700 Boulevard South
Suite 102
Huntsville, AL 35802
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) 6.1.0.0

EAC Project Number: ESSEVS6100

Version: 01

Date: 06/20/2019

U.S. Election Assistance Commission

VSTL

EAC Lab Code 1501

NVLAP®

NVLAP LAB CODE 200908-0

SIGNATURES

Approved by: _Michael L Walker_   _6/20/19_

                     Michael Walker, VSTL Project Manager   Date

Approved by: _Wendy Owens_   _6/20/19_

                     Wendy Owens, VSTL Program Manager   Date

REVISIONS

Revision	Description	Date
00	Initial Release	06/14/2019
01	Updates per EAC Comments	06/20/2019

TABLE OF CONTENTS

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 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. 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.

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 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); DS450 high-throughput central scanner and tabulator (DS450); DS200 precinct-based scanner and tabulator (DS200); DS850 high-throughput central scanner and tabulator (DS850); ExpressVote XL Full-Faced 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 (ExpressVote HW2.1)

ExpressVote HW2.0 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, 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-Throughput 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-Faced Universal Voting System (ExpressVote XL)

ExpressVote XL is a hybrid paper-based polling place voting device that provides a full-face touchscreen 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
Delkin USB Flash Drive		BitLocker 32.2 MB	Storage for election and ballot definition
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_MP1 (64-bit)
Symantec	Symantec Endpoint Protection Intelligent Updater (File-Based Protection)	20190122-001-core15sdsv5i64.exe
Symantec	Symantec Endpoint Protection Intelligent Updater (Network-Based Protection)	20190121-062-IPS_IU_SEP_14RU1.exe
Symantec	Symantec Endpoint Protection Intelligent Updater (Behavior-Based Protection)	20190115-001-SONAR_IU_SEP.exe
Gigabyte	WindowsImageTool	B17.1116.01
Cerberus	CerberusFTP 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
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

Manufacturer	Hardware	Model/Version
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 and DS850 Surge Protector	Spike Cube
Seiko Instruments	Thermal Printer	LTPD-347B
NCR/Nashua	Paper Roll	2320
Fujitsu	Thermal Printer	FTP-62GDSL001, FTP-63GMCL153

1.1.2 Description of Modification

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. 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 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 Reacrchitecture

  Enabled the ExpressVote to operate using the touchscreen user interface and functionality developed for the ExpressVote XL in EVS6000 and 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 touchscreen 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 Security 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.

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 campaign was used to establish the baseline. Based on the assessment, it was determined the following tasks would be required to verify compliance of the 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

- Security Testing

- Usability & Accessibility Testing

1.1.4 Regression Test

Regression testing for this test campaign will consist of the execution of the System Integration and Accuracy Tests.

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, 2008 Edition, "Voting System Testing (NIST Handbook 150-22)", dated May 2008

- 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 Certification Test Report – Modification, Report No. ESY-18004-CTR-01, v1.1, dated April 23, 2019

- EAC Certificate of Conformance ES&S EVS 6.0.4.0, dated May 3, 2019

- EAC Grant of Certification, ESSEV6040, 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 4.5.1 of this Test Plan)*

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

"BOD" – Ballot on Demand

"CBT" – Central Ballot Tabulator

"CM" – Configuration Management

"COTS" – Commercial Off-The-Shelf

"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

"PBT" – Precinct Ballot Tabulator

"PCA" – Physical Configuration Audit

"QA" – Quality Assurance

"RMS" – Removable Media Service

"RFI" – Request for Interpretation

"TDP" – Technical Data Package

"UVC" – Universal Voting Console

"UVS" – Universal Voting System

"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. Primarily, these modifications focused on upgrades to the components of the previously certified EVS 6.0.4.0 and the introduction of 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

1.5.1 VVSG

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

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 6.1.0.0 includes 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-throughput central scanner and tabulator (DS850); ExpressVote XL Full-Faced Universal Voting System (ExpressVote XL); and ExpressTouch Electronic Universal Voting System (ExpressTouch).

EVS 6.1.0.0 system components submitted for testing are listed in the following tables.

Table 1-4. 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
ExpressVote HW1.0	4.0.0.0	1.0	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
DS200	2.30.0.0	1.2, 1.3, 1.3.11	Precinct Count Tabulator that scans voter selections from both sides of the ballot simultaneously
DS450	3.4.0.0	1.0	Central Count Scanner and Tabulator
DS850	3.4.0.0	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
Delkin USB Flash Drive		BitLocker 32.2 MB	Storage for election and ballot definition
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)
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

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

System Component	Software or Firmware Version	Hardware Version(s)	Description
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	3.0.0.2	---	Proprietary Hardening Script

Table 1-5. 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-core15sdsv5i64.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
---	Ayumani PDF Converter Printer Driver	5.5
Cerberus	CerberusFTP Server – Enterprise	10.0.8 (64-bit)
Sumatra	SumatraPDF	3.1.2 (64-bit)
RSA Security	RSA BSAFE Crypto-C ME for Windows 32-bit	4.1

Table 1-6. 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 version 2.0	M48YR
Innodisk	USB EDC H2SE (8GB) for ExpressVote 1.0	DEEUH1-01GI72AC1SB

Table 1-6. 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	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	USB Embedded 2.0 Module Flash Drive (8GB)	MY08TQJ7A-RA000-D
Delkin	Secure CF Card (8GB)	CE02TLQCK-FD000-D
Delkin	Compact Flash Memory Card Reader/Writer	6381
Delkin	CFAST Card (2GB, 4GB)	N/A
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 and DS850 Surge Protector	Spike Cube
Seiko Instruments	Thermal Printer	LTPD-347B
NCR/Nashua	Paper Roll	2320
Fujitsu	Thermal Printer	FTP-62GDSL001, FTP-63GMCL153

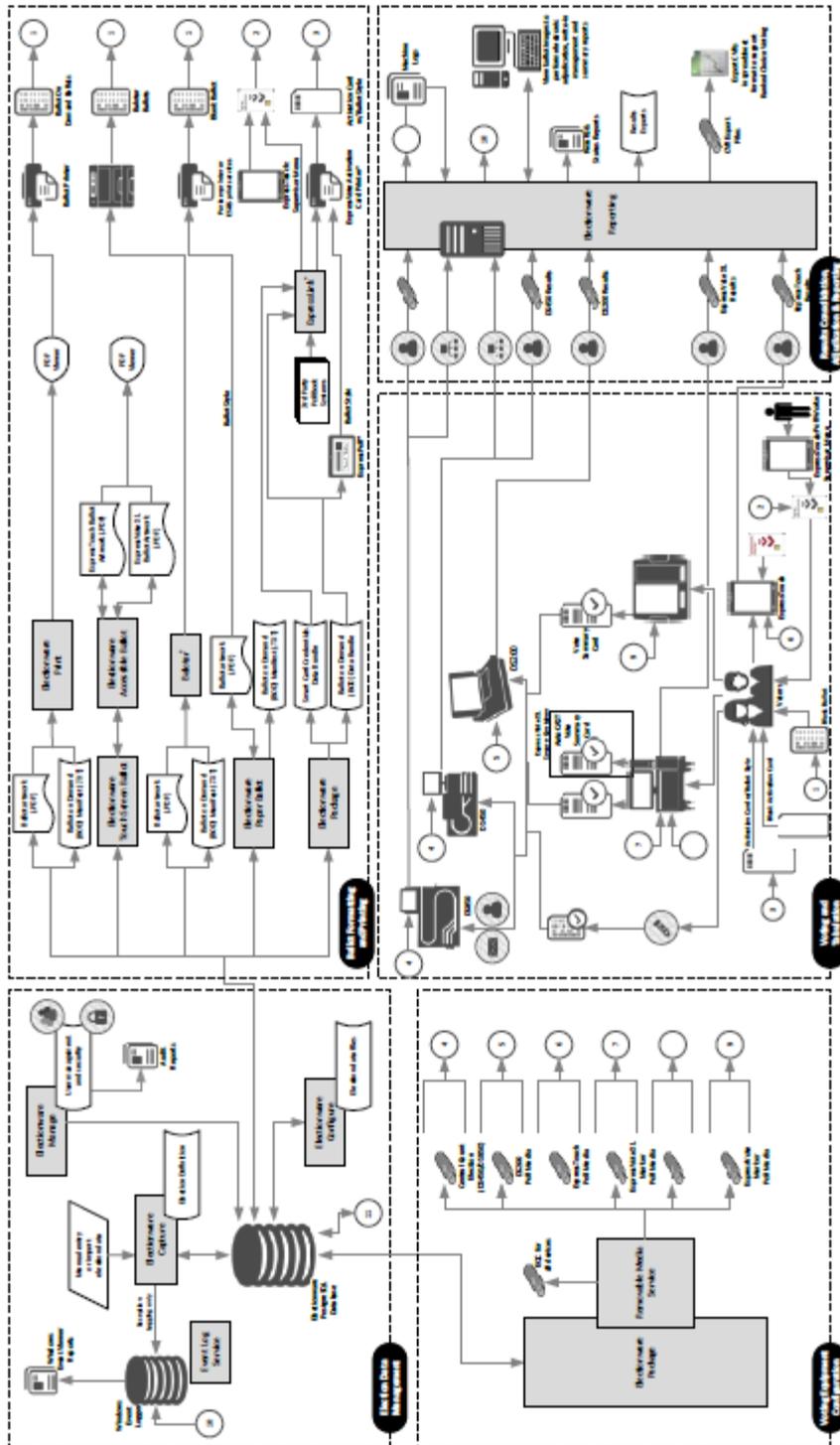## 1.6.1 Block Diagram

Figure 1-1. EVS 6.1.0.0 System Overview

1.6.2   System Limits

The system limits that ES&S has stated to be supported by the EVS 6.1.0.0 are provided in the table below.

Table 1-7. 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)	---
Max. reporting groups	14	Electionware

Additionally, the following EVS 6.1.0.0 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 Multiple Target Cross Endorsement.

6. ExpressVote XL does not support Reviewer or Judges Initials boxes.

7. ExpressVote XL does not support multi-card ballots.

8. 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 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 limits 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 appendix. 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.

1.6.3 Supported Languages

The following languages are supported by the 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 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 6.1.0.0 is designed to support the following voting variations:

- General Election
- Closed Primary
- Open 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 Test Report for the EVS 6.0.4.0 in order to baseline the current system under test.

2.2   Evaluation of Prior Non-VSTL Testing

No prior non-VSTL testing of the EVS 6.1.0.0 modifications were considered for this test campaign.

2.3   Known Field Issues

EVS 6.1.0.0 is a modification to a previously certified system and has not yet been fielded.

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 6.1.0.0 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

- Headphone Covers

- Ethernet Switch

- Printer Paper

- Ballots and blank ballot grade paper

- Activation cards

- Ballot pens

- CF 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 6.1.0.0 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 6.1.0.0 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 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 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 integrity of the system, Pro V&V will develop specifically designed test cases in an attempt to defeat the access controls and security measures documented in the system TDP as well as verifying compliance to EAC RFI 2012-05. A threat matrix will be created to determine the risks and vulnerabilities. An evaluation of the system will be accomplished by utilizing a combination of functional testing, source code review, and static code analyzers.

During the security testing, the system shall be inspected for various controls and measures that are in place to meet the objectives of the security standards which include: protection of the critical elements of the voting system; establishing and maintaining controls to minimize errors; protection from intentional manipulation, fraud and malicious mischief; identifying fraudulent or erroneous changes to the voting system; and protecting the secrecy in the voting process.

Additional review will be performed on the implementation of the FIPS cryptographic module in order to:

- Confirm the module (model and version) that is used and implemented is present on the NIST CMVP validated products list.

- Confirm the module in all five instances is configured and used per the NIST published security policy for that module.

4.1.1 Rationale for 'Not Applicable' Requirements

All requirements that were excluded from the previous test campaign (EVS 6.0.4.0) were also deemed not applicable to this test campaign due to the submitted modifications not impacting the specific requirements.

4.2 Hardware Configuration and Design

The EVS 6.1.0.0 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-throughput central scanner and tabulator (DS850); ExpressVote XL Full-Faced Universal Voting System (ExpressVote XL); ExpressTouch Electronic Universal Voting System (ExpressTouch).

4.3 Software System Functions

The EVS 6.1.0.0 EMS is an application suite consisting of Electionware, Removable Media Service (RMS) and Event Log Service (ELS).

<u>Electionware</u>

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.

<u>Removable Media Service (RMS)</u>

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.

<u>Event Log Service (ELS)</u>

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

The updates to the baselined system do not require hardware testing to be performed.

4.4.2   Hardware Environmental Test Case Design

Previous hardware examinations were performed on the certified baseline system (EVS 6.0.4.0) and/or previous certified versions of the EVS 6.1.0.0 components. The updates to the baselines system do not require additional hardware testing to be performed.

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 6.1.0.0 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 6.1.0.0 TDP is provided in Table 4-1.

Table 4-1. EVS 6.1.0.0 TDP Documents

Document ID	Description	Revision
00_Preface		
ESSSYS_6'1'0'0_L_RequirementsMatrix_TDP	Requirements of the VVSG 1.0 Trace to Vendor Testing	1.0
01_System Overview		
ESSSYS_6'1'0'0_D_SYSOVR	ES&S Voting System 6.1.0.0 System Overview	1.0
02_System Functionality Description		
ESSSYS_6'1'0'0_D_SFD	ES&S Voting System 6.1.0.0 System Functionality Description	1.0
03_System Hardware Specification		
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
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
03_System Hardware Specification – Approved Parts List		
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

Table 4-1. EVS 6.1.0.0 TDP Documents *(continued)*

Document ID	Description	Revision
04_Software Design and Specification		
DS200_2'30'0'0_SDS	DS200 - Software Design Specification	1.0
DS450_3'4'0'0_SDS	DS450 - Software Design Specification	1.0
DS850_3'4'0'0_SDS	DS850 - Software Design Specification	1.0
ELS_2'0'0'0_SDS	Event Log Service – Software Design Specification	1.0
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	1.0
EVOTE_4'0'0'0_SDS	ExpressVote 2.1 - Software Design Specification	1.0
ESSSYS_1'0_P_CODINGSTANDARDS	Coding Standards	1.4
ESSSYS_1'0_P_SYSDEVPROGRAM	System Development Program	1.6
ESSSYS_1'0_SPC_LicenseAgreements.docx	License Agreements for Procured Software	1.6
EWARE_6'0'0'0_SDS	Electionware – Software Design Specification	1.0
EVOTEXL_1'0'3'0_SDS	ExpressVote XL – Software Design Specification	1.2
05_System Test and Verification		
ESSSYS_6'1'0'0_D_TESTPLAN	ES&S Voting System 6.1.0.0 System Test Plan	1.0
ETOUCH_1'0_D_CIFRpt.pdf	Usability Test Report: ExpressTouch Electronic Universal Voting System Version 1.0.3.0	---
DS200_1'3_D_CIFRpt.pdf	Usability Test Report: DS200 Precinct Ballot Scanner Version 2.30.0.0	---
EVOTE_1'0_D_CIFRpt.pdf	Usability Test Report: ExpressVote Universal Voting System Version 4.0.0.0.	---
EVOTE_2'1_D_CIFRpt.pdf	Usability Test Report: ExpressVote Universal Voting System Version 4.0.0.0	---
EVOTEXL_1'0_D_CIFRpt.pdf	Usability Test Report: ExpressVote XL Full-Faced Universal Voting System Version 1.0.3.0	---
06_System Security Specification		
ESSSYS_6'1'0'0_SPC_ENT_CLIENTWORKSTATIONSETUPCONFIGGUIDE.DOCM	EMS Client Workstation Secure Setup & Configuration Guide	1.0
ESSSYS_6'1'0'0_SPC_EMSSERVERSETUPCONFIGGUIDE.DOCM	EMS Server Secure Setup & Configuration Guide	1.0
ESSSYS_6'1'0'0_SPC_SECBESTPRACT	Best Practices for Physically Securing ES&S Equipment	1.0
ESSSYS_6'1'0'0_SPC_SECURITYSCRIPTDESC.DOCM	Security Script Description	1.0

Table 4-1. EVS 6.1.0.0 TDP Documents *(continued)*

Document ID	Description	Revision
ESSSYS_6'1'0'0_SPC_ENT_STANDALONEWORKSTATIONSETUPCONFIGGUIDE.DOCM	EMS Standalone Workstation Secure Setup & Configuration Guide	1.0
ESSSYS_6'1'0'0_SPC_SYSTEMSECURITY	Voting System Security Specification	1.0
06_System Security Specification – Validation File Lists		
DS200_2'30_L_ValFileList	Validation File List: DS200	1.0
DS450_3'4_L_ValFileList	Validation File List: DS450	1.0
DS850_3'4_L_ValFileList	Validation File List: DS850	1.0
ETOUCH_1'0_L_ValFileList	Validation File List: ExpressTouch	1.3
EVOTEXL_1'0_L_ValFileList	Validation File List: ExpressVote XL	1.4
07_System Operations Procedures		
DS200_2'30'0'0_SOP	DS200 Operator's Guide, Firmware Version 2.30.0.0.	1.0
DS450_3'4'0'0_SOP	DS450 Operator's Guide, Firmware Version 3.4.0.0	1.0
DS850_3'4'0'0_SOP	DS850 Operator's Guide, Firmware Version 3.4.0.0	1.0
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	1.0
EVOTE_4'0'0'0_SOP_HW2'1	ExpressVote Operator's Guide, Hardware Version 2.1, Firmware Version 4.0.0.0	1.0
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	1.0
EWARE_6'0'0'0_SOP_02Define	Electionware Vol. II: Define User Guide, Software Version 6.0.0.0	1.0
EWARE_6'0'0'0_SOP_03Design	Electionware Vol. III: Design User Guide, Software Version 6.0.0.0	1.0
EWARE_6'0'0'0_SOP_04Deliver	Electionware Vol. IV: Deliver User Guide, Software Version 6.0.0.0	1.0
EWARE_6'0'0'0_SOP_05Results	Electionware Vol. V: Results User Guide, Software Version 6.0.0.0	1.0
EWARE_6'0'0'0_SOP_06Appendices	Electionware Vol. VI: Appendices, Software Version 6.0.0.0	1.0
08_System Maintenance Manuals		

Table 4-1. EVS 6.1.0.0 TDP Documents *(continued)*

Document ID	Description	Revision
DS200_2'30'0'0_SMM	DS200 Maintenance Manual, Firmware Version 2.30.0.0	1.0
DS450_3'4'0'0_SMM	DS450 Maintenance Manual, Firmware Version 3.4.0.0	1.0
DS850_3'4'0'0_SMM	DS850 Maintenance Manual, Firmware Version 3.4.0.0	1.0
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	1.0
EVOTE_4'0'0'0_SMM_HW2'1	ExpressVote Maintenance Manual, Firmware Version 4.0.0.0, Hardware Version 2.1	1.0
EVOTEXL_1'0'3'0_SMM	ExpressVote XL Maintenance Manual, Firmware Version 1.0	1.4
09_Personnel Deployment and Training		
ESSSYS_1'0_P_TRAININGPROGRAM	Personnel Deployment and Training Program	1.1
10_Configuration Management Plan		
ESSSYS_1'0_P_CMPROGRAM	Configuration Management Program	1.5
ESSSYS_1'0_P_TDPROGRAM	Technical Documentation Program	1.3
11_QA Program		
ESSSYS_1'0_P_MNFQAPROGRAM	Manufacturing Quality Assurance Program	1.9
ESSSYS_1'0_P_SWQAPROGRAM	Software Quality Assurance Program	1.4
12_System Change Notes		
ESSSYS_6'1'0'0_D_CHANGENOTES	ES&S Voting System 6.1.0.0 System Change Notes	1.0
13_Attachments		
BPG_1'0_SOP	Ballot Production Guide for EVS	3.2

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 voting system. 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

4.5.4 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.

4.5.5 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. 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.

System Level Testing includes the evaluations of the following test areas: Security Review, FCA, Volume & Stress Testing, Accuracy Testing, and System Integration Testing.

Pro V&V defined 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.

4.5.5.1 Accuracy

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. 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 6.1.0.0 will be accomplished by the execution of the standard accuracy test utilizing pre-marked vote summary cards of each card length supported.

4.5.5.2 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.

Additionally, 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 6.1.0.0 technical documentation.

4.5.5.3 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.

4.5.5.4 Regression Testing

Regression testing will be conducted on the EVS 6.1.0.0 to establish assurance that the modifications have no adverse impact on the compliance, integrity, or performance of the system.

4.5.6 Security Functions

The objective of the Security Testing is to evaluate the effectiveness of the voting system in detecting, preventing, recording, reporting, and recovering from security threats. To evaluate the integrity of the system, Pro V&V shall develop specifically designed test cases in an attempt to defeat the access controls and security measures documented in the system TDP.

The submitted threat matrix identifying the system's risks and vulnerabilities shall be evaluated for completeness and to determine that mitigating controls are adequately implemented. An evaluation of the system shall be accomplished by utilizing a combination of functional testing and source code review. All findings will be reported to the EAC and ES&S.

The test methods for performing the Security Testing are execution and review. Prior to performance of Security testing, the examiner will verify that security hardening scripts have been properly applied to system components per the system documentation. The examiner will review the submitted TDP to verify that documented access and physical controls are in place. Following the documented procedures, the examiner will configure the voting system for use and functionality to verify that the documented controls are in place and adequate and meet the stated requirements.

Physical Security will be tested by setting up the system as described in the TDP and then examining the effectiveness and comprehensiveness of physical security measures.

Administrative Security will be tested by examining the system's documented security instructions and procedures for effectiveness and breadth.

Logical security will be tested as part of FCA testing by a recognized security expert who not only will review the physical and administrative testing outcomes, but will perform the following tests on system components: Vulnerability Scans, SCAP Scans, and Physical Bypass Attempts. Logical security testing will assess the effectiveness of the security hardening scripts applied during the system setup and install process.

4.5.7   Usability & Accessibility Testing

Usability & Accessibility Testing will be performed to evaluate the usability of the EVS 6.1.0.0 to the requirements set forth in the EAC VVSG 1.0.

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 6.1.0.0 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 (±3.6∘F)
- Relative Humidity: Local Site Humidity
- Atmospheric Pressure: Local Site Pressure
- Time Allowable Tolerance: ±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 6.1.0.0 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 6.1.0.0. 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	Assigned To	Duration	Predecessors
TDP	**05/08/19**	**08/26/19**		**77d**	
Initial Review	05/08/19	05/13/19	Alan	4d	
Compliance Review	05/14/19	08/20/19	Alan	69d	6
Final review	08/21/19	08/26/19	Alan	4d	7
Test Plan	05/15/19	08/07/19		59d	
Test Plan Creation	05/15/19	06/11/19	Wendy	20d	
Vendor Review & Comments	06/12/19	06/13/19	Wendy	2d	10
EAC Submission and Review	06/14/19	07/15/19	Wendy	20d	11
VSTL Comment Review & Update	07/16/19	07/22/19	Wendy	5d	12
EAC Submission & Review of Revision	07/23/19	08/05/19	Wendy	10d	13
EAC Approved Test Plan	08/06/19	08/07/19	Wendy	2d	14
Source Code	**05/17/19**	**06/21/19**		**26d**	
Automated Review	05/17/19	06/19/19	Jack	24d	
Source Code Review	05/17/19	06/19/19	Jack	24d	
Source Code Re-Review	06/20/19	06/20/19	Jack	1d	18
Document Review	06/17/19	06/17/19	Stephen	1d	
Compliance Build	06/17/19	06/21/19	Stephen	5d	
System Delivery & Setup	**05/08/19**	**06/26/19**		**36d**	
PCA	05/08/19	05/09/19	Stephen	2d	
System Setup	05/10/19	05/13/19	Stephen	2d	23
System Loads & Hardening	06/24/19	06/26/19	Stephen	3d	21
System Level Testing	**06/28/19**	**08/20/19**		**36d**	
FCA	06/28/19	07/22/19	Stephen	15d	
Security (SCAP)	07/23/19	07/29/19	Stephen	5d	27
Usability	07/23/19	07/23/19	Stephen	1d	27
Accessibility	07/24/19	07/24/19	Stephen	1d	29
Volume & Stress	07/25/19	07/29/19	Stephen	3d	30
Accuracy	07/30/19	08/02/19	Stephen	4d	31
Regression Testing	08/05/19	08/05/19	Stephen	1d	32
Trusted Build	08/06/19	08/08/19	Stephen	3d	33
System Loads & Hardening	08/09/19	08/13/19	Stephen	3d	34
System Validation	08/14/19	08/15/19	Stephen	2d	35
System Integration	08/14/19	08/20/19	Stephen	5d	35
Test Report	**08/14/19**	**10/16/19**		**45d**	
Test Report Creation	08/14/19	08/27/19	Wendy	10d	35
Vendor Review & Comments	08/28/19	08/28/19	Wendy	1d	39
EAC Submission & Review	08/29/19	09/26/19	Wendy	20d	40
VSTL Comment Review & Update	09/27/19	10/01/19	Wendy	3d	41
EAC Submission & Review of Revision	10/02/19	10/15/19	Wendy	10d	42
EAC Approved Test Report	10/16/19	10/16/19	Wendy	1d	43