performance, the system is configured as would be for normal field use.

The accuracy test ensures that each component of the voting system can each process 1,549,703 consecutive ballot positions correctly within the allowable target error rate. The Accuracy test is designed to test the ability of the system to “capture, record, store, consolidate and report” specific selections and absences of a selection. The required accuracy is defined as an error rate. This rate is the maximum number of errors allowed while processing a specified volume of data.

### Section 3: Usability and Accessibility Requirements

The requirements in this section shall be tested during the Usability and Accessibility Testing. This evaluation will utilize baseline test cases as well as specifically designed test cases and will include predefined election definitions for the input data.

The usability testing focuses on the usability of the system being tested. Usability is defined generally 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. Additional requirements for task performance are independence and privacy: the voter should normally be able to complete the voting task without assistance from others, and the voter selections should be private. Accessibility evaluates the requirements for accessibility. These requirements are intended to address HAVA 301 (a) (3) (B).

### Section 4: Hardware Requirements

The requirements in this section shall be tested utilizing a combination of hardware testing and TDP review.

*Note: Due to the introduction of the DS950 as a new system component and the submitted modifications to the ExpressVote HW2.1, it was determined that hardware testing would be required. The full suite of hardware electrical testing and all applicable environmental tests for the DS950 as well as select electrical tests for the modified ExpressVote HW2.1 was successfully performed as part of a previous state level test campaign. The Pro V&V test report and associated hardware test reports of this testing were submitted to the EAC for evaluation and approved for reuse in this test campaign.*

## Section 5: Software Requirements

The requirements in this section shall be tested utilizing a combination of review and functional testing during the source code review, TDP review, and FCA.

To perform the source code review, Pro V&V will review the submitted source code to the EAC VVSG 1.0 and the manufacturer-submitted coding standards. Prior to initiating the software review, Pro V&V shall verify that the submitted documentation is sufficient to enable:

(1) a review of the source code and (2) Pro V&V to design and conduct tests at every level of the software structure to verify that design specifications and performance guidelines are met. The source code review includes a compliance build and a trusted build of the submitted source code.

## Section 7: Security Requirements

The requirements in this section shall be tested during the source code review, security tests, and FCA.

To evaluate the changes to the system, Pro V&V will perform a SCAP review to detect the presence of vulnerabilities and policy compliance. CIS (Center for Internet Security) Benchmarks will be used to baseline the evaluations.

*Note: Section 6 (Telecommunications Requirements) of the VVSG 1.0 is not applicable to EVS 6.0.6.0 and is therefore not included in this Test Plan. Additionally, Sections 8 (Quality Assurance Requirements) and 9 (Configuration Management Requirements) were reviewed in the test campaigns for the baseline systems and are not impacted by the submitted modifications.*

### **4.1.1 Rationale for ‘Not Applicable’ Requirements**

All requirements that were excluded from the previous test campaigns (EVS 6.0.4.0 and EVS 6.1.0.0) were also deemed not applicable to this test campaign. The submitted modifications did not require the evaluation of any requirements that were not included in the baseline systems.

### **4.2 Hardware Configuration and Design**

The EVS 6.0.6.0 is an electronic voting system consisting of the following hardware: ExpressVote Universal Voting System Hardware 1.0 (ExpressVote HW1.0), ExpressVote Universal Voting System Hardware 2.1 (ExpressVote HW2.1); DS450 high-throughput central scanner and tabulator (DS450); DS200 precinct-based scanner and tabulator (DS200); DS850 high-speed central scanner and tabulator (DS850); ExpressVote XL Full Face Universal Voting System (ExpressVote XL); and DS950 high-speed central scanner and tabulator (DS950).

### **4.3 Software System Functions**

The EVS 6.0.6.0 EMS is an application suite consisting of Electionware, Removable Media Service (RMS) and Event Log Service (ELS).

## Electionware

Electionware is the election management software that provides end-to-end election management activities (from creating the ballots to reporting the voting results) through user interface.

## Removable Media Service (RMS)

RMS is a utility that runs in the background of the Windows Operating System. RMS reads specific information from any attached USB flash drives so that ES&S applications such as Electionware can use that information for flash drive validation purposes.

## Event Log Service (ELS)

ELS is an application that logs users' interactions with the EMS.

### **4.4 Test Case Design**

Test cases are designed based on the manufacturer's design specifications and the relevant technical requirements set forth by the VVSG. Test cases shall be based on the following aspects of the voting system:

- Software module test case design and data
- Software functional test case design
- System level test case design

Test cases shall provide information regarding the sequence of actions to be performed for the execution of a test, the requirements being met, the test objective, test configuration, equipment needed, special requirements, assumptions, and pass/fail criteria. Once the test cases are finalized, they will be validated and published for use in the test campaign. The validation of the test case will be accomplished by technical review and approval. This validation will include the following: confirmation of adequate test coverage of all requirements; confirmation that test case results are not ambiguous and gave objective pass/fail criteria; and confirmation that any automated test suites will produce valid results.

#### **4.4.1 Hardware Qualitative Design**

Previous hardware examinations were performed on the certified baseline systems (EVS 6.0.4.0 and EVS 6.1.0.0) and/or previous certified versions of the EVS 6.0.6.0 components. Due to the introduction of the DS950 as a new system component and the submitted modifications to the ExpressVote HW2.1, it was determined that hardware testing would be required. The full suite of hardware electrical testing and all applicable environmental tests for the DS950 as well as select electrical tests for the modified ExpressVote HW2.1 was successfully performed as part of a previous state level test campaign. The Pro V&V test report and associated hardware test reports of this testing were submitted to the EAC for evaluation and approved for reuse in this test campaign.

#### **4.4.2 Hardware Environmental Test Case Design**

Previous hardware examinations were performed on the EAC-certified baseline systems (EVS 6.0.4.0 and EVS 6.1.0.0) and/or previous certified versions of the EVS 6.0.6.0 components. During previous state level test campaign, Pro V&V performed hardware testing on the DS950 and the ExpressVote HW2.1. As a new system component, the full suite of hardware electrical and all applicable environmental testing, as detailed in the EAC VVSG 1.0, was performed on the DS950. For the modified ExpressVote HW2.1, abbreviated electrical testing was performed. Pro V&V utilized third party testing during the performance of hardware testing. All hardware testing was performed at the NTS Longmont facility located in Longmont, Colorado. All testing was witnessed on-site by Pro V&V personnel, with the exception of Temperature Power Variation in which Pro V&V qualified staff executed all testing at the NTS Longmont facility.

#### **4.4.3 Software Module Test Case Design and Data**

Pro V&V shall review the manufacturer's program analysis, documentation, and module test case design and shall evaluate the test cases for each module with respect to flow control parameters and entry/exit data. As needed, Pro V&V shall design additional test cases to satisfy the coverage criteria specified in Volume II, Section 7.2.1. Component Level Testing will be implemented during the FCA for each component and subcomponent.

During the Source Code Review, Compliance Builds, and Security Testing, Pro V&V will utilize limited structural-based techniques (white-box testing). Additionally, specification-based techniques (black-box testing) will be utilized for the individual software components.

Pro V&V shall define the expected result for each test and the ACCEPT/REJECT criteria for certification. If the system performs as expected, the results will be accepted. If the system does not perform as expected, an analysis will be performed to determine the cause. The test will be repeated in an attempt to reproduce the results. If the failure can be reproduced and the expected results are not met, the system will have failed the test. If the results cannot be reproduced, the test will continue. All errors encountered will be documented and tracked through resolution.

#### **4.4.4 Software Functional Test Case Design and Data**

Pro V&V shall review the manufacturer-submitted test plans and data to verify that the individual performance requirements specified in the EAC VVSG 1.0 and the TDP are reflected in the software. As part of this process, Pro V&V shall review the manufacturer's test case design and prepare a detailed matrix of system functions and the test cases that exercise them. Pro V&V shall also prepare a test procedure describing all test ballots, operator procedures, and the data content of output reports. Pro V&V shall define abnormal input data and operator actions and then design test cases to verify that the system is able to handle and recover from these abnormal conditions. During this review, emphasis shall be placed on those functions where the manufacturer data on module development, such as the system release notes and comments within the source code, reflects significant debugging problems, and on functional tests that resulted in high error rates.

Pro V&V shall define the expected result for each test and the ACCEPT/REJECT criteria for certification. If the system performs as expected, the results will be accepted. If the system does

not perform as expected, an analysis will be performed to determine the cause. The test will be repeated in an attempt to reproduce the results. If the failure can be reproduced and the expected results are not met, the system will have failed the test. If the results cannot be reproduced, the test will continue. All errors encountered will be documented and tracked through resolution.

#### 4.4.5 System-Level Test Case Design

System Level testing will be implemented to evaluate the complete system. This testing will include all proprietary components and COTS components (software, hardware, and peripherals) in a configuration of the system’s intended use. For software system tests, the tests shall be designed according to the stated design objective without consideration of its functional specification. The system level hardware and software test cases shall be prepared independently to assess the response of the hardware and software to a range of conditions.

#### 4.5 Test Specifications

Descriptions of the tests required to evaluate the EVS 6.0.6.0 to the scope defined in Section 1.5 are provided in the subsections below.

##### 4.5.1 TDP Evaluation

In order to determine compliance of the modified TDP documents with the EAC VVSG 1.0, a limited TDP review shall be conducted. This review will focus on TDP documents that have been modified since the certification of the baseline system. The review will consist of a compliance review to determine if each regulatory, state, or manufacturer-stated requirement has been met based on the context of each requirement. Results of the review of each document will be entered on the TDP Review Checklist and reported to the manufacturer for disposition of any anomalies. This process will be ongoing until all anomalies are resolved. Any revised documents during the TDP review process will be compared with the previous document revision to determine changes made, and the document will be re-reviewed to determine whether subject requirements have been met.

A listing of all documents contained in the EVS 6.0.6.0 TDP is provided in Table 4-1.

**Table 4-1. EVS 6.0.6.0 TDP Documents**

<b>Document ID</b>	<b>Description</b>	<b>Revision</b>
<i>00_Preface</i>		
ESSSYS_6'0'6'0_L_Requirements Matrix_QA	Requirements of the VVSG 1.0 Trace to Vendor Testing	1.0
ESSSYS_6'0'6'0_L_Requirements Matrix_TDP	Requirements of the VVSG 1.0 Trace for TDP	1.0
<i>01_System Overview</i>		
ESSSYS_6'0'6'0_D_SysOvr	ES&S Voting System 6.0.6.0 System Overview	1.1
<i>02_System Functionality Description</i>		

**Table 4-1. EVS 6.0.6.0 TDP Documents (continued)**

<b>Document ID</b>	<b>Description</b>	<b>Revision</b>
ESSSYS_6'0'6'0_D_SFD	ES&S Voting System 6.0.6.0 System Functionality Description	1.0
<b><i>03_System Hardware Specification</i></b>		
DS200_1'2_SPC_HWSpec	DS200 Hardware Specification, Hardware Revision 1.2	3.6
DS200_1'3_SPC_HWSpec	DS200 Hardware Specification, Hardware Revision 1.3	4.8
DS450_1'0_SPC_HWSpec	DS450 Hardware Specification, Hardware Revision 1.0	1.10
DS850_1'0_SPC_HWSpec	DS850 Hardware Specification, Hardware Revision 1.0	1.10
DS950_1'0_SPC_HWSpec	DS950 Hardware Specification, Hardware Revision 1.0	1.0
EVOTE_1'0_SPC_HWSpec	ExpressVote Hardware Specification, Hardware Revision 1.0	3.12
EVOTE_2'1_SPC_HWSpec	ExpressVote Hardware Specification, Hardware Revision 2.1	1.5
EVOTEXL_1'0_SPC_HWSpec	ExpressVote XL Hardware Specification, Hardware Revision 1.0	1.3
<b><i>03_System Hardware Specification – Approved Parts List</i></b>		
DS200_1'2_L_APL	Approved Parts List: DS200 HW 1.2	1.1
DS200_1'3_L_APL	Approved Parts List: DS200 HW 1.3	1.6
DS450_1'0_L_APL	Approved Parts List: DS450 HW 1.0	1.4
DS850_1'0_L_APL	Approved Parts List: DS850 HW 1.0	1.4
DS950_1'0_L_APL	Approved Parts List: DS950 HW 1.0	1.0
EVOTE_1'0_L_APL	Approved Parts List: ExpressVote HW 1.0	2.3
EVOTE_2'1_L_APL	Approved Parts List: ExpressVote HW 2.1	2.7
EVOTEXL_1'0_L_APL	Approved Parts List: ExpressVote XL HW Rev 1.0	1.3
<b><i>04_Software Design and Specification</i></b>		
DS200_2'21'0'0_SDS	DS200 - Software Design Specification	1.0
DS450_3'5'0'0_SDS	DS450 - Software Design Specification	1.0
DS850_3'5'0'0_SDS	DS850 - Software Design Specification	1.0
DS950_3'5'0'0_SDS	DS950 - Software Design Specification	1.1
ELS_2'0'0'0_SDS	Event Log Service – Software Design Specification	1.1
EVOTE_1'5'4'0_SDS	ExpressVote 1.0 - Software Design Specification	1.0
EVOTE_2'6'0'0_SDS	ExpressVote 2.1 - Software Design Specification	1.0

**Table 4-1. EVS 6.0.6.0 TDP Documents (continued)**

<b>Document ID</b>	<b>Description</b>	<b>Revision</b>
EVOTEXL_1'3'0'0_SDS	ExpressVote XL – Software Design Specification	1.0
ESSSYS_1'0_P_CodingStandards	Coding Standards	1.6
ESSSYS_1'0_P_SysDevProgram	System Development Program	2.1
ESSSYS_6'0'6'0_SPC_LicenseAgreements	License Agreements for Procured Software	1.0
EWARE_5'0'6'0_SDS	Electionware - Software Design Specification	1.0
EWARE_99'3_D_PostGreSQLDescriptions_EVS6060	PostGre SQL Descriptions EVS6060	---
EWARE_99'5_D_XMLDiagrams_EVS6060	XML Diagrams EVS6060	---
EWARE_99'6_D_MediaContents_6060	Media Contents 6060	---
<b>05_System Test and Verification</b>		
ESSSYS_6'0'6'0_D_TestPlan	ES&S Voting System 6.0.6.0 System Test Plan	1.0
DS200_1'3_D_CIFRpt.pdf	Usability Test Report: DS200 Precinct Ballot Scanner	---
EVOTE_1'0_D_CIFRpt.pdf	Usability Test Report: ExpressVote Universal Voting System	---
EVOTE_2'1_D_CIFRpt.pdf	Usability Test Report: ExpressVote Universal Voting System	---
EVOTEXL_1'0_D_CIFRpt.pdf	Usability Test Report: ExpressVote XL Full-Faced Universal Voting System	---
ESSSYS_6'0'6'0_Cert_TC_PreCert	Certification Test Cases ES&S Voting System 6.0.6.0	1.0
ESSSYS_6'0'6'0_QA_TC_FallThru	QA Test Cases for Fall Thru ES&S Voting System 6.0.6.0	1.0
ESSSYS_6'0'6'0_QA_TC_Integration	QA Test Cases for Integration ES&S Voting System 6.0.6.0	1.1
<b>06_System Security Specification</b>		
ESSSYS_6'0'6'0_SPC_ClientWorkstationSetupConfigGuide	EMS Client Workstation Secure Setup & Configuration Guide ES&S Voting System 6.0.6.0	1.0
ESSSYS_6'0'6'0_SPC_EMSServerSetupConfigGuide	EMS Server Secure Setup & Configuration Guide ES&S Voting System 6.0.6.0	1.0
ESSSYS_6'0'6'0_SPC_SecBestPract	Best Practices for Physically Securing ES&S Equipment ES&S Voting System 6.0.6.0	1.0
ESSSYS_6'0'6'0_SPC_SecurityScriptDesc	Security Script Description ES&S Voting System 6.0.6.0	1.1
ESSSYS_6'0'6'0_SPC_StandaloneWorkstationSetupConfigGuide	EMS Standalone Workstation Secure Setup & Configuration Guide ES&S Voting System 6.0.6.0	1.0
ESSSYS_6'0'6'0_SPC_SystemSecurity	Voting System Security Specification	1.0

**Table 4-1. EVS 6.0.6.0 TDP Documents (continued)**

<b>Document ID</b>	<b>Description</b>	<b>Revision</b>
ESSSYS_6'0'6'0_D_VerificationPack	Verification Pack	n/a
ESSSYS_6'0'6'0_D_VerProc_DS200	Verification Procedure: DS200 Precinct Scanner and Tabulator	1.1
ESSSYS_6'0'6'0_D_VerProc_DS450	Verification Procedure: DS450 High-Throughput Scanner & Tabulator	1.1
ESSSYS_6'0'6'0_D_VerProc_DS850	Verification Procedure: DS850 High-Speed Scanner & Tabulator	1.1
ESSSYS_6'0'6'0_D_VerProc_DS950	Verification Procedure: DS950 High-Speed Scanner and Tabulator	1.1
ESSSYS_6'0'6'0_D_VerProc_EMS	Verification Procedure: Election Management System	1.2
ESSSYS_6'0'6'0_D_VerProc_EVOTE_HW1'0	Verification Procedure: ExpressVote Hardware 1.0	1.1
ESSSYS_6'0'6'0_D_VerProc_EVOTE_HW2'1	Verification Procedure: ExpressVote Hardware 2.1	1.2
ESSSYS_6'0'6'0_D_VerProc_EVOTEXL	Verification Procedure: ExpressVote XL	1.1
ESSSYS_6'0'6'0_D_VerProc_VerificationPCSetup	Verification Procedure: Verification PC Setup	1.1
<b>06 System Security Specification</b>		
<b>02_ValidationFileLists</b>		
DS200_2'21_L_ValFileList	Validation File List: DS200	1.0
DS450_3'5_L_ValFileList	Validation File List: DS450	1.3
DS850_3'5_L_ValFileList	Validation File List: DS850	1.2
DS950_3'5_L_ValFileList	Validation File List: DS950	1.3
EMS_5'0_L_ValFileList	Validation File List: Election Management System	1.3
EVOTE_1'5_L_ValFileList	Validation File List: ExpressVote HW1.0	1.4
EVOTE_2'6_L_ValFileList	Validation File List: ExpressVote HW2.1	1.0
EVOTEP_1'5_L_ValFileList	Validation File List: ExpressVote HW1.0 Previewer	1.0
EVOTEP_2'6_L_ValFileList	Validation File List: ExpressVote HW2.1 Previewer	1.0
EVOTEXL_1'3_L_ValFileList	Validation File List: ExpressVote XL	1.4
<b>07_System Operations Procedures</b>		
DS200_2'21'0'0_SOP	DS200 Operator's Guide Firmware Version 2.21.0.0	1.0
DS450_3'5'0'0_SOP	DS450 Operator's Guide Firmware Version 3.5.0.0	1.0
DS850_3'5'0'0_SOP	DS850 Operator's Guide Firmware Version 3.5.0.0	1.1
DS950_3'5'0'0_SOP	DS950 Operator's Guide Firmware Version 3.5.0.0	1.0



**Table 4-1. EVS 6.0.6.0 TDP Documents (continued)**

<b>Document ID</b>	<b>Description</b>	<b>Revision</b>
ELS_2'0'0'_SOP	EVS Event Log Service User's Guide Software Version 2.0.0.0	1.0
EVOTE_1'5'4'_SOP_HW1'0	ExpressVote Operator's Guide Hardware Version 1.0 Firmware Version 1.5.4.0	1.2
EVOTE_2'6'0'_SOP_HW2'1	ExpressVote Operator's Guide Hardware Version 2.1 Firmware Version 2.6.0.0	1.2
EVOTEXL_1'3'0'_SOP	ExpressVote XL Operator's Guide Firmware Version 1.3.0.0	1.1
EWARE_5'0'6'_SOP_01Admin	Electionware Vol. I: Administrator Guide Software Version 5.0.6.0	1.0
EWARE_5'0'6'_SOP_02Define	Electionware Vol. II: Define User Guide Software Version 5.0.6.0	1.0
EWARE_5'0'6'_SOP_03Design	Electionware Vol. III: Design User Guide Software Version 5.0.6.0	1.0
EWARE_5'0'6'_SOP_04Deliver	Electionware Vol. IV: Deliver User Guide Software Version 5.0.6.0	1.0
EWARE_5'0'6'_SOP_05Results	Electionware Vol. V: Results User Guide Software Version 5.0.6.0	1.0
EWARE_5'0'6'_SOP_06Appendices	Electionware Vol. VI: Appendices Software Version 5.0.6.0	1.0
<b><i>08_System Maintenance Manuals</i></b>		
DS200_2'21'0'_SMM	DS200 Maintenance Manual Firmware Version 2.21.0.0	1.0
DS450_3'5'0'_SMM	DS450 Maintenance Manual Firmware Version 3.5.0.0	1.0
DS850_3'5'0'_SMM	DS850 Maintenance Manual Firmware Version 3.5.0.0	1.0
DS950_3'5'0'_SMM	DS950 Maintenance Manual Firmware Version 3.5.0.0	1.0
EVOTE_1'5'4'_SMM_HW1'0	ExpressVote Maintenance Manual Firmware Version 1.5.4.0, Hardware Version 1.0	1.0
EVOTE_2'6'0'_SMM_HW2'1	ExpressVote Maintenance Manual Firmware Version 2.6.0.0, Hardware Version 2.1	1.0
EVOTEXL_1'3'0'_SMM	ExpressVote XL Maintenance Manual Firmware Version 1.3.0.0	1.0
<b><i>09_Personnel Deployment and Training</i></b>		
ESSSYS_1'0'_P_TrainingProgram	Personnel Deployment and Training Program	1.3
<b><i>10_Configuration Management Plan</i></b>		
ESSSYS_1'0'_P_CMProgram	Configuration Management Program	1.8
ESSSYS_1'0'_P_TDProgram	Technical Documentation Program	1.5

**Table 4-1. EVS 6.0.6.0 TDP Documents (continued)**

<b>Document ID</b>	<b>Description</b>	<b>Revision</b>
<b><i>11_QA Program</i></b>		
ESSSYS_1'0_P_MNFQAProgram	Manufacturing Quality Assurance Program	1.11
ESSSYS_6'0'6'0_P_SWQAProgram	Software Quality Assurance Program	1.0
<b><i>12_System Change Notes</i></b>		
ESSSYS_6'0'6'0_D_ChangeNotes	System Change Notes ES&S Voting System 6.0.6.0	1.3
ESSSYS_6'0'6'0_D_ChangeNotes_QA	System Change Notes w/ QA Test Notes ES& S Voting System 6.0.6.0	1.0
<b><i>13_Attachments</i></b>		
BPG_1'0_SOP	Ballot Production Guide for EVS	3.6

**4.5.2 Source Code Review**

Pro V&V will review the submitted source code to the EAC VVSG 1.0 and the manufacturer-submitted coding standards. Prior to initiating the software review, Pro V&V shall verify that the submitted documentation is sufficient to enable: (1) a review of the source code and (2) Pro V&V to design and conduct tests at every level of the software structure to verify that design specifications and performance guidelines are met.

A combination of Automated Source Code Review and Manual Source Code Review methods will be used to review the changes in the source code from the previously certified EVS 6.0.4.0 and EVS 6.1.0.0 voting systems. A compliance review of all modified source code will be performed. Once the compliance review is performed and the source is deemed stable enough to proceed with testing, the source code and all additional packages will be compiled into a Compliance Build. Following successful completion of the FCA, a Trusted Build will be performed. The trusted build consists of inspecting the submitted source code, COTS, and third-party software products and combining them to create the executable code following the documented process from the “United States Election Assistance Commission Voting System Test Laboratory Program Manual” Section 5.5 – 5.7. Performance of the trusted build includes the build documentation review.

The Automated Source Code Review will be performed during the Compliance and Trusted Builds. In addition, 10% of the source code comments will be manually reviewed.

**4.5.3 Physical Configuration Audit (PCA)**

The Physical Configuration Audit (PCA) compares the voting system components submitted for qualification to the manufacturer’s technical documentation, and shall include the following activities:

- Establish a configuration baseline of software and hardware to be tested; confirm whether manufacturer's documentation is sufficient for the user to install, validate, operate, and maintain the voting system
- Verify software conforms to the manufacturer's specifications; inspect all records of manufacturer's release control system; if changes have been made to the baseline version, verify manufacturer's engineering and test data are for the software version submitted for certification
- If the hardware is non-COTS, Pro V&V shall review drawings, specifications, technical data, and test data associated with system hardware to establish system hardware baseline associated with software baseline
- Review manufacturer's documents of user acceptance test procedures and data against system's functional specifications; resolve any discrepancy or inadequacy in manufacturer's plan or data prior to beginning system integration functional and performance tests
- Subsequent changes to baseline software configuration made during testing, as well as system hardware changes that may produce a change in software operation are subject to re-examination

During execution of the PCA, the components of the EVS 6.0.6.0 system will be documented by component name, model, serial number, major component, and any other relevant information needed to identify the component. Additionally, each technical document submitted in the TDP will be recorded by document name, description, document number, revision number, and date of release. At the conclusion of the test campaign, Pro V&V test personnel will verify that any changes made to the software, hardware, or documentation during the test process are fully and properly documented.

#### **4.5.4 System Level Testing**

System Level Testing will be implemented to evaluate the complete system. This testing will include all proprietary components and COTS components (software, hardware, and peripherals) in a configuration of the system's intended use.

System Level Testing includes the evaluations of the following test areas: Security Review, FCA, Volume & Stress Testing, Accuracy Testing, and System Integration Testing. All functional modifications submitted in this release that have not been evaluated in a previously tested and approved EAC-certified system that are included in the listed Cross-Products Changes as well as for each of the following individual components will be evaluated during this area of testing: DS200, DS450, DS850, ExpressVote HW1.0, ExpressVote HW2.1, and ExpressVote XL. Additionally, modifications submitted for Electionware, Event Logging Service, and Removable Media Service will be evaluated during this area of testing. The full functionality of the DS950 will be assessed during System Level Testing, as it is a new component for this configuration.

For software system tests, the tests will be designed according to the stated design objective without consideration of its functional specification. The system level hardware and software test

cases will be prepared independently to assess the response of the hardware and software to a range of conditions. Pro V&V will review the manufacturer's program analysis, documentation, and module test case design and evaluate the test cases for each module with respect to flow control parameters and entry/exit data.

Pro V&V defines the expected result for each test and the ACCEPT/REJECT criteria for certification. If the system performs as expected, the results will be accepted. If the system does not perform as expected, an analysis was performed to determine the cause. If needed, the test will be repeated in an attempt to reproduce the results. If the failure can't be reproduced and the expected results are not met, the system will be determined to have failed the test. If the results can't be reproduced, the test will continue. All errors encountered will be documented and tracked through resolution.

#### **4.5.4.1 Functional Configuration Audit (FCA)**

The Functional Configuration Audit (FCA) encompasses an examination of manufacturer's tests, and the conduct of additional tests, to verify that the system hardware and software perform all the functions described in the manufacturer's documentation submitted in the TDP. In addition to functioning according to the manufacturer's documentation, tests will be conducted to ensure all applicable EAC VVSG 1.0 requirements are met.

The FCA for this test campaign will include an assessment of the submitted modifications and will include inputs of both normal and abnormal data during test performance. This evaluation will utilize baseline test cases as well as specifically designed test cases and will include predefined election definitions for the input data.

#### **4.5.4.2 System Integration**

System Integration is a system level test that evaluates the integrated operation of both hardware and software. Compatibility of the voting system software components or subsystems with one another, and with other components of the voting system environment, shall be determined through functional tests integrating the voting system software with the remainder of the system.

During test performance, the system shall be configured exactly as it would for normal field use. This includes connecting all supporting equipment and peripherals including ballot boxes, voting booths (regular and accessible), and any physical security equipment such as locks and ties. Pro V&V personnel shall properly configure and test the system by following the procedures detailed in the EVS 6.0.6.0 technical documentation.

To accomplish the test objective, two General Elections and two Primary Elections will be exercised on the voting system, as described below:

Two general elections with the following breakdowns:

- General Election GEN-01: A General Election with Straight Party held in four precincts, one of which is a split precinct. This election contains 19 contests compiled into four ballot styles. Five of the contests are in all four ballot styles. The other 15 contests are

split between at least two of the precincts with a maximum of four different contest spread across the four precincts.

- General Election GEN-03: A General Election held in two precincts. This election contains eight contests and compiled into two ballot styles. Four of the contests are in both ballot styles. The other four contests are split between the two precincts. This election is designed to functionally test the handling of multiple ballot styles, support for at least three languages including a character-based language, support for common voting variations, and audio support for at least three languages and an ADA binary input device.

Two primary elections with the following breakdowns:

- Primary Election PRIM-01: This election is designed to functionally test a Closed Primary Election with multiple ballots and support for common voting variations. This election contains 31 contests and six parties compiled into 18 ballot styles, each ballot containing six contests.
- Primary Election PRIM-03: A Closed Primary Election held in two precincts. This election contains 10 contests and is compiled into two ballot styles. Two of the contests are in both ballot styles. The other eight contests are split between the two parties' ballots. This election is designed to functionally test the handling of multiple ballot styles, support for at least three languages including a character-based language, support for common voting variations, and audio support for at least three languages and an ADA binary input device.

#### **4.5.4.3 Accuracy**

The Accuracy test ensures that each component of the voting system can process at least 1,549,703 consecutive ballot positions correctly within the allowable target error rate. The Accuracy test is designed to test the ability of the system to “capture, record, store, consolidate and report” specific selections and absences of a selection. The required accuracy is defined as an error rate. This rate is the maximum number of errors allowed while processing a specified volume of data.

For paper-based voting systems, the ballot positions on a paper ballot must be scanned to detect selections for individual candidates and contests and the conversion of those selections detected on the paper ballot converted into digital data. In an effort to achieve this and to verify the proper functionality of the units under test, the following methods will be used to test components of the voting system:

The accuracy requirements for the EVS 6.0.6.0 will be accomplished by the execution of accuracy tests utilizing manual voting, automated voting, manually-marked and pre-marked voting summary cards of each card length supported. During test performance, a combination of hand marked (65%) and pre-marked (35%) paper ballots will be utilized and all of the available ballot sizes supported by the system will be processed.

#### **4.5.4.4 Volume & Stress**

The Volume & Stress test investigates the system's response to conditions that tend to overload the system's capacity to process, store, and report data. The test parameters will focus on the system's stated limits and the ballot logic for areas such as the maximum number of active voting positions, maximum number of ballot styles, maximum candidates, maximum contests, and stated limits within the EMS. This test will be utilized to ensure the system can achieve the manufacturer's TDP claims of what the system can support. Testing will be performed by exercising an election definition and test cases developed specifically to test for volume and stress conditions of the system being tested.

Previous test results will be utilized for all components with the exception DS950 which will be subjected to full testing.

#### **4.5.4.5 Regression Testing**

Regression testing will be conducted on the EVS 6.0.6.0 to establish assurance that the modifications have no adverse impact on the compliance, integrity, or performance of the system. Regression testing for this test campaign will consist of the execution of the System Integration Test.

#### **4.5.5 Security Functions**

ES&S submitted a modification to Electionware that upgraded the operating system from Microsoft Windows 7 to Microsoft Windows 10 Enterprise LTSC and from Microsoft Windows Server 2008 R2 to Microsoft Windows Server 2016. This upgrade also moves the voting system to a 64-bit architecture. This change to the system may impact the security of the system as a whole; therefore, Pro V&V will perform a SCAP review to evaluate system security functions. A DISA-STIG will be used as the tool to detect the possible presence of vulnerabilities and policy compliance. The specific STIG for SCAP Review will be provided by ES&S prior to evaluation.

#### **4.5.6 Usability & Accessibility Testing**

Usability & Accessibility Testing will be performed to evaluate the usability of the EVS 6.0.6.0 to the requirements set forth in the EAC VVSG 1.0.

This area of testing will focus on the addition of the DS950 and the new configuration options submitted for the ExpressVote (ExpressVote Dual Express Cart and ExpressVote Ben Franklin Voting Booth), and the DS200 (Ballot Trolley and Ballot Tote Bag).

### **5.0 TEST DATA**

The following subsections provide information concerning test data recording and criteria.

#### **5.1 Test Data Recording**

All equipment utilized for test data recording shall be identified in the test data package. The output test data shall be recorded in an appropriate manner as to allow for data analysis. For

source code and TDP reviews, results shall be compiled in reports and submitted to ES&S for resolution.

## **5.2 Test Data Criteria**

The EVS 6.0.6.0 shall be evaluated against all applicable requirements contained in the EAC VVSG 1.0. The acceptable range for system performance and the expected results for each test case shall be derived from the manufacturer-submitted technical documentation and the EAC VVSG 1.0.

## **6.0 TEST PROCEDURE AND CONDITIONS**

The following subsections detail the facility requirements, test setup conditions, sequence of testing, and test operation procedures.

### **6.1 Facility Requirements**

Unless otherwise annotated, all testing shall be conducted at the Pro V&V test facility located in Huntsville, AL, by personnel verified by Pro V&V to be qualified to perform the test.

Unless otherwise specified herein, testing shall be performed at the following standard ambient conditions and tolerances:

- Temperature: 68-75° F ( $\pm 3.6^\circ\text{F}$ )
- Relative Humidity: Local Site Humidity
- Atmospheric Pressure: Local Site Pressure
- Time Allowable Tolerance:  $\pm 5\%$

Testing performed at third-party laboratories will be subjected to the test parameters and tolerances defined by the test facility and will be reported in the final Test Report.

### **6.2 Test Set-up**

All voting system equipment shall be received and documented using Pro V&V proper QA procedures. Upon receipt of all hardware, an inspection will be performed to verify that the equipment received is free from obvious signs of damage and/or degradation that may have occurred during transit.

If present, this damage shall be recorded, photographed, and reported to the ES&S Representative. Additionally, a comparison shall be made between the recorded serial numbers/part numbers and those listed on shipper's manifest and any discrepancies shall be reported to the ES&S Representative.

TDP items and all source code received shall be inventoried and maintained by Pro V&V during the test campaign.

During test performance, the system shall be configured as it would be for normal field use. This includes connecting all supporting equipment and peripherals.

### **6.3 Test Sequence**

The EVS 6.0.6.0 will be evaluated against all applicable requirements in the EAC VVSG 1.0. There is no required sequence for test performance.

### **6.4 Test Operations Procedure**

Pro V&V will identify PASS/FAIL criteria for each executed test case. The PASS/FAIL criteria will be based on the specific expected results of the system.

In the case of an unexpected result that deviates from what is considered standard, normal, or expected, a root cause analysis will be performed.

Pro V&V will evaluate every EAC VVSG 1.0 requirement applicable to the EVS 6.0.6.0. Any deficiencies noted will be reported to the EAC and the manufacturer. If it is determined that there is insufficient data to determine compliance, this Test Plan will be altered and additional testing will be performed.



**APPENDIX A**

**PROJECT SCHEDULE**

Task Name	Start Date	End Date
<input type="checkbox"/> EAC Application & TRR	07/30/21	08/17/21
Application Submitted to EAC	07/30/21	07/30/21
TRR	08/02/21	08/04/21
Application Approval from EAC	08/05/21	08/17/21
<input type="checkbox"/> TDP	08/02/21	09/27/21
Initial Review	08/02/21	08/03/21
Compliance Review	08/04/21	09/23/21
Final review	09/24/21	09/27/21
<input type="checkbox"/> Test Plan	08/20/21	10/20/21
Test Plan Creation	08/20/21	08/31/21
Vendor Review & Comments	09/01/21	09/02/21
EAC Submission and Review	09/03/21	10/01/21
VSTL Comment Review & Update	10/04/21	10/04/21
EAC Submission & Review of Revision	10/05/21	10/18/21
EAC Approved Test Plan	10/19/21	10/20/21
<input type="checkbox"/> Source Code	08/02/21	08/09/21
Automated Review	08/02/21	08/03/21
Source Code Review	08/04/21	08/06/21
Source Code Re-Review	08/04/21	08/04/21
Document Review	08/05/21	08/05/21
Compliance Build	08/06/21	08/09/21
<input type="checkbox"/> System Delivery & Setup	08/02/21	08/13/21
PCA	08/02/21	08/02/21
System Setup	08/03/21	08/03/21
System Loads & Hardening	08/04/21	08/13/21
<input type="checkbox"/> Hardware Testing	09/14/21	09/15/21
Electrical Testing ( Request Reuse)		

Task Name	Start Date	End Date
Environmental Testing (Request Reuse)		
Temp Power (Request Reuse)		
Electrical Supply	09/14/21	09/14/21
Maintainability	09/15/21	09/15/21
<b>- System Level Testing</b>	<b>08/23/21</b>	<b>10/07/21</b>
FCA	08/23/21	09/13/21
Security - SCAP	09/14/21	09/16/21
Volume and Stress	09/17/21	09/21/21
Accuracy	09/22/21	09/27/21
Regression Testing	09/28/21	09/28/21
Trusted Build	09/29/21	10/01/21
System Integration	10/04/21	10/07/21
<b>- Test Report</b>	<b>10/08/21</b>	<b>12/13/21</b>
Test Report Creation	10/08/21	10/19/21
Vendor Review & Comments	10/20/21	10/21/21
EAC Submission & Review	10/22/21	11/18/21
VSTL Comment Review & Update	11/19/21	11/23/21
EAC Submission & Review of Revision	11/29/21	12/10/21
EAC Approved Test Report	12/13/21	12/13/21