

PRO V&V



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

Test Report for EAC VVSG 1.0 Certification Testing Election Systems & Software (ES&S) Voting System (EVS) 6.1.0.0

EAC Project Number: ESSEVS6100

Version: 02

Date: 09/11/2019

U.S. Election Assistance Commission

VSTL

EAC Lab Code 1501

The logo for NVLAP (National Voluntary Laboratory Accreditation Program) features the letters 'NVLAP' in a stylized, outlined font. The 'P' is significantly larger and more decorative than the other letters, and a registered trademark symbol (®) is located to the upper right of the 'P'.

NVLAP LAB CODE 200908-0

REVISIONS

Revision	Description	Date
00	Initial Release	08/30/2019
01	Updated Versions in Table 1-1	09/09/2019
02	Highlights Removed	09/11/2019

TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	Description and Overview of EAC System Being Modified.....	1
1.1.1	Baseline Certified System.....	2
1.2	References.....	6
1.3	Terms and Abbreviations.....	7
2.0	CERTIFICATION TEST BACKGROUND	8
2.1	Revision History	8
2.2	Scope of Testing	8
2.2.1	Modification Overview	9
2.2.1.1	Detailed List of Changes.....	9
2.2.2	Block Diagram.....	15
2.2.3	Supported Functionality.....	15
2.2.4	Supported Languages.....	15
2.2.5	System Limits	16
2.2.6	VVSG	19
2.2.7	RFIs.....	19
2.2.8	NOCs	19
3.0	TEST FINDINGS AND RECOMMENDATIONS	20
3.1	Summary Findings and Recommendation	20
3.1.1	Source Code Review.....	25
3.1.2	Physical Configuration Audit (PCA)	25
3.1.3	System Level Testing	26
3.1.3.1	Functional Configuration Audit (FCA)	26
3.1.3.2	Accuracy	27
3.1.3.3	Volume and Stress Testing	27
3.1.3.4	System Integration	29
3.1.3.5	Usability and Accessibility	29
3.2	Anomalies and Resolutions	29
3.3	Deficiencies and Resolutions	29
4.0	RECOMMENDATION FOR CERTIFICATION	30

APPENDIX A - ANCILLARY SYSTEMS..... 33

APPENDIX B - AS-RUN TEST PLAN..... 33

1.0 INTRODUCTION

The purpose of this Test Report is to document the procedures that Pro V&V, Inc. followed to perform certification testing during a system modification campaign for the Election Systems and Software (ES&S) Voting System (EVS) 6.1.0.0 (EVS 6.1.0.0) 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. Certification testing of EVS 6.1.0.0 was performed to ensure the applicable requirements of the EAC VVSG 1.0 and the EAC Testing and Certification Program Manual, Version 2.0 were met. Additionally, all EAC Request for Interpretations (RFI) and Notices of Clarification (NOC) relevant to the system under test were incorporated in the test campaign.

Prior to submitting the voting system for testing, ES&S submitted an application package to the EAC for certification of the EVS 6.1.0.0. The application was accepted by the EAC and the project was assigned the unique Project Number of ESSEVS6100.

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 following subsections describe the baselined 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-throughput central scanner and tabulator (DS850); ExpressVote XL Full-Face Universal Voting System (ExpressVote XL); ExpressTouch Electronic Universal Voting System (ExpressTouch); Electionware Election Management System (Electionware); ES&S Event Log Service (ELS); and Removable Media Service (RMS).

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, and tabulation scanning into a single unit. ExpressVote HW2.1 is capable of operating in either marker or tabulator mode, depending on the configurable mode that is selected in Electionware.

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 System (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.

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.

1.1.1 Baseline Certified System

The baseline system for this modification is the EVS 6.0.4.0. The tables below describe the certified equipment and firmware versions.

Detailed descriptions of the EVS 6.0.4.0 test campaign are contained in SLI Report No. ESY-18004-CTR-01, v1.1, which is available for viewing on the EAC's website at www.eac.gov.

Table 1-1. EVS 6.0.4.0 EAC Certified System Components - Proprietary

System Component	Software or Firmware Version	Hardware Version(s)	Description
Electionware	5.0.4.0	---	Election management software that provides end-to-end election management activities
ES&S Event Log Service (ELS)	1.6.0.0	---	Logs users' interactions with EMS
Removable Media Service (RMS)	1.5.1.0	---	Utility that runs in the background of the Windows operating system
ExpressVote HW1.0	1.5.2.0	1.0	Paper-based vote capture and selection device
ExpressVote Previewer 1.0	1.5.2.0	---	Application within the EMS program that allows the user to preview audio text and screen layout prior to burning Election Day media for the ExpressVote
ExpressVote HW2.1	2.4.5.0	2.1.0.0 2.1.2.0	Hybrid paper-based vote capture and selection device and precinct count tabulator
ExpressVote Previewer 2.1	2.4.5.0	---	Application within the EMS program that allows the user to preview audio text and screen layout prior to burning Election Day media for the ExpressVote
DS200	2.17.4.0	1.2.1, 1.2.3, 1.3, 1.3.11	Precinct Count Tabulator that scans voter selections from both sides of the ballot simultaneously
DS450	3.1.1.0	1.0	Central Count Scanner and Tabulator
DS850	3.1.1.0	1.0	Central Count Scanner and Tabulator
ExpressVote XL	1.0.3.0	1.0	Hybrid full-faced paper-based vote capture and selection device and precinct count tabulator
ExpressTouch	1.0.3.0	1.0	DRE
ExpressVote Rolling Kiosk	---	1.0	Portable Voting Booth (Model 98-00049)
Voting Booth	---	---	Stationary Voting Booth (Model 98-00051)
Quad Express Cart	---	---	Portable Voting Booth (Model 41404)
MXB ExpressVote Voting Booth	---	---	Sitting and Standing Voting Booth (Model 95000)
ExpressVote Single Table	---	---	Voting Table for One Unit (Model 87033)

Table 1-1. EVS 6.0.4.0 EAC Certified System Components – Proprietary (continued)

System Component	Software or Firmware Version	Hardware Version(s)	Description
ExpressVote Double Table	---	---	Voting Table for Two Units (Model 87032)
ADA Table	---	---	Voting Table for One Unit (Model 87031)
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)
DS450 Cart	---	---	Model 3002
DS850 Cart	---	---	Model 6823
Universal Voting Console (UVC)	---	1.0	Detachable ADA support peripheral (Model 98-00077)
Tabletop Easel	---	---	Model 14040
ExpressTouch Voting Booth	---	---	Stationary Voting Booth (Model 98-00081)
SecureSetup	2.1.0.3	---	Proprietary Hardening Script

Table 1-2. EVS 6.0.4.0 EAC Certified System Components – COTS Software

Manufacturer	Application	Version
Microsoft Corporation	Server 2008	R2 w/ SP1 (64-bit)
Microsoft Corporation	Windows 7 Professional	SP1 (64-bit)
Microsoft Corporation	Windows 7 Enterprise	SP1 (64-bit)
Microsoft Corporation	WSUS Microsoft Windows Offline Update Utility	11.5
Symantec	Endpoint Protection	14.2.0_MPI (64-bit)
Symantec	Symantec Endpoint Protection Intelligent Updater (File-Based Protection)	20190122-001-core15sds5i64.exe
Symantec	Symantec Endpoint Protection Intelligent Updater (Network-Based Protection)	20190121-062-IPS_IU_SEP_14RU1.exe
Symantec	Symantec Endpoint Protection Intelligent Updater (Behavior-Based Protection)	20190115-001-SONAR_IU_SEP.exe
Gigabyte	WindowsImageTool	B17.1116.01
Cerberus	Cerberus FTP Server – Enterprise	10.0.5 (64-bit)
Adobe	Acrobat	XI

Table 1-2. EVS 6.0.4.0 EAC Certified System Components – COTS Software (continued)

Manufacturer	Application	Version
Microsoft Corporation	Visual C++ Redistributable	en_visual_cpp_2015_redistributable_x86_8487157.exe (32-bit)
RSA Security	RSA BSAFE Crypto-C ME for Windows 32-bit	4.1
OpenSSL	OpenSSL	2.0.12
OpenSSL	OpenSSL	2.0.16
OpenSSL	OpenSSL	1.02d
OpenSSL	OpenSSL	1.02h
OpenSSL	OpenSSL	1.02k

Table 1-3. EVS 6.0.4.0 EAC Certified System Components – COTS Hardware

Manufacturer	Hardware	Model/Version
Dell	EMS Server	PowerEdge T420, T630
Dell	EMS Client or Standalone Workstation	Latitude 5580, E6430 OptiPlex 5040, 5050, 7020
Dell	Trusted Platform Module (TPM) Chip version 1.2	R9X21
Innodisk	USB EDC H2SE (1GB) for ExpressVote 1.0	DEEUH1-01GI72AC1SB
Innodisk	USB EDC H2SE (16GB) for ExpressVote 2.1	DEEUH1-16GI72AC1SB
Delkin	USB Flash Drive (512MB, 1GB, 2GB, 4GB, 8GB)	N/A
Delkin	Validation USB Flash Drive (16 GB)	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	Compact Flash Memory Card Reader/Writer	6381
Delkin	CFAST Card (2GB, 4GB)	N/A
Delkin USB	BitLocker 32.2 MB	Storage for security key (optional)
Lexar	CFAST Card Reader/Writer	LRWCR1TBNA
CardLogix	Smart Card	CLXSU128kC7/ AED C7
SCM Microsystems	Smart Card Writer	SCR3310
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 and DS850 Report Printer	B431dn, B431d, B432DN
OKI	DS450 and DS850 Audit Printer	Microline 420

Table 1-3. EVS 6.0.4.0 EAC Certified System Components – COTS Hardware *(continued)*

Manufacturer	Hardware	Model/Version
APC	DS450 UPS	Back-UPS Pro 1500, Smart-UPS 1500
APC	DS850 UPS	Back-UPS RS 1500, Pro 1500
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

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, 2016 Edition, “NVLAP Procedures and General Requirements (NIST HB 150-2016)”, dated July 2016
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2017 Edition, “Voting System Testing (NIST Handbook 150-22-)”, dated July 2017
- United States 107th 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) (listed on www.eac.gov)
- EAC Notices of Clarification (NOC) (listed on www.eac.gov)
- SLI Report No. ESY-18004-CTR-01, v1.1, “Certification Test Report – Modification ES&S EVS 6.0.4.0”
- EAC Certificate of Conformance ES&S EVS 6.0.4.0, dated May 3, 2019
- ES&S Technical Data Package *(A listing of the EVS 6.1.0.0 documents submitted for this test campaign is listed in Section 3.1 of this Test Report)*

1.3 Terms and Abbreviations

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

“ADA” – Americans with Disabilities Act 1990

“BMD” – Ballot Marking Device

“CM” – Configuration Management

“COTS” – Commercial Off-The-Shelf

“EAC” – United States Election Assistance Commission

“EMS” – Election Management System

“ERM” – Election Reporting Manager

“ES&S” – Election Systems and Software

“FCA” – Functional Configuration Audit

“HAVA” – Help America Vote Act

“ISO” – International Organization for Standardization

“NOC” – Notice of Clarification

“PCA” – Physical Configuration Audit

“QA” – Quality Assurance

“RFI” – Request for Interpretation

“RMS” – Removable Media Service

“TDP” – Technical Data Package

“VAT” – Voting Assist Terminal

“VSTL” – Voting System Test Laboratory

“VVSG” – Voluntary Voting System Guidelines

2.0 CERTIFICATION TEST BACKGROUND

The EVS 6.1.0.0 is a modification of a previously certified system (EVS 6.0.4.0). Pro V&V performed an evaluation of results from the previous test campaign to determine the scope of testing required for certification of the EVS 6.1.0.0. Based on this evaluation, Pro V&V determined that testing from the previous test campaign would establish the baseline and that the focus of this test campaign would be on the documented system updates.

2.1 Revision History

The table below details the version history of the EVS 6.1.0.0 System:

Table 2-1. EVS 6.1.0.0 System Revision History

System Version	Certification Type	Baseline System	Certification Number
EVS 6.0.0.0	New System	--- (Original System)---	ESSEVS6000
EVS 6.0.2.0	Modification	EVS 6.0.0.0	ESSEVS6020
EVS 6.0.4.0	Modification	EVS 6.0.2.0	ESSEVS6040
EVS 6.1.0.0	Modification	EVS 6.0.4.0	ESSEVS6100*

*Upon grant of certification by the EAC

2.2 Scope of Testing

The scope of testing focused on evaluating the modifications detailed in Section 2.2.1.1 of this Test Report. Primarily, these modifications focused on upgrades to the components of the previously certified EVS 6.0.4.0 and new security features as well as the ExpressVote Voting Booth Workstation

To determine the EVS 6.1.0.0 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 would 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 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 Testing
 - Technical Documentation Package (TDP) Review

2.2.1 Modification Overview

The EVS 6.1.0.0 is a modified voting system configuration that includes upgrades to the components of the EVS 6.0.4.0 that includes new hardware configuration options and modifications to existing components.

2.2.1.1 Detailed List of Changes

The list below includes specific changes between the current EVS 6.1.0.0 and the baseline of the EVS 6.0.4.0:

HARDWARE

- ExpressVote Voting Booth Workstation

The ExpressVote voting booth workstation is an ADA-compliant way to deploy the ExpressVote for use as a marker. The voting booth workstation can be positioned to accommodate both standing and seated voters. This voting booth solution can accommodate seated voters using the side-approach position.

SOFTWARE/FIRMWARE

Cross-Product Changes

- Operating System

The operating system was upgraded 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

- ExpressVote Re-architecture

Enabled the ExpressVote to operate using the touch screen user interface and functionality developed for the ExpressVote XL in EVS6000. Removed Accessible Ballot menu items and functionality to Format ExpressVote Headings, Contests, Contest Summaries and Candidates as these functions are now part of the Touch Screen Ballot module.

Impacted products:

- ExpressVote HW1.0

- ExpressVote HW2.1

- Electionware

- Alert Management

Changed low battery alerts to work as follows: At approaching low - warn the user that battery is approaching low levels - alert is dismissible - no actions are suppressed. At low level - warn the user that battery is low - allow any current vote session to finish - suppress entering any new vote session. At critical level - Force shut down the system. Updated audible system alarms to mimic ExpressVote XL.

Impacted products:

- ExpressVote HW1.0

- ExpressVote HW2.1

- Calibration

Instituted the ability to calibrate the tabulator double sheet sensor in the paper path.

Impacted products:

- ExpressVote HW1.0

- ExpressVote HW2.1

- Color Options (Touch Screen Ballot and Paper Ballot)

Incorporated the ability to display text formatted with different colors and formatting inline.

Impacted products:

- ExpressVote HW1.0

- ExpressVote HW2.1

- Electionware

- External Barcode

Incorporated the ability to select precinct and ballot style by scanning an external barcode.

Impacted products:

- ExpressVote HW1.0

- ExpressVote HW2.1

- Manual Deselect

Instituted the ability to configure the system to require users to deselect a currently selected voting target before allowing a new selection in a Vote for One contest. Previous versions always toggled selections.

Impacted products:

- ExpressVote HW1.0

- ExpressVote HW2.1

- Electionware

- Media Label

Updated the ExpressVote to require the volume label 'XPRSSVOTE' for election media (previous volume label was 'EXPRESSVOTE'). Electionware now assigns the volume label 'XPRSSVOTE' when creating ExpressVote media which will make it more consistent with other touch screen media.

Impacted products:

- ExpressVote HW1.0

- ExpressVote HW2.1

- Electionware

- Readiness Report

Incorporated the connection status (connected/not connected) for external barcode scanners and accessible keypad to the system readiness report. Incorporated versioning for the input/output board and Audio Tactile Interface board to the system readiness report.

Impacted products:

- ExpressVote HW1.0

- ExpressVote HW2.1
- Update via Flash Drive

Incorporated the ability to update the system application and board firmware using an update flash drive.

Impacted products:

 - ExpressVote HW1.0
 - ExpressVote HW2.1
- User Interface

Updated the ExpressVote welcome screen graphic.

Impacted products:

 - ExpressVote HW1.0
 - ExpressVote HW2.1
- Validation

Instituted the ability to export VVSG required voting system validation files to an export flash drive.

Impacted products:

 - ExpressVote HW1.0
 - ExpressVote HW2.1

DS200

- Routine Tasks
 - Updated copyright date on DS200 startup/shutdown splash screens.
- Write-In Review Report
 - The Write-in Review report has been changed to sort write-ins by precinct.
 - Contests with no entered write-in votes will be suppressed from the Write-in Review report. This will save space on the report and avoid wasting report tape.
- Security
 - Integrated support for Secure CF Cards.

DS450

- Routine Tasks
 - Updated copyright date on DS450 startup/shutdown splash screens.
- Security
 - Integrated support for Locked CF Cards.

DS850

- Routine Tasks
 - Updated copyright date on DS850 startup/shutdown splash screens.
- Security
 - Integrated support for Locked CF Cards.

Electionware

- Audio and Translations
 - Incorporated the ExpressVote audio and translations to the Touch Screen audio spreadsheet so the user only has to maintain one spreadsheet for all Touch Screen equipment.
 - Removed the ExpressVote import screen definitions menu, as the user will be able to import all screen definitions using the Touch Screen Translations Script.
 - The Electionware Touch Screen System Audio script and Ballot Audio script now identify .ogg file formats in order to support the ExpressVote, ExpressVote XL and ExpressTouch change to utilize .ogg audio files instead of .wav audio files. By moving to the .ogg file format, the audio file size will be greatly reduced, providing better performance on the machines.
- Ballot Layout
 - Electionware now generates ExpressVote PDF ballots in the Accessible Ballot module.
 - The Touch Screen Ballot module now designs all ExpressVote ballots. All menus, buttons, and the navigator include ExpressVote when ExpressVote ballot styles have been generated in Capture.
 - Electionware now offers the option to configure ExpressVote and ExpressVote XL to print the text *** Official Ballot *** in the header text area of a vote summary card. This option appears on the settings screens for these equipment types.
- Ballot PDF Files

- Electionware no longer requires Adobe to generate ballot PDF files. The recommended PDF generator is Amyuni.
- Electionware no longer requires Adobe to view ballot PDF files. The recommended PDF viewer is Sumatra.
- Configuration Settings
 - Added a Configure module tab on the ExpressVote settings screen for Absentee/Early. Users can now configure different settings for Election Day and Absentee/Early equipment.
 - Removed print card size from ExpressVote XL and ExpressVote in Configure module's settings report as this option is now in the Touch Screen Ballot module.
- Review Box
 - The setting to create and enforce the Review Box option for the ExpressVote will now be independent of Paper Ballot. It is set by the user in Configure Settings.
 - The setting to create and enforce the ExpressVote Review Box option is now displayed on the ExpressVote settings report.
- Routine Tasks
 - The copyright year has been updated to 2019.

Event Log Service

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

Removable Media Service

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

2.2.3 Supported Functionality

The EVS 6.1.0.0 supports 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
- Rank Choice Voting

2.2.4 Supported Languages

The following languages are supported by EVS 6.1.0.0:

- 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 was verified; however, only English and Spanish language ballots were cast during the performance of functional testing. Additionally, one character based language (Chinese) was tested during System Integration Testing.

For the character based language, the ballot was created by Pro V&V and voted utilizing both paper ballots and ADA voting devices along with all applicable peripherals.

2.2.5 System Limits

The system limits that were verified during testing to be supported by the EVS 6.1.0.0 are provided in the table below.

Table 2-2. EVS 6.1.0.0 System Limits

System Characteristic	Boundary or Limitation	Limiting System Component
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
Max. precinct types/groups	25 (arbitrary)	Electionware
Max. precincts of a given type	250 (arbitrary)	Electionware
Max. reporting groups	14	Electionware

Additionally, the following EVS 6.1.0.0 component limitations have been identified:

ExpressVote and ExpressVote XL Limitations

1. ExpressVote and 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 and 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 and ExpressVote XL does not support Massachusetts Group Vote.
4. ExpressVote and ExpressVote XL does not support Universal Primary Contest.
5. ExpressVote and ExpressVote XL does not support Multiple Target Cross Endorsement.
6. ExpressVote and ExpressVote XL does not support Reviewer or Judges Initials boxes.
7. ExpressVote and ExpressVote XL does not support multi-card ballots.
8. ExpressVote and 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.
9. ExpressVote and ExpressVote XL does not support Team Write-In.

ExpressTouch Limitations

1. ExpressTouch capacities exceed all documented limitations for the ES&S election management, vote tabulation and reporting system. For this reason, Election Management System limitations define the boundaries and capabilities of the ExpressTouch system as the maximum capacities of the ES&S ExpressTouch are never approached during testing.
2. ExpressTouch 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. ExpressTouch does not support Massachusetts Group Vote.
4. ExpressTouch does not support Universal Primary Contest.
5. ExpressTouch does not support Multiple Target Cross Endorsement.
6. ExpressTouch does not support Team Write-In.

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 this 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.

5. The 'MasterFile.txt' and the 'Votes File.txt' do not support results for elections that contain multiple sheets or multiple ExpressVote cards per voter. These files can be produced using the Electionware > Reporting > Tools > Export Results menu option. This menu option is available when the Rules Profile is set to "Illinois".

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.

2.2.6 VVSG

The EVS 6.1.0.0 was evaluated against the relevant requirements contained in the EAC VVSG 1.0.

2.2.7 RFIs

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

2.2.8 NOCs

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

3.0 TEST FINDINGS AND RECOMMENDATIONS

The EVS 6.1.0.0 was evaluated against the relevant requirements contained in the EAC 2005 VVSG, Volumes I and II. The focus of this test campaign was on the modifications to the voting system configuration that included upgrades to the components of the baselined system. The summary findings and recommendations for each area of testing are provided in the following sections.

3.1 Summary Findings and Recommendation

Summary findings for the System Level Testing (System Integration Testing, Accuracy, and Limited FCA), PCA, and Source Code Review are detailed in the relevant sections of this report. In addition to these areas of testing, a TDP Review was performed, as described below.

Technical Documentation Package (TDP) Review

In order to determine compliance of the modified TDP documents with the EAC VVSG 1.0, a limited TDP review was conducted. This review focused on TDP documents that have been modified since the certification of the baseline system. The review consisted of a compliance review to verify that each regulatory, state, or manufacturer-stated requirement had been met based on the context of each requirement.

Results of the review of each document were entered on the TDP Review Checklist and reported to the manufacturer for disposition of any anomalies. This process was ongoing until all anomalies were resolved. Any revised documents during the TDP review process were compared with the previous document revision to determine changes made, and the document was re-reviewed to determine whether subject requirements had been met. A listing of all documents contained in the EVS 6.1.0.0 TDP is provided in Table 3-1.

Table 3-1. EVS 6.1.0.0 TDP Documents

Document ID	Description	Revision
<i>00_Preface</i>		
ESSSYS_6'1'0'0_L_RequirementsMatrix_TDP	Requirements of the VVSG 1.0 Trace to Vendor Testing	1.2
<i>01_System Overview</i>		
ESSSYS_6'1'0'0_D_SysOvr	ES&S Voting System 6.1.0.0 System Overview	1.3
<i>02_System Functionality Description</i>		
ESSSYS_6'1'0'0_D_SFD	ES&S Voting System 6.1.0.0 System Functionality Description	1.2
<i>03_System Hardware Specification</i>		
DS200_1'2_SPC_HWSpec	DS200 Hardware Specification, Hardware Revision 1.2	3.5
DS200_1'3_SPC_HWSpec	DS200 Hardware Specification, Hardware Revision 1.3	4.7

Table 3-1. EVS 6.1.0.0 TDP Documents (continued)

Document ID	Description	Revision
DS450_1'0_SPC_HWSpec	DS450 Hardware Specification, Hardware Revision 1.0	1.9
DS850_1'0_SPC_HWSpec	DS850 Hardware Specification, Hardware Revision 1.0	1.9
ETOUCH_1'0_SPC_HWSpec	ExpressTouch Hardware Specification, Hardware Revision 1.0	1.1
EVOTE_1'0_SPC_HWSpec	ExpressVote Hardware Specification, Hardware Revision 1.0	3.10
EVOTE_2'1_SPC_HWSpec	ExpressVote Hardware Specification, Hardware Revision 2.1	1.3
EVOTEXL_1'0_SPC_HWSpec	ExpressVote XL Hardware Specification, Hardware Revision 1.0	1.1
<i>03_System Hardware Specification – Approved Parts List</i>		
DS200_1'2_L_APL	Approved Parts List: DS200 HW1.2	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
ETOUCH_1'0_L_APL	Approved Parts List: ExpressTouch HW Rev 1.0	1.0
EVOTE_1'0_L_APL	Approved Parts List: ExpressVote HW 1.0	2.1
EVOTE_2'1_L_APL	Approved Parts List: ExpressVote HW 2.1	2.4
EVOTEXL_1'0_L_APL	Approved Parts List: ExpressVote XL HW Rev 1.0	1.1
<i>04_Software Design and Specification</i>		
DS200_2'30'0'0_SDS	DS200 - Software Design Specification	1.2
DS450_3'4'0'0_SDS	DS450 - Software Design Specification	1.2
DS850_3'4'0'0_SDS	DS850 - Software Design Specification	1.3
ELS_2'0'0'0_SDS	Event Log Service – Software Design Specification	1.1
ETOUCH_1'0'3'0_SDS	ExpressTouch – Software Design Specification	1.1
EVOTE_4'0'0'0_SDS_HW1'0	ExpressVote 1.0 - Software Design Specification	1.1
EVOTE_4'0'0'0_SDS_HW2'1	ExpressVote 2.1 - Software Design Specification	1.1
ESSSYS_1'0_P_CodingStandards	Coding Standards	1.5
ESSSYS_1'0_P_SysDevProgram	System Development Program	1.7
ESSSYS_1'0_SPC_LicenseAgreements	License Agreements for Procured Software	1.9
EWARE_6'0'0'0_SDS	Electionware – Software Design Specification	1.2
EVOTEXL_1'0'3'0_SDS	ExpressVote XL – Software Design Specification	1.2

Table 3-1. EVS 6.1.0.0 TDP Documents (continued)

Document ID	Description	Revision
<i>05_System Test and Verification</i>		
ESSSYS_6'1'0'0_D_TestPlan	ES&S Voting System 6.1.0.0 System Test Plan	1.1
ETOUCH_1'0_D_CIFRpt.pdf	Usability Test Report: ExpressTouch Electronic Universal Voting System	---
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	---
<i>06_System Security Specification</i>		
ESSSYS_6'1'0'0_SPC_Client WorkstationSetupConfigGuide	EMS Client Workstation Secure Setup & Configuration Guide	1.4
ESSSYS_6'1'0'0_SPC_EMSServerSetupConfigGuide	EMS Server Secure Setup & Configuration Guide	1.3
ESSSYS_6'1'0'0_SPC_SecBest Pract	Best Practices for Physically Securing ES&S Equipment	1.1
ESSSYS_6'1'0'0_SPC_SecurityScriptDesc	Security Script Description	1.2
ESSSYS_6'1'0'0_SPC_StandaloneWorkstationSetupConfigGuide	EMS Standalone Workstation Secure Setup & Configuration Guide	1.4
ESSSYS_6'1'0'0_SPC_System Security	Voting System Security Specification	1.2
<i>06_System Security Specification – 01_VerificationProcedures&Scripts</i>		
ESSSYS_6'1'0'0_D_VerProc_DS200	Verification Procedure: DS200 Precinct Scanner and Tabulator	1.2
ESSSYS_6'1'0'0_D_VerProc_DS450	Verification Procedure: DS450 High-Throughput Scanner & Tabulator	1.2
ESSSYS_6'1'0'0_D_VerProc_DS850	Verification Procedure: DS850 High-Speed Scanner & Tabulator	1.2
ESSSYS_6'1'0'0_D_VerProc_EVOTE_HW1'0	Verification Procedure: ExpressVote Hardware 1.0	1.0
ESSSYS_6'1'0'0_D_VerProc_EVOTE_HW2'1	Verification Procedure: ExpressVote Hardware 2.1	1.1
ESSSYS_6'1'0'0_D_VerProc_VerificationPCSetup	Verification Procedure: Verification PC Setup	1.1
ESSSYS_6'1'0'0_D_VerProc EMS	Verification Procedure: Election Management System	1.1
ESSSYS_6'1'0'0_D_VerProc ETOUCH	Verification Procedure: ExpressTouch	1.1

Table 3-1. EVS 6.1.0.0 TDP Documents (continued)

Document ID	Description	Revision
ESSSYS_6'1'0'0_D_VerProc_EVOTEXL	Verification Procedure: ExpressVote XL	1.1
06_System Security Specification – 02_Validation File Lists		
DS200_2'30_L_ValFileList	Validation File List: DS200	1.1
DS450_3'4_L_ValFileList	Validation File List: DS450	1.2
DS850_3'4_L_ValFileList	Validation File List: DS850	1.1
ETOUCH_1'0_L_ValFileList	Validation File List: ExpressTouch	1.4
EVOTEXL_1'0_L_ValFileList	Validation File List: ExpressVote XL	1.5
EMS_6'0_L_ValFileList	Validation File List: Election Management System	1.1
EVOTE_4'0_L_ValFileList_HW1'0	Validation File List: ExpressVote HW1.0	1.1
EVOTE_4'0_L_ValFileList_HW2'1	Validation File List: ExpressVote HW2.1	1.1
07_System Operations Procedures		
DS200_2'30'0'0_SOP	DS200 Operator's Guide, Firmware Version 2.30.0.0.	1.1
DS450_3'4'0'0_SOP	DS450 Operator's Guide, Firmware Version 3.4.0.0	1.2
DS850_3'4'0'0_SOP	DS850 Operator's Guide, Firmware Version 3.4.0.0	1.2
ELS_2'0'0'0_SOP	EVS Event Log Service User's Guide, Software Version 2.0.0.0	1.0
ETOUCH_1'0'3'0_SOP	ExpressTouch Operator's Guide, Firmware Version 1.0	1.2
EVOTE_4'0'0'0_SOP_HW1'0	ExpressVote Operator's Guide, Hardware Version 1.0, Firmware Version 4.0.0.0	1.2
EVOTE_4'0'0'0_SOP_HW2'1	ExpressVote Operator's Guide, Hardware Version 2.1, Firmware Version 4.0.0.0	1.2
EVOTEXL_1'0'3'0_SOP	ExpressVote XL Operator's Guide, Firmware Version 1.0	1.4
EWARE_6'0'0'0_SOP_01Admin	Electionware Vol. I: Administrator Guide, Software Version 6.0.0.0	1.2
EWARE_6'0'0'0_SOP_02Define	Electionware Vol. II: Define User Guide, Software Version 6.0.0.0	1.4
EWARE_6'0'0'0_SOP_03Design	Electionware Vol. III: Design User Guide, Software Version 6.0.0.0	1.3
EWARE_6'0'0'0_SOP_04Deliver	Electionware Vol. IV: Deliver User Guide, Software Version 6.0.0.0	1.1
EWARE_6'0'0'0_SOP_05Results	Electionware Vol. V: Results User Guide, Software Version 6.0.0.0	1.2
EWARE_6'0'0'0_SOP_06Appendices	Electionware Vol. VI: Appendices, Software Version 6.0.0.0	1.2

Table 3-1. EVS 6.1.0.0 TDP Documents (continued)

Document ID	Description	Revision
<i>08_System Maintenance Manuals</i>		
DS200_2'30'0'0_SMM	DS200 Maintenance Manual, Firmware Version 2.30.0.0	1.1
DS450_3'4'0'0_SMM	DS450 Maintenance Manual, Firmware Version 3.4.0.0	1.1
DS850_3'4'0'0_SMM	DS850 Maintenance Manual, Firmware Version 3.4.0.0	1.1
ETOUCH_1'0'3'0_SMM	ExpressTouch Maintenance Manual, Firmware Version 1.0	1.1
EVOTE_4'0'0'0_SMM_HW1'0	ExpressVote Maintenance Manual, Firmware Version 4.0.0.0, Hardware Version 1.0	1.2
EVOTE_4'0'0'0_SMM_HW2'1	ExpressVote Maintenance Manual, Firmware Version 4.0.0.0, Hardware Version 2.1	1.2
EVOTEXL_1'0'3'0_SMM	ExpressVote XL Maintenance Manual, Firmware Version 1.0	1.4
<i>09_Personnel Deployment and Training</i>		
ESSSYS_1'0_P_TrainingProgram	Personnel Deployment and Training Program	1.2
<i>10_Configuration Management Plan</i>		
ESSSYS_1'0_P_CMProgram	Configuration Management Program	1.6
ESSSYS_1'0_P_TDProgram	Technical Documentation Program	1.4
<i>11_QA Program</i>		
ESSSYS_1'0_P_MNFQAProgram	Manufacturing Quality Assurance Program	1.10
ESSSYS_1'0_P_SWQAProgram	Software Quality Assurance Program	1.5
<i>12_System Change Notes</i>		
ESSSYS_6'1'0'0_D_ChangeNotes	ES&S Voting System 6.1.0.0 System Change Notes	1.2
<i>13_Attachments</i>		
BPG_1'0_SOP	Ballot Production Guide for EVS	3.2

3.1.1 Source Code Review

Pro V&V reviewed 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 verified 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 were used to review the changes in the source code from the previously certified EVS 6.0.4.0 voting system. In addition, 10% of the source code comments were manually reviewed.

Summary Findings

- Automated Source Code Review: The Automated Source Code Review was performed during the EVS 6.1.0.0 Compliance and Trusted Builds. No source code issues were found during the Automated Source Code review.
- Manual Source Code Review: The Manual Source Code review was performed on 10% of the comments for compliance to VVSG Volume Section 5.2.7. No source code issues were found during the Manual Source Code review.
- Compliance Build: The compliance build was performed following the compliance review. Once the compliance review was performed and the source was deemed stable enough to proceed with testing, the source code and all additional packages were compiled into a Compliance Build.
- Trusted Build: The trusted build consisted of inspecting customer submitted source code, COTS, and third-party software products and combining them to create the executable code. This inspection followed 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 Trusted Build was performed following the completion of the Functional Configuration Audit.

3.1.2 Physical Configuration Audit (PCA)

The Physical Configuration Audit (PCA) compares the voting system components submitted for qualification to the manufacturer’s technical documentation, and included 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 reviewed drawings, specifications, technical data, and test data associated with system hardware to establish a system hardware baseline associated with the 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

Summary Findings

During execution of the test procedure, the components of the EVS 6.1.0.0 system were documented by component name, model, serial number, major component, and any other relevant information needed to identify the component. For COTS equipment, every effort was made to verify that the COTS equipment had not been modified for use. Additionally, each technical document submitted in the TDP was recorded by document name, description, document number, revision number, and date of release. At the conclusion of the test campaign, test personnel verified that any changes made to the software, hardware, or documentation during the test process were fully and properly documented.

3.1.3 System Level Testing

System Level Testing included the Functional Configuration Audit (FCA), the Accuracy Test, the Volume and Stress Test, and the System Integration Tests. The System Integration test was performed as part of the regression test requirements for this campaign. System Level Testing also included a limited Accessibility/Usability Review. System Level testing was implemented to evaluate the complete system. This testing included all proprietary components and COTS components (software, hardware, and peripherals), as well as the Ancillary Systems detailed in Appendix A. Although not part of the system under test, the Ancillary Devices were used during the test campaign to support testing. For software system tests, the tests were designed according to the stated design objective without consideration of its functional specification.

The system level test cases were prepared independently to assess the response of the hardware and software to a range of conditions.

The FCA for this test campaign included an assessment of the submitted modifications and included inputs of both normal and abnormal data during test performance. This evaluation utilized baseline test cases as well as specifically designed test cases and included predefined election definitions for the input data. The System Integration Tests were performed to verify the EVS 6.1.0.0 functioned as a complete system.

Additionally, during test performance, the system was configured exactly as it would for normal field use per the procedures detailed in the EVS 6.1.0.0 technical documentation. This included connecting all supporting equipment and peripherals including ballot boxes, voting booths (regular and accessible), and any physical security equipment such as locks and ties.

3.1.3.1 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 were conducted to ensure all applicable EAC VVSG 1.0 requirements were met.

Summary Findings

All functional tests were successfully executed.

3.1.3.2 Accuracy

The Accuracy Test ensured that each component of the voting system could 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.

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 were used to test components of the voting system.

Summary Findings

The EVS 6.1.0.0 system was tested by utilizing a combination of hand marked (70%) and pre-marked (30%) paper ballots to achieve an accuracy rate greater than 1,549,703 correct ballot positions. The EVS 6.1.0.0 system was tested by using all of the available ballot sizes to cast a sufficient number of ballots to achieve an accuracy rate of 1,565,800 correct ballot positions.

In addition to the paper ballots, the accuracy test utilizing pre-marked vote summary cards of each card length supported, the ExpressVote successfully passed the Accuracy Test without issue. A total of 1,800,000 voting positions were processed during testing with all actual results obtained during test execution matching the expected results.

3.1.3.3 Volume and Stress Testing

A Volume and Stress Test was performed on the EVS 6.1.0.0. The Volume & Stress test investigated the system’s response to conditions that tend to overload the system’s capacity to process, store, and report data. The test parameters focused 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.

Summary Findings

The EVS 6.1.0.0 successfully met the requirements of the Volume and Stress Testing. It was verified that the system can achieve the manufacturer’s TDP claims of what the system can support. Testing was performed by exercising six election definitions and test cases developed specifically to test for volume and stress conditions of the system.

3.1.3.4 System Integration

System Integration is a system level test that evaluates the integrated operation of both hardware and software. System Integration tests the compatibility of the voting system software

components, or subsystems, with one another and with other components of the voting system environment. This functional test evaluates the integration of the voting system software with the remainder of the system.

Summary Findings

During test performance, the system was configured as it would be for normal field use. This involved 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 properly configured and tested the system by following the procedures detailed in the EVS 6.1.0.0 technical documentation.

During System Integration testing, two General Elections and two Primary Elections were successfully 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:

- T 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.

The EVS 6.1.0.0 system successfully passed the System Integration Test. During execution of the test procedure, it was verified that the EVS 6.1.0.0 system successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results.

3.1.3.5 Usability and Accessibility Testing

A Limited Accessibility and Usability Review was performed on the EVS 6.1.0.0. During test performance, the voting system was configured as per the ES&S TDP. Primarily, the testing focused on the usability requirements for privacy and the accessibility requirements for mobility for the new voting booth workstation.

Summary Findings

The EVS 6.1.0.0 successfully met the requirements of the limited Usability and Accessibility evaluation. During the evaluation, it was verified that the new voting booth workstation prevented others from observing the contents of a voter's ballot when it was deployed according to the ES&S TDP. Additionally, it was verified that the voting process was accessible to voters who use mobility aids, including wheelchairs.

3.2 Anomalies and Resolutions

When a result is encountered during test performance that deviates from what is standard or expected, a root cause analysis is performed. Pro V&V considers it an anomaly if no root cause can be determined. In instances in which a root cause is established, the results are then considered deficiencies. No anomalies occurred during the testing of the EVS 6.1.0.0.

3.3 Deficiencies and Resolutions

Any violation of the specified requirement or a result is encountered during test performance that deviates from what is standard or expected in which a root cause is established is considered to be a deficiency. Upon occurrence, deficiencies are logged throughout the test campaign for disposition and resolution. No deficiencies were encountered during testing of the EVS 6.1.0.0.

4.0 RECOMMENDATION FOR CERTIFICATION

The EVS 6.1.0.0, as presented for testing, successfully met the requirements set forth for voting systems in the U.S. Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (VVSG), Version 1.0. Additionally, Pro V&V, Inc. has determined that the EVS 6.1.0.0 functioned as a complete system during System Integration Testing. Based on the test findings, Pro V&V recommends the EAC grant the EVS 6.1.0.0 identified in Table 4-1 certification to the EAC VVSG 1.0.

Table 4-1. EVS 6.1.0.0 System Components - Proprietary

System Component	Software or Firmware Version	Hardware Version(s)	Description
Electionware	6.0.0.0	---	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	2.30.0.0	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)
DS450	3.4.0.0	1.0	Central Count Scanner and Tabulator
DS450 Cart	---	---	Model 3002
DS850	3.4.0.0	1.0	Central Count Scanner and Tabulator
DS850 Cart	---	---	Model 6823
ExpressVote XL	1.0.3.0	1.0	Hybrid full-faced paper-based vote capture and selection device and precinct count tabulator
ExpressTouch	1.0.3.0	1.0	DRE
ExpressVote HW1.0	4.0.0.0	1.0	Hybrid paper-based vote capture and selection device
ExpressVote HW2.1	4.0.0.0	2.1.0.0 2.1.2.0	Hybrid paper-based vote capture and selection device
ExpressVote Rolling Kiosk	---	1.0	Portable Voting Booth (Model 98-00049)
Voting Booth	---	---	Stationary Voting Booth (Model 98-00051)
Voting Booth Workstation	---	---	Stationary voting booth (Model 87035)
Quad Express Cart	---	---	Portable Voting Booth (Model 41404)
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)

Table 4-1. EVS 6.1.0.0 System Components – Proprietary (continued)

System Component	Software or Firmware Version	Hardware Version(s)	Description
Universal Voting Console (UVC)	---	1.0	Detachable ADA support peripheral (Model 98-00077)
Tabletop Easel	---	---	Model 14040
ExpressTouch Voting Booth	---	---	Stationary Voting Booth (Model 98-00081)
SecureSetup	3.0.0.2	---	Proprietary Hardening Script

Table 4-2. EVS 6.1.0.0 System Components – COTS Software

Manufacturer	Application	Version
Microsoft Corporation	Server 2016	(64-bit)
Microsoft Corporation	Windows 10 Enterprise LTSC	SP1 (64-bit)
Microsoft Corporation	WSUS Microsoft Windows Offline Update Utility	11.6.1
Symantec	Endpoint Protection	14.2.0_MP1 (64-bit)
Symantec	Symantec Endpoint Protection Intelligent Updater (File-Based Protection)	20190329-001-core15sds5i64.exe
Symantec	Symantec Endpoint Protection Intelligent Updater (Network-Based Protection)	20190328-061-IPS_IU_SEP_14RU1.exe
Symantec	Symantec Endpoint Protection Intelligent Updater (Behavior-Based Protection)	20190325-001-SONAR_IU_SEP.exe
Amyuni	Amyuni PDF Converter Printer Driver	5.5
Cerberus	Cerberus FTP Server – Enterprise	10.0.8 (64-bit)
Sumatra	Sumatra PDF	3.1.2 (64-bit)
RSA Security	RSA BSAFE Crypto-C ME for Windows 32-bit	4.1

Table 4-3. EVS 6.1.0.0 System Components – COTS Hardware

Manufacturer	Hardware	Model/Version
Dell	EMS Server	PowerEdge T430, T630
Dell	EMS Client or Standalone Workstation	Latitude 5580, OptiPlex 5040, 5050, 7020
Dell	Trusted Platform Module (TPM) Chip 1.2 and 2.0 (optional)	M48YR
Innodisk	USB EDC H2SE (8GB) for ExpressVote 1.0	DEEUH1-01GI72AC1SB

Table 4-3. EVS 6.1.0.0 System Components – COTS Hardware *(continued)*

Manufacturer	Hardware	Model/Version
Innodisk	USB EDC H2SE (16GB) for ExpressVote 2.1	DEEUH1-16GI72AC1SB
Delkin	USB Flash Drive (512MB, 1GB, 2GB, 4GB, 8GB)	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
Delkin	Compact Flash Memory Card Reader/Writer	6381
Delkin	CFAST Card (2GB, 4GB)	N/A
Delkin USB Flash Drive	BitLocker 32.2 MB	Storage for security key (optional)
Lexar	CFAST Card Reader/Writer	LRWCR1TBNA
CardLogix	Smart Card	CLXSU128kC7/ AED C7
SCM Microsystems	Smart Card Writer	SCR3310
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 and DS850 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
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

APPENDIX A

ANCILLARY SYSTEMS

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

Ancillary systems include:

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

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

**Table A-1
Ancillary Systems**

System Component	Software or Firmware Version	Hardware Version(s)
BOD Software (Balotar)	1.0	---
Balotar Compact	---	OKI C712
ExpressRunoff	1.0.2.0	---
ExpressPoll	7.0.1.0 (or greater)	Microsoft Surface Go
ExpressLink	2.0.0.0	---
ExpressVote Activation Card Printer	---	1.0
ExpressTouch Smart Card Writer	---	ST-U100C
Electionware Toolbox – Test Deck	4.0.0.0	---
Electionware Toolbox – Text to Speech	4.0.0.0	---
Electionware Toolbox – Media Restore	4.0.0.0	---

APPENDIX B

AS-RUN TEST PLAN

*Pro V&V Document No. TP-01-01-ESS-006-01.04, “Test Plan for EAC VVSG 1.0 Certification Testing
Election Systems and Software (ES&S) Voting System (EVS) 6.1.0.0”*

(Provided Separately)