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## Test Report for EAC 2005 VVSG Certification Testing Clear Ballot Group ClearVote 2.5-OR Voting System

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Disclaimer: This campaign was tested by an EAC accredited VSTL to applicable standards of the VVSG. All testing and references were performed outside of the EAC Test and Certification Program.

**SIGNATURES**

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**REVISIONS**

<b>Revision</b>	<b>Description</b>	<b>Date</b>
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## 1.0 INTRODUCTION

The purpose of this Test Report is to document the procedures that Pro V&V, Inc. followed to perform state certification testing of the Clear Ballot Group (CBG) ClearVote 2.5-OR Voting System 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, and the State of Oregon requirements.

### 1.1 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 3.0
- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 3.0
- National Voluntary Laboratory Accreditation Program NIST Handbook 150, 2020 Edition, “NVLAP Procedures and General Requirements (NIST HB 150-2020)”
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2021 Edition, “Voting System Testing (NIST Handbook 150-22-2021)”
- United States 107<sup>th</sup> Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Pro V&V, Inc. Quality Assurance Manual
- Election Assistance Commission “Approval of Clear Ballot ClearVote 2.3 Voting System Testing Application Package” letter dated February 2, 2022
- EAC Requests for Interpretation (RFI) and Notices of Clarification (NOC) (listed on [www.eac.gov](http://www.eac.gov))
- Clear Ballot Group’s Technical Data Package (*A listing of the ClearVote 2.5-OR documents submitted for this test campaign is listed in Section 3.1.1 of this Test Report*)

### 1.2 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

“BMD” – Ballot Marking Device

“CM” – Configuration Management

“COTS” – Commercial Off-The-Shelf

“EAC” – United States Election Assistance Commission

“EMS” – Election Management System

“FCA” – Functional Configuration Audit

“HAVA” – Help America Vote Act

“ISO” – International Organization for Standardization

“NOC” – Notice of Clarification

“PC” – Personal Computer

“PCA” – Physical Configuration Audit

“QA” – Quality Assurance

“RAM” – Random Access Memory

“RFI” – Request for Interpretation

“SCAP” – Security Content Automation Protocol

“TDP” – Technical Data Package

“UPS” – Uninterruptible Power Supply

“VSTL” – Voting System Test Laboratory

“VVSG” – Voluntary Voting System Guidelines

### **1.3 Background**

Clear Ballot Group (“CBG”) initiated the certification of the ClearVote 2.5-OR Voting System by submitting a request for evaluation of the ClearVote 2.5-OR system, along with corresponding documentation and information, to Pro V&V, Inc.

### **1.4 Description and Overview of System Being Modified**

The ClearVote 2.5-OR configuration submitted for testing is a modification from the EAC-certified ClearVote 2.3 configuration. ClearVote 2.5-OR is comprised of components tested during the ClearVote 2.3 test campaign.

The ClearVote 2.5-OR Voting System is a paper-based optical scan voting system consisting of the following major components: ClearDesign (ballot design and EMS), ClearCount (central count, tabulation, and election reporting), and ClearAccess (accessible voting and ballot marking device).

### 1.4.1 Baseline Certified System

The baseline system for this modification is the ClearVote 2.3 System. Detailed descriptions of the ClearVote 2.3 test campaign, including a listing of all configurations and components, are contained in Pro V&V Report No. TR-01-01-CBG-006-01.03, available for viewing on the EAC's website at [www.eac.gov](http://www.eac.gov).

The following sections contain a product description and an overview of the design methodology of the applicable components of the ClearVote 2.3 Voting System, as taken from the Clear Ballot Group technical documentation.

#### **ClearDesign**

ClearDesign is an Election Management System consisting of an interactive set of applications which are responsible for all pre-voting activities necessary for defining and managing elections. This includes ballot design, ballot proofing, ballot layout, and ballot production. The ClearDesign system consists of the physical components listed below. All of the components and generation of voting machine election definition file packages are unmodified COTS that are connected via a wired, closed, and isolated network not connected to any other systems or the Internet.

- **DesignServer**: A laptop or desktop computer running Ubuntu with the ClearDesign software and hosting the election database.
- **DesignStation(s)**: One or more laptops or desktops running Windows used to connect to the DesignServer. A browser is used to perform the necessary tasks. A user with administrative rights is able to define users and manage the elections.
- **Network Switch**: Used to connect the DesignStations to the DesignServer using a wired, closed Ethernet-based network.

#### **ClearCount**

ClearCount is a central, high-speed, optical scan ballot tabulator coupled with ballot processing applications. The ClearCount software runs on unmodified COTS laptop or desktop computers running the Windows operating system and supports specific models of scanners. The ClearCount central-count system running on an Ubuntu Linux operating system, with Ethernet connections to workstations running the Windows operating system consists of the physical components listed below. All of the components are unmodified COTS that are connected via a wired, closed, and isolated network not connected to any other systems or the Internet.

- **CountServer**: An Ubuntu Linux laptop or desktop computer running the ClearCount software and hosting its election database and the web server that serves its election reports.
- **ScanStation(s)**: One or more Windows laptop or desktop/scanner pairs used to scan and tabulate ballots.
- **Network Switch**: Used to connect the ScanStations to the CountServer using a wired, closed Ethernet.
- **CountStation**: One or more Windows laptop or desktop computers installed with browser software, linked by a wired Ethernet connection to the CountServer using the network switch.

This station can serve multiple uses: user administration, election administration, adjudication, and reporting. This station is also used to consolidate the vote totals and ballot images from the ClearCast precinct tabulator. The vote totals and ballot images are consolidated by the ClearCount Software via the ClearCast USB drive.

All files that make up the ClearCount software reside on a single CountServer that is shared by all client ScanStations. The Tabulator software is executed by the ScanStations at run-time from files that reside on the CountServer. The only software programs that have to be installed on ScanStations, apart from the Windows operating system, are the Fujitsu PaperStream Capture software and drivers required by the scanner hardware. The ClearCount software consists of the following components:

- Tabulator: The Tabulator application handles ballot tabulation. The Tabulator software is stored on the CountServer and an instance of Tabulator runs on each ScanStation. The Tabulator counts the ballots and adjudicates the vote for the ballots scanned on that ScanStation. Upon completion of a batch of ballots, the Tabulator application sends its results and the associated card images to the central election database on the CountServer.
- Election Database: A centralized election database that resides on the CountServer and collects the output of each Tabulator.
- Election Reports: A suite of reports that provides election results and analysis and allows election officials to review individual ballot images.
- Card Resolutions tool: A web application that allows election officials to review and appropriately resolve unreadable voted ballots. It also allows manual adjudication of automatically adjudicated ballots where officials determine changes need to be made to reflect voter intent.
- User and Election Database Management through web applications: On the User Administration dashboard, the administrator can add, rename, or delete users, assign permissions, and change user passwords. On the Election Administration dashboard, the administrator can create or delete an election, set an election as active, merge ClearCast election results, and backup or restore an election.

### **ClearAccess**

ClearAccess is an accessible touchscreen ballot marking device (BMD) used for the creation of paper ballots that can be scanned and tabulated by ClearCast or ClearCount. The ClearAccess components of the ClearVote voting system consist of computers combined with personal assistive devices, printers, and uninterruptible power supplies to form a ballot-marking device.

#### **1.4.2 Description of Modification**

ClearVote 2.5-OR is a modified voting system configuration that includes upgrades to the ClearAccess, ClearCount, and ClearDesign components of the ClearVote 2.3 system. The submitted modifications include the following changes from ClearVote 2.3 to ClearVote 2.5-OR, as taken from the submitted technical documentation:



**Table 1-1 Submitted Modifications**

<b>Unique ID</b>	<b>Component(s)</b>	<b>Type of Change</b>	<b>Description</b>
SW-13263	ClearDesign	Bug	Resolves an issue that could cause HTML ballots to not layout properly due to the VoterGroupID to not being set properly.
SW-13211	ClearCount	Enhancement	The ClearCount operating system has been upgraded to Ubuntu 20.04.5.
SW-13210	ClearDesign	Enhancement	The ClearDesign operating system has been upgraded to Ubuntu 20.04.5.
SW-13204	ClearDesign	Bug	Fix issue with not displaying the party separator '.' between parties when multiple parties endorse a choice.
SW-12466	ClearCount	Enhancement	Added functionality to detect whether system logging is running and to display an error message if it has been disabled.
SW-12303	ClearCount	Bug	Previous versions incorrectly created summary counts for ballots where the card style could be determined but not the precinct. This version only creates counters when both the card style and precinct id are valid.
SW-12290	ClearCount	Enhancement	Users logged into the Ubuntu operating system on the CountServer are logged out automatically after 5 minutes of inactivity.
SW-12253	ClearCount	Bug	Data exported into CSV format (for example, cast vote records) now has double quotes around all strings to guard against SQL injection.
SW-12247	ClearCount	Bug	Previously, for performance reasons, the 'find' utility was used to find files, such as election backups, and ballot images. Now an equally efficient internal function has been created to 'find' the files.
SW-12244	ClearCount	Bug	Previously the OpenSSL command line utility was used to check the expiry date on the SSL certificate. Now the check is done using the OpenSSL shared library.

**Table 1-1 Submitted Modifications** *(continued)*

Unique ID	Component(s)	Type of Change	Description
SW-12214	ClearDesign	Enhancement	The username and password for the grub boot loader are now set during the installation of the system, when the install-setup script is run.
SW-12213	ClearCount	Enhancement	Installer now prompts for and sets the grub username and password
SW-11930	ClearVote	Enhancement	Upgraded to use Windows Enterprise IoT 21H2 release.
SW-11928	BallotTabulator	Bug	Enables ClearCount to properly tabulate a card that only has contests on the back side.
SW-11927	ClearDesign	Bug	Updated OpenSSL1.0 version to 1.0.2n-1ubuntu5.9 and OpenSSL1.1 version to 1.1.1f-1ubuntu2.13 to address <a href="https://ubuntu.com/security/notices/USN-5402-1">https://ubuntu.com/security/notices/USN-5402-1</a>
SW-11925	ClearCount	Bug	Updated OpenSSL1.0 version to 1.0.2n-1ubuntu5.9 and OpenSSL1.1 version to 1.1.1f-1ubuntu2.13 to address <a href="https://ubuntu.com/security/notices/USN-5402-1">https://ubuntu.com/security/notices/USN-5402-1</a> .
SW-11921	ClearCount	Bug	Previously, doing a "Safely merge updatable BDF content" operation would create an additional "Invalid" candidate name in the Write-in Assignments Tool for each contest that has write-in choices. There is now only one "Invalid" entry in the candidate names regardless of whether a safe merge has been performed.
SW-11911	ClearCount	Bug	Enables ClearCount to properly tabulate a card that only has contests on the back side.
SW-11820	ClearDesign	Enhancement	The smart card election key can be regenerated for the Accessible Marker device.
SW-11819	ClearDesign	Enhancement	The ADFx has been modified to contain the smart card customer and election keys.

**Table 1-1 Submitted Modifications** *(continued)*

Unique ID	Component(s)	Type of Change	Description
SW-11817	ClearDesign	Enhancement	A unique smart card election key is now generated when an election is created in ClearDesign, or when an election that did not previously have a smart card key is upgraded from a previous version.
SW-11816	ClearDesign	Enhancement	A unique smart card customer key is now generated when a customer is created in ClearDesign, or when a customer that did not previously have a smart card key is upgraded from a previous version.
SW-11661	ClearDesign	Enhancement	Updated system configuration for the CIS SCAP Ubuntu 20.04 revision 1.1.0 profile.
SW-11641	ClearCount	Bug	Removed dead code related to encrypted backups.
SW-11640	ClearCount	Bug	Changed the ClearCount API to require authentication before uploading files (such as ballot images and tabulation results) to the server.
SW-11606	ClearDesign	Bug	Updated OpenSSL1.0 version to 1.0.2n-1ubuntu5.8 and OpenSSL1.1 version to 1.1.1f-1ubuntu2.12 to address CVE-2022-0778.
SW-11605	ClearCount	Bug	Updated OpenSSL1.0 version to 1.0.2n-1ubuntu5.8 and OpenSSL1.1 version to 1.1.1f-1ubuntu2.12 to address CVE-2022-0778.
SW-11391	ClearCount	Enhancement	Add support for displaying ClearDesign landscape ballots in the proper orientation.
SW-11342	ClearDesign	Bug	Changed the behavior for the 'float' language option so that each language only uses the space required rather than each language being allocated the same width.
SW-11261	ClearCount	Bug	Added "Precinct" Localization to BDFExport metadata. Allows Localization to be uploaded to ClearCount when creating an Election under Election Administration.

**Table 1-1 Submitted Modifications** *(continued)*

Unique ID	Component(s)	Type of Change	Description
SW-11184	ClearDesign	Bug	During a ClearAccess voting session, if a voter votes for a cross-endorsed candidate more than once, they will be notified that only the first instance will count. This warning is always enabled for ClearMark.
SW-11108	ClearDesign, ClearAccess	Bug	Fixed issue with not displaying contests if there were contests for only one partisan party and no nonpartisan contests on the ballot in an open primary election.
SW-10733	ClearCount	Bug	Previously the 'whole' precinct record was record with the minimum BallotStyleID and now it is the precinct with BallotStyleID equal to 0.
SW-10700	ClearDesign	Enhancement	This release implements the New York Grid Style Ballot layout.
SW-10691	ClearAccess	Bug	minor version update to the libssl and openssl libraries
SW-10690	ClearAccess, ClearDesign	Bug	Updated the ADF to account for the new page number macros introduced in this release.
SW-10663	ClearCount	Enhancement	Added the Statement of Votes Cast with Parties to the reports menu.
SW-10639	ClearDesign	Enhancement	Added "Precinct" Localization to BDFExport metadata. Allows Localization to be uploaded to ClearCount when creating an Election under Election Administration.
SW-10432	ClearCount	Enhancement	Improve the positioning of the green line used to show what contest is being adjudicated in the Resolver.
SW-10336	ClearDesign	Bug	Fixed a bug preventing the accurate display of non-Latin characters on the digital ballot.
SW-10224	ClearCount	Bug	Creating an election with no parser row in the metadata.csv no longer defaults to "Premier". Instead an error is thrown stating the field is missing and required.
SW-10222	ClearCount	Enhancement	On the Election Administration page, the Redact Small Vote Subtotals column will no longer default to hidden.

**Table 1-1 Submitted Modifications** *(continued)*

Unique ID	Component(s)	Type of Change	Description
SW-10118	ClearCount	Enhancement	Add support to export card images filtered by contests, precinct, counter groups, boxes, and voting conditions (overvoted, undervote, write-ins).
SW-9194	ClearCount	Enhancement	"Show Party Subtotals" option should only show for a closed primary/semi-closed. These are elections with more than one party associated with it.
SW-8168	ClearDesign	Enhancement	The ClearDesign code has been updated to Python 3.
SW-8166	ClearCount	Enhancement	The ClearCount code has been updated to Python 3.
SW-8071	ClearCount	Enhancement	The ScanStation operating system has been upgraded to Windows 10 IoT Enterprise LTSC 2021.
SW-8070	ClearCount	Enhancement	The CountStation operating system has been upgraded to Windows 10 IoT Enterprise LTSC 2021.
SW-8069	ClearDesign	Enhancement	The DesignStation operating system has been upgraded to Windows 10 IoT Enterprise LTSC 2021.
SW-7916	ClearCount	Bug	The SOVC by Choice report no longer includes withdrawn candidates.
SW-14822	ClearCount	Enhancement	Updates user creation to validate user names in order to prevent errors with logging.
SW-14817	ClearCount	Enhancement	Updates requirements in order to reach MySQL database to prevent any unintentional access.
SW-14754	ClearDesign	Enhancement	This allows for the RCV Ruleset functionality to be disabled or enabled for a given user.
SW-14710	ClearCount	Bug	Resolves an issue that caused Ballot Tabulator to fail to start properly.
SW-14573	ClearAccess	Bug	Exported csv files now have double quotes around all strings
SW-14572	ClearAccess	Bug	Resolves an issue that caused an extra column in the CSV when exporting logs.

**Table 1-1 Submitted Modifications** *(continued)*

Unique ID	Component(s)	Type of Change	Description
SW-14549	ClearCount	Enhancement	Upgrades the ClearCount database to MySQL 8 and InnoDB
SW-14012	ClearDesign	Enhancement	SW-14012. Added support for ranked-choice voting tabulation rulesets and ranked-choice voting contest type.
SW-13760	ClearDesign	Enhancement	Allows a user to save name and sort seq changes to an image without requiring a change of the image itself.
SW-13555	ClearDesign	Bug	Enhance the message displayed when ovals overlap front to back (coincide) to include the candidate and contest names cause the issue.
SW-13545	ClearCount, ClearDesign	Bug	Previous versions of ClearDesign did not reserve space for the Judges Initial's box and so could end up with a box of zero height. The new release ensures the box is at least 2/3 of a timing mark high.
SW-10792	ClearCount	Enhancement	Reduces ClearCount security vulnerabilities regarding SQL injection.
SW-10508	ClearCount	Enhancement	Database and threading updates to make ClearCount more performant, especially with many concurrent tasks and larger elections.
COTS-144	ClearVote	COTS device mgm't	Add Dell Latitude 5540 as admin station for ClearDesign and ClearCount, and as a ClearCount ScanStation.
COTS-11	ClearVote	COTS device mgm't	Add Dell OptiPlex XE4 as an admin station for ClearDesign and ClearCount.
COTS-40	ClearVote	COTS device mgm't	Add Dell PowerEdge T150 as a DesignServer and a CountServer
COTS-41	ClearVote	COTS device mgm't	Add Dell PowerEdge R450 as a DesignServer and a CountServer
SW-10275	ClearAccess	Enhancement	When the user opens an election, if there are more than 1000 logs in the system log, the system log will now be automatically rolled to a new log to prevent performance issues.
SW-14806	ClearCount	Enhancement	Updates to ClearCount to ensure core functionality remains intact after the database upgrades.

**Table 1-1 Submitted Modifications** *(continued)*

Unique ID	Component(s)	Type of Change	Description
SW-14877	ClearCount	Enhancement	Updates the XML functionality to accommodate RCV contest data.
SW-13575	ClearAccess	Enhancement	Updates the ClearAccess software to allow it to run on all needed hardware configurations and associated operating systems.
SW-14818	ClearDesign	Enhancement	Updates the BDF/ADF to allow for contests with no candidates, or with Label Only candidates, to be used throughout ClearVote
SW-14825	ClearAccess	Enhancement	Updates hardening scripts to more thoroughly protect software and OS.
SW-14830	ClearAccess	Enhancement	Updates battery status indicators/messaging to remove confusion that could result from some hardware configurations.
SW-14471	ClearCount	Enhancement	Updated ballot tabulation functionality in ClearCount to be able to adjudicate ranked-choice contests.
SW-14063	ClearDesign	Enhancement	This updates the voter experience on the HTML ballot to allow for ranking and re-ranking of candidates in RCV contests on HTML ballots, provide appropriate on-screen and audio warnings for RCV contests, updates the Review page to show candidates ranked and allows for printing of a ballot with RCV contests.
SW-14743	ClearCount	Enhancement	This updates manual adjudication for RCV contests to work through the contest one rank at a time and seamlessly integrates it with adjudication of non-RCV contests.
SW-14470	ClearCount	Enhancement	This creates a function in ClearCount to export a zip with the RCV CVRs and their associated configuration files that are needed to tabulate the contest in RCTab.
SW-14253	ClearDesign	Enhancement	This allows for the creation and editing of a RCV ruleset with specific tabulation and layout rules. The ruleset can then be associated to a RCV contest, where some of the rules can be overwritten.

**Table 1-1 Submitted Modifications** *(continued)*

Unique ID	Component(s)	Type of Change	Description
SW-14744	ClearCount	Enhancement	This allows Oval Visualization in ClearCount to display ovals for RCV contests, applies a Rank filter to the page so that a user can choose to see ovals for only a given rank or ranks, and updates the oval hover to show the RCV contests appropriately.
SW-14062	ClearDesign	Enhancement	This allows ClearDesign to layout a paper ballot that includes a RCV contest, with consideration of the RCV contest's layout configurations, number of ranks/candidates and the other contests and content on the ballot.
SW-14913	ClearCount	Enhancement	Provides more specificity of which ClearDesign build/version number is being used.
SW-14727	ClearCount	Enhancement	Provides more specificity of which ClearCount build/version number is being used.
SW-14993	ClearAccess	Enhancement	Provides more specificity of which ClearAccess build/version number is being used.
SW-14241	ClearCount, ClearDesign	Enhancement	ClearCount is now compatible with BDFs and ADFs that include RCV contest and ruleset data.
SW-14711	ClearAccess	Enhancement	Allows for Windows IoT OS to run on all required versions of ClearAccess hardware.
SW-14459	ClearCount	Enhancement	Allows for RCV contests to be included in ClearCount web and PDF reports with a Rank filter to determine which ranks should be included on those reports.
SW-14758	ClearCount	Enhancement	Added a new report 'Statement of Votes Cast by Rank' which is available in the report menu if the election contains RCV contests. This report displays the votes grouped by Contest and Rank.
SW-15242	ClearDesign	Enhancement	Updates the way that ballot PDFs are named by ClearDesign to they can be more easily identified and organized.



**Table 1-1 Submitted Modifications** *(continued)*

Unique ID	Component(s)	Type of Change	Description
SW-15280	ClearDesign	Enhancement	Updates the BlankBallotFileName value in the BDF to match the updates made to ballot PDF naming in SW-15242
SW-14864	ClearDesign	Enhancement	Updates the Text Editor translation tool to hide a Google Translator overlay which made it difficult to click the Save button
SW-14888	ClearAccess	Bug	Resolves an issue that caused a timeout when using the "Save System Info" feature as a maintenance user
SW-15587	ClearDesign	Bug	Resolves an issue on very large elections/ballot sets that could cause Printing of ballots to result in an internal server error.
SW-15583	ClearDesign	Bug	Previous versions did not include the audio that was recorded in ClearDesign in the file created using the Export Audio function. This version now includes them.
SW-15395	ClearCount	Bug	Resolves an issue that could cause XML exports to have inconsistent count of Ballots Cast when using multi-card ballots.
SW-15634	ClearCount	Enhancement	RCV contest exports are created more efficiently, so that files can be ready for download more quickly
SW-15917	ClearDesign	Bug	Ensure functionality conforms with VVSG 1.0 Volume 1 Sec 3.1.6 d. ii. "No key or control on a voting machine shall have a repetitive effect as a result of being held in its active position."
COTS-195	ClearDesign, Clear Count	Successor device	Brother HL-L2350DW printer
COTS-195	ClearDesign, ClearCount	Successor device	Brother HL-L2460DW printer
DEV-1289	ClearCount	Enhancement	Added two ballot saving queue views to the Election Dashboard that provide information about scanned ballots and whether or not they have been successfully saved to the Count database. Also updated MySQL configurations to optimize database performance and minimize potential error messages on Scan Stations.

**Table 1-1 Submitted Modifications** *(continued)*

Unique ID	Component(s)	Type of Change	Description
DEV-668	ClearCount	Bug	Previous versions of ScanStation UI would close when the PaperStream dialog was displayed and the ScanStation UI was either moved or scrolled. This fixes that issue.

## 2.0 CERTIFICATION TEST BACKGROUND

The ClearVote 2.5-OR is a modification of a previously EAC-certified system (ClearVote 2.3). Pro V&V performed an evaluation of results from the previous test campaign to determine the scope of testing required for certification of the ClearVote 2.5-OR. 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 Scope of Testing

The scope of testing focused on evaluating the modifications detailed in Section 1.4.2 of this Test Report. To determine the ClearVote 2.5-OR 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. Additionally, it was determined that Regression Testing would consist of executing the System Integration Test and the Accuracy Test.

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

- EAC VVSG 1.0 Volume I, 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
  - Volume and Stress
- EAC VVSG 1.0 Volume I, 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

*Note: Section 6 (Telecommunications Requirements) of the VVSG 1.0 is not applicable to ClearVote 2.5-OR, therefore, it was not included in testing. Additionally, Section 3 (Usability & Accessibility), Section 5 (Hardware Requirements), Section 8 (Quality Assurance Requirements), and Section 9 (Configuration Management Requirements) were reviewed in previous test campaigns and were not impacted by the submitted modifications.*

**2.2 System Overview**

The ClearVote 2.5-OR Voting System is a paper-based optical scan voting system consisting of the following major components: ClearDesign (ballot design and EMS), ClearCount (central count, tabulation, and election reporting), and ClearAccess (accessible voting and ballot marking device).

The tables below detail the submitted ClearVote 2.5-OR equipment.

**Table 2-1. ClearVote 2.5-OR Voting System Equipment**

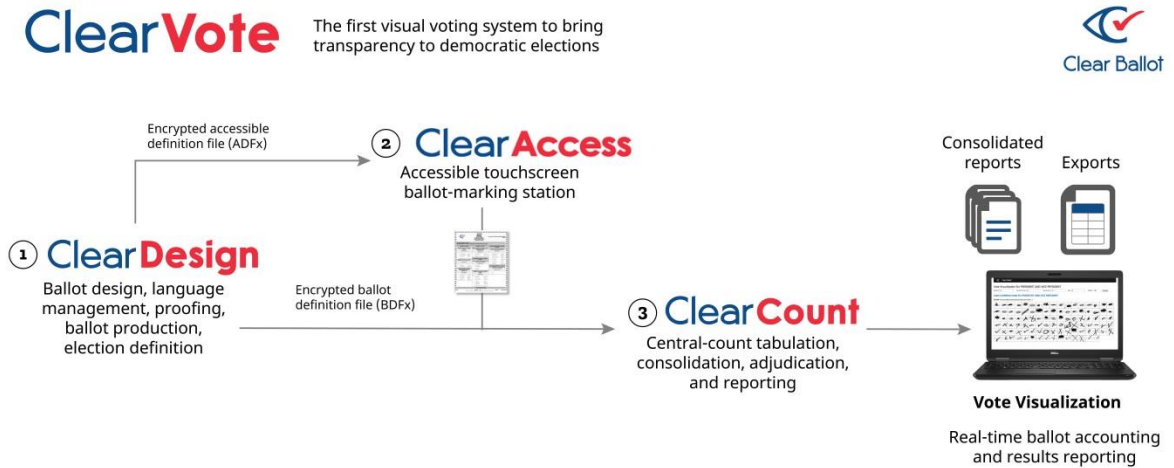
<b>Component</b>	<b>Model</b>	<b>Description</b>
<i><b>ClearDesign Components</b></i>		
Dell Latitude Laptop	5580, 5590, 5500, 5511, 5521, 5540, 5550	ClearDesign DesignStation.
Lenovo ThinkPad	E14 G4	ClearDesign DesignStation.
Dell OptiPlex (client)	XE3 SFF, XE4 SFF	ClearDesign DesignStation.
Dell PowerEdge Server	T130, T140, T150, R440, R450, T440, T630	ClearDesign DesignServer.
Brother Laser Printer	HL-L2350DW, HL-L2460DW	Duplex laser report printer.
<i><b>ClearAccess Components</b></i>		
ELO 15 inch EloPOS	EPS15E2	All-in-One touchscreen.
ELO 15 inch AIO	E-Series (ESY15E2)	All-in-One touchscreen.
ELO 15 inch AIO	X-Series (ESY20X2)	All-in-One touchscreen.
Dell OptiPlex	5250	All-in-One touchscreen.
Oki Data Laser Printer	B432dn	Duplex laser ballot printer.
Lexmark Laser Printer	MS521dn	Duplex laser ballot printer.
CyberPower Smart App UPS	PR1500RT2U	External uninterruptible power supply.
APC Smart UPS	SRT1500RMXLA	External uninterruptible power supply.
Storm EZ Access Keypad	EZ08-22201	Accessible keypad input device.

**Table 2-1. ClearVote 2.5-OR Voting System Equipment (continued)**

<b>Component</b>	<b>Model</b>	<b>Description</b>
Storm EZ Access Keypad	EZ08-22200	Accessible keypad input device.
Zebra Technologies Barcode Scanner	DS457-SR	Barcode Scanner
ELO Barcode Scanner	UM600149	Barcode Scanner
ClearAccess Transportation and Setup Case	62311-1-1, 62312-1-1	Case for ClearAccess ELO touchscreen computer, Lexmark printer, headphones, keypad, and associated cables.
<b><i>ClearCount Components</i></b>		
Dell PowerEdge Server	T130, T140, T150, T330, T440, R440, R450	ClearCount CountServer.
Lenovo ThinkServer	TS140	ClearCount CountServer.
Dell OptiPlex	XE3 SFF, XE4 SFF	ClearCount CountStation.
Dell Latitude Laptop	5580, 5590, 5500, 5511, 5520, 5540, 5550	ClearCount CountStation.
Lenovo ThinkPad	E14 G4	ClearCount CountStation.
Dell Latitude Laptop	5580, 5590, 5500, 5511, 5520, 5540, 5550	ClearCount ScanStation.
Lenovo ThinkPad	E14 G4	ClearCount ScanStation.
Fujitsu/Ricoh Scanner	fi-7180	Central-count scanner.
Fujitsu/Ricoh Scanner	fi-6800	Central-count scanner.
Fujitsu/Ricoh Scanner	fi-6400	Central-count scanner.
Fujitsu/Ricoh Scanner	fi-7800	Central-count scanner.
Fujitsu/Ricoh Scanner	fi-7900	Central-count scanner.
Brother Laser Printer	HL-L2350DW, HL- L2460DW	Duplex laser report printer.
APC Smart-UPS	SMT-1500C	External uninterruptible power supply.

## 2.2.1 Block Diagram

The system overview of the submitted voting system is depicted in Figure 2-1.



**Figure 2-1. ClearVote 2.5-OR Product Relationship**

## 2.2.2 System Limits

The system limits that CBG has stated to be supported by the ClearVote 2.5-OR Voting System are listed in the Table 2-2.

**Table 2-2. ClearVote System Limits**

<b>Characteristic</b>	<b>Limit</b>
<i>Election Parameters</i>	
Precincts per election	3200
Splits per election	3200
District categories per election	100
Districts per single category	3200
Districts per election	3200
Contests per election	3200
Choices per election	3200
Choices per contest	300
Vote positions per side	420
Card styles per election	3200
Contests per ballot style	60
Card styles per precinct	50
Parties per election	50
Counter groups per election	7
"Vote for" per contest	50
Languages per election	15
Cards per ballot (per language)	5
Write-ins per contest	50
<i>Reporting Name Parameters (Reports Only)</i>	
Election name (characters)	60
Jurisdiction name (characters)	60
Precinct name (characters)	60
Vote center name (characters)	60
Contest name (characters)	60
Candidate name (characters)	60
Party name (characters)	60
Write-in length (characters)	60
<i>System Parameters</i>	
Central-count scanners per network	10
Cards per precinct-voting device	10,000
Cards per central-count device	4,000,000

**2.2.3 Supported Languages**

The submitted voting system supports:

- English
- Spanish
- Chinese
- Korean
- Vietnamese
- Danish
- Dutch

- Flemish
- French
- German
- Italian
- Japanese
- Norwegian
- Portuguese
- Swedish

Due to the limited scope of testing, only English and Spanish language ballots were cast during the performance of functional testing.

#### **2.2.4 Supported Functionality**

The ClearVote 2.5-OR was verified to support the following voting variations:

- General Election
- Primary Election (Open and Closed)
- Early Voting
- Partisan/Non-Partisan Offices
- Write-In Voting
- Primary Presidential Delegation Nominations
- Straight Party Voting
- Split Precincts
- Vote for N of M
- Ballot Rotation
- Provisional or Challenged Ballots
- Ranked Choice Voting

*Note: Ranked Choice Voting (RCV) was tested using the City of Portland Ranked Choice Voting Rulesets. The system was evaluated against the requirements that the RCV functionality allows the voter to rank their selections in order of preference, and record those selections as a first choice, second choice, and so on. When tabulating, the voting system must capture how the voter ranked each selection in the contest, and store that selection in the Cast Vote Record associated with that ballot style. The ClearVote 2.5-OR Voting System uses a third-party software application, RCTab, to determine the winner (or winners) of an RCV contest.*

### 3.0 TEST FINDINGS AND RECOMMENDATION

The ClearVote 2.5-OR Voting System 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 made to the baseline certified 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, Accuracy, Volume and Stress, and FCA), Hardware Testing, and Source Code Review are detailed in the relevant sections of this report. In addition to these areas of testing, a PCA and a limited TDP Review were performed, as described below.

##### 3.1.1 TDP Review

In order to determine compliance of the modified TDP documents with the EAC 2005 VVSG, 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 determine if 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 into the TDP Review Checklist and reported to the manufacturer for resolution of any anomalies. This process continued until all anomalies were addressed. 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.

##### Summary Findings

The submitted TDP was determined to be in compliance with the requirements set forth in the EAC 2005 VVSG. A listing of all documents contained in the ClearVote 2.5-OR TDP is provided in Table 3-1.

**Table 3-1. ClearVote 2.5-OR TDP Documents**

Description	Version	Document Number
<i>ClearVote Documents</i>		
ClearVote 2.5-OR Change Notes	---	100132
ClearVote 2.5-OR ClearVote Approved Parts List	2.5.1	100101
ClearVote 2.5-OR ClearVote Ballot Stock and Printing Specification	2.5.1	100067
ClearVote 2.5-OR ClearVote Configuration Management Plan	2.5.0	100057
ClearVote 2.5-OR ClearVote Disc Content and Compilation Procedures	2.5.3	100151
ClearVote 2.5-OR ClearVote Glossary	2.5.0	100069



**Table 3-1. ClearVote 2.5-OR TDP Documents (continued)**

Description	Version	Document Number
ClearVote 2.5-OR ClearVote Personnel Deployment and Training Plan	2.5.0	100058
ClearVote 2.5-OR ClearVote Quality Assurance Program	2.5.1	100059
ClearVote 2.5-OR ClearVote Security Policy	2.5.0	100068
ClearVote 2.5-OR ClearVote System Overview	2.5.2	100071
ClearVote 2.5-OR ClearVote Test and Verification Specification	2.5.0	100073
<b><i>ClearDesign Documents</i></b>		
CBG Web Model	---	---
ClearVote 2.5-OR ClearDesign Acceptance Test Checklist	2.5.0	100011
ClearVote 2.5-OR ClearDesign Accessible Definition File Guide	2.5.0	100133
ClearVote 2.5-OR ClearDesign Administration Guide	2.5.0	100062
ClearVote 2.5-OR ClearDesign Ballot Definition File Guide	2.5.0	100131
ClearVote 2.5-OR ClearDesign Build Procedures	2.5.0	100083
ClearVote 2.5-OR ClearDesign Database Specification	2.5.0	100103
ClearVote 2.5-OR ClearDesign DesignServer SCAP Checklist Ubuntu 20.04	2.5.2	100121
ClearVote 2.5-OR ClearDesign DesignStation SCAP Checklist	2.5.2	100122
ClearDesign 2.5-OR Election Model	---	---
ClearVote 2.5-OR ClearDesign Functionality Description	2.5.0	100046
ClearVote 2.5-OR ClearDesign Hardware Specification	2.5.0	100098
ClearDesign 2.5-OR ClearDesign Installation Guide	2.5.1	100063
ClearVote 2.5-OR ClearDesign Maintenance Guide	2.5.0	100082
ClearVote 2.5-OR ClearDesign Security Specification	2.5.0	100045
ClearVote 2.5-OR ClearDesign Software Design and Specification	2.5.1	100072
ClearVote 2.5-OR ClearDesign System Identification Guide	2.5.1	100074
ClearDesign 2.5-OR System Model	---	---
ClearVote 2.5-OR ClearDesign System Overview	2.5.0	100043
ClearVote 2.5-OR ClearDesign User Guide	2.5.1	100041
<b><i>ClearCount Documents</i></b>		
ClearVote 2.5-OR ClearCount Acceptance Test Checklist	2.5.1	100102
ClearVote 2.5-OR ClearCount Build Procedures	2.5.0	100009

**Table 3-1. ClearVote 2.5-OR TDP Documents** *(continued)*

Description	Version	Document Number
ClearVote 2.5-OR ClearCount ScanStation SCAP Checklist Window 10 IoT LTSC	2.5.5	100156
ClearVote 2.5-OR ClearCount Database Specification	2.5.1	100005
ClearVote 2.5-OR ClearCount Election Administration Guide	2.5.2	100004
ClearVote 2.5-OR ClearCount Functionality Description	2.5.1	100021
ClearVote 2.5-OR ClearCount Hardware Specification	2.5.0	100022
ClearVote 2.5-OR ClearCount Installation Guide	2.5.0	100006
ClearVote 2.5-OR ClearCount Maintenance Guide	2.5.0	100023
ClearCount 2.5-OR Quick Guide XML Report Conversion Tool	---	---
ClearVote 2.5-OR ClearCount Reporting Guide	2.5.1	100070
ClearVote 2.5-OR ClearCount Scanner Operator Guide	2.5.1	100013
ClearVote 2.5-OR ClearCount CountStation SCAP Checklist Windows 10 IoT LTSC	2.5.5	100120
ClearVote 2.5-OR ClearCount Security Specification	2.5.0	100026
ClearVote 2.5-OR ClearCount Software Design and Specification	2.5.2	100019
ClearVote 2.5-OR ClearCount System Identification Guide	2.5.1	100047
ClearVote 2.5-OR ClearCount System Operations Procedures	2.5.0	100024
ClearVote 2.5-OR ClearCount System Overview	2.5.0	100025
ClearVote 2.5-OR ClearCount CountServer SCAP Checklist Ubuntu 20.04	2.5.2	100119
<b><i>ClearAccess Documents</i></b>		
ClearVote 2.5-OR ClearAccess Build Procedures	2.5.1	100051
ClearVote 2.5-OR ClearAccess Functionality Description	2.5.0	100049
ClearVote 2.5-OR ClearAccess Hardware Specification	2.5.0	100085
ClearVote 2.5-OR ClearAccess Installation Guide	2.5.1	100053
ClearVote 2.5-OR ClearAccess Maintenance Guide	2.5.0	100052
ClearVote 2.5-OR ClearAccess Poll Worker Guide	2.5.0	100054
ClearVote 2.5-OR ClearAccess Security Specification	2.5.0	100050
ClearVote 2.5-OR ClearAccess Software Design and Specification	2.5.0	100099
ClearVote 2.5-OR ClearAccess Supervisor Guide	2.5.0	100055
ClearVote 2.5-OR ClearAccess System Identification Guide	2.5.1	100038

**Table 3-1. ClearVote 2.5-OR TDP Documents** *(continued)*

Description	Version	Document Number
ClearVote 2.5-OR ClearAccess System Overview	2.5.0	100044
ClearVote 2.5-OR ClearAccess SCAP Checklist Window 10 IoT LTSC	2.5.3	100118
ClearVote 2.5-OR ClearAccess Acceptance Test Checklist	2.5.1	100109
ClearVote 2.5-OR ClearAccess Voter Guide	2.5.0	100056

### 3.1.2 Physical Configuration Audit (PCA)

The physical configuration audit 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, 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

#### Summary Findings

During execution of the PCA, the components of the ClearVote 2.-OR 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 Source Code Review, Compliance Build, Trusted build, and Build Documentation Review

Pro V&V evaluated the submitted source code against the EAC 2005 VVSG and the manufacturer-submitted coding standards using both Automated Source Code Review and Manual Review methods. Prior to initiating the software review, Pro V&V verified that the submitted documentation was sufficient to enable Pro V&V to: (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.

#### Summary Findings

- Automated Source Code Review: The Automated Source Code Review was performed to review the changes in the source code from the previously certified ClearVote 2.3 voting system. 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 I, 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 proprietary source code, COTS software, 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. Completion of the trusted build included the build documentation review. The Trusted Build was performed following the completion of the Functional Configuration Audit.

### 3.1.4 System Level Testing

System Level testing was implemented to evaluate the complete system. This testing included 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 were designed according to the stated design objective without consideration of its functional specification. The system level hardware and software test cases were prepared independently to assess the response of the hardware and software to a range of conditions. Pro V&V reviewed the manufacturer’s program analysis, documentation, and module test case design and evaluated the test cases for each module with respect to flow control parameters and entry/exit data.

The software system functions for the previously certified voting system (ClearVote 2.3) remained unchanged for the submitted modifications. The ClearVote 2.5-OR Election Management System (EMS) consists of a set of applications responsible for all pre-voting and post-voting activities used in election definition and management process. The ClearVote 2.5-OR EMS applications are as follows:

- ClearDesign

- ClearCount

System Level Testing included the evaluations of the following test areas: FCA, Accuracy Testing, Volume and Stress, and System Integration Testing. Each of these areas is reported in detail in the subsections that follow.

#### Summary Findings

Component Level Testing was implemented during the FCA for each component and subcomponent. During the source code review, compliance builds, and security testing, Pro V&V utilized limited structural-based techniques (white-box testing). Additionally, specification-based techniques (black-box testing) were utilized for the individual software components.

Pro V&V defined the expected result for each test and the ACCEPT/REJECT criteria for certification. If the system performed as expected, the results were accepted. If the system did not perform as expected, an analysis was performed to determine the cause. If needed, the test was repeated in an attempt to reproduce the results. If the failure could be reproduced and the expected results were not met, the system was determined to have failed the test. If the results could not be reproduced, the test continued. Any errors encountered were documented and tracked through resolution. To verify the modifications were successfully addressed throughout the test campaign, each modification was tracked and verified to be addressed during the execution of the relevant test area. For example, source code changes were verified during the source code review. Modifications requiring functional test verification were evaluated by executing the standard Accuracy Test, the System Integration Test, or during performance of the FCA. Modifications that were not adequately evaluated during the performance of these tests were subjected to specifically designed test cases.

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

The functional configuration audit 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 are conducted to ensure all applicable EAC 2005 VVSG requirements are met.

For this campaign FCA testing included several exhaustive paths applied in concert:

- FCA-VVSG Testing: Each component of the system was evaluated against a standardized test-case suite centered upon requirements stated in the VVSG and administered through a test-management software tool. All applicable test-cases were performed while any non-applicable test-cases were logged as "n/a" for substantiation. The system operations and functional capabilities were categorized in the tool as follows by the phase of election activity in which they are required:
  - o 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.

All issues (if any) found during these efforts are detailed in Section 3.3. Any issues noted were tracked using an issue tracking software program and issue tracking spreadsheets.

### Summary Findings

All functional tests were successfully executed. During execution of the test procedure, it was verified that the ClearVote 2.5-OR System successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results. At the conclusion of the test campaign, it was determined that all issues communicated to Clear Ballot Group had been successfully reconciled.

The functional configuration audit also included Regression Testing. ClearVote 2.5-OR is a modified voting system configuration that includes functional upgrades and modifications to the baseline system. Modified system testing is an abbreviated testing campaign built upon a regression review of the modifications against the baseline system and requirements. Modifications, alone and collectively, are reviewed (tested) to see if they fall under any requirement(s), or functionally impact the ability of the modified system to continue to meet requirements. Regression reviews consist of targeted investigations to determine if further testing is necessary based on the nature and scope of the communicated modifications (whether activated or deactivated), and any other submitted information. The objective of regression testing was to establish assurance that the modifications have no adverse impact on the compliance, integrity, or performance of the system. All functional regression tests were successfully completed.

#### **3.1.4.2 Accuracy**

The Accuracy Test ensures that each component of the voting system can each process at least 1,549,703 consecutive ballot positions correctly within the allowable target error rate. The Accuracy Test is designed to test the ability of the system to “capture, record, store, consolidate and report” specific selections and absences of a selection. The required accuracy is defined as an error rate. This rate is the maximum number of errors allowed while processing a specified volume of data. For paper-based voting systems the ballot positions on a paper ballot must be scanned to detect selections for individual candidates and contests, and those selections converted into digital data.

### Summary Findings

The accuracy requirements for ClearCount were met by the execution of the standard accuracy test utilizing pre-marked and hand-marked paper ballots of each ballot length supported by the system, and BMD ballots produced by the ClearAccess. ClearCount and ClearCast will be tested by utilizing a combination of hand marked (70%) and pre-marked (30%) ballots.

The ClearVote 2.5-OR System successfully passed the Accuracy Test. Any deficiencies encountered during the Accuracy Test are detailed in Section 3.3. Any issues noted were successfully resolved. During execution of the test procedure, it was verified that the ClearVote 2.5-OR System successfully completed the test with all actual results obtained during test execution matching the expected results.

#### **3.1.4.3 System Integration**

System Integration is a system level test for the integrated operation of both hardware and software. System Integration evaluates the compatibility of the voting system software components or subsystems with one another, and with other components of the voting system environment. This compatibility was determined through functional tests integrating the voting system software with the remainder of the system. During test performance, the system was configured exactly as it would be for normal field use. 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.

### Summary Findings

During System Integration testing, one General Election and one Primary Elections were exercised on the voting system, as described below:

- General Election GEN-02: A General Election held in three precincts. This election contains fifteen contests compiled into three ballot styles. Ten of the contests are in all three ballot styles with the other five contests split across the three precincts. This election was designed to functionally test the handling of multiple ballot styles, support for two languages, support for complex voting variations and ADA Audio capability for multiple languages.
- Primary Election PRIM-01: A Closed Primary Election held in two precincts. This election contains thirty contests and is compiled into five ballot styles. Each ballot style contains six contests. This election is designed to functionally test a closed primary with multiple ballot styles, support for common voting variations, audio support for at least two languages and an ADA binary input device.

The ClearVote 2.5-OR System successfully passed the System Integration Test. Any deficiencies encountered during the System Integration test are detailed in Section 3.3. All issues noted were successfully resolved. During execution of the test procedure, it was verified that the ClearVote 2.5-OR System successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results.

#### **3.1.4.4 Volume & Stress**

The Volume & Stress test investigates the system's response to conditions that tend to overload the system's capacity to process, store, and report data.

The test parameters will focus on the system's stated limits and the ballot logic for areas such as the maximum number of active voting positions, maximum number of ballot styles, maximum candidates, maximum contests, and stated limits within the EMS. This test was utilized to ensure the system can achieve the manufacturer's TDP claims of what the system can support. Testing was performed by exercising an election definition and test cases developed specifically to test for volume and stress conditions of the system being tested.

#### Summary Findings

Previous test results were utilized for all components with the exception of the ClearAccess which was subjected to focused testing. The ClearVote 2.5-OR System successfully passed Volume and Stress Testing. Any deficiencies encountered during the Volume and Stress testing are detailed in Section 3.3. Any issues noted were successfully resolved.

### **3.1.5 Security Testing**

The objective of the Security Testing was 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 developed specifically designed test cases in an attempt to defeat the access controls and security measures documented in the system TDP.

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

#### Summary Findings

Pro V&V determined there were no modifications made to the Physical and Administrative Security in the ClearVote 2.5-OR system. Pro V&V did not specifically test these areas, however Physical and Administrative Security testing was performed throughout the test campaign.

Logical Security was tested as part of FCA testing by a recognized security expert who not only reviewed the physical and administrative testing outcomes, but performed the following tests on system components: Vulnerability Scans, SCAP Scans, and Physical Bypass Attempts. Logical security testing assessed the effectiveness of the security hardening scripts applied during the system setup and install process. Based on the review results, the system was deemed secure.

### **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.

#### Summary Findings

There were no anomalies encountered during this test campaign.



### 3.3 Deficiencies and Resolutions

Any violation of the specified requirement or a result encountered during test performance that deviates from what is standard or expected in which a root cause is established was considered to be a deficiency. When a root cause can be determined, instances of nonstandard or unexpected results are considered deficiencies, rather than anomalies. Throughout the test campaign, any deficiencies encountered were logged in the Pro V&V tracking system (Mantis) for disposition and resolution. In each instance, if applicable, the resolution was verified to be resolved through all required means of testing (regression testing, source code review, and TDP update) as needed. The noted deficiencies are listed in Table 3-2.

**Table 3-2. Noted Deficiencies**

ID#	Test Category	Deficiency	Resolution
549	General	In ClearCount, if additional boxes (target card + ballots) are re-scanned on a second scan station without running deletebox, the counts in Statements of Votes Cast vote totals increment up every time the Tabulator is restarted.	Source Code change in which the ballots cast under the same target card do not increment the Votes Total count.
550	Accuracy	All the Fujitsu scanners would scan about 20 ballots at normal rate but would then slow down considerably to the images taking time to write to the C:\CBGBallotImages folder	Fixed by revising the Hardening Scripts to exclude the following executables from Microsoft Defender: PFU.PaperStream.Capture.exe PFU.PaperStream.Capture.Proc.exe ScandAllPDFProc.exe
551	FCA	Clicking on the Scroll Bar track when there is a duplicate Target card is scanned causes the Tabulator application to close.	Source Code change fixed the ScanStation Tabulator User Interface from crashing.

### 4.0 RECOMMENDATION FOR CERTIFICATION

The ClearVote 2.5-OR Voting System, 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 ClearVote 2.5-OR functioned as a complete system during System Integration Testing.

**Table 4-1. ClearVote 2.5-OR Voting System Equipment**

Component	Model	Serial Number
<i>ClearDesign Components</i>		
Dell Latitude Laptop	5580, 5590, 5500, 5511, 5521, 5540, 5550	2F3L3G2, 9W5DIN2, JV3WXY2, 13KWY33, JM3WSG3, 31XXYW3, 60RS824
Lenovo ThinkPad	E14 G4	PF-48B509

**Table 4-1. ClearVote 2.5-OR Voting System Equipment (continued)**

<b>Component</b>	<b>Model</b>	<b>Serial Number</b>
Dell OptiPlex (client)	XE3 SFF, XE4 SFF	93VDB03, D36DDZ3
Dell PowerEdge Server	T130, T140, T150, R440, R450	5G0YLN2, 8BFH3W2, 30318V3, 55BGB03, 9LHGDZ3
ELO 15 inch EloPOS	EPS15E2	J193011873, K193008678
ELO 15 inch AIO	E-Series (ESY15E2)	K17C012858
ELO 15 inch AIO	X-Series (ESY20X2)	B18Q001601
Oki Data Laser Printer	B432dn	BW0107753CD
<b><i>ClearAccess Components</i></b>		
Lexmark Laser Printer	MS521dn	4600952318T35
CyberPower Smart App UPS	PR1500RT2U	PY3JT2000004
APC Smart UPS	SRT1500RMXLA	AS2155292757
Storm EZ Access Keypad	EZ08-22200	20010073, 20010615, 20011230
Origin Instruments Sip/Puff Breeze with Headset	BZ2	0500
Origin Instruments Sip/Puff Breeze with Headset	BZ2U	0748
Samson Over-Ear Stereo Headphones	SASR350	SR350J8G390 & SR350J8G396
ClearAccess Transportation and Setup Case	62311-1-1, 62312-1-1	CBG-001, CBG-002
<b><i>ClearCount Components</i></b>		
Dell PowerEdge Server (CountServer)	T130, T140, T330, R440, R450	5G0ZLN2, 8BFJ3W2, FHV9RD2, 55FDB03, DZZY7V3
Lenovo ThinkServer (CountServer)	TS140	MJ0472UV
Dell OptiPlex (CountStation)	XE3 SFF, XE4 SFF	93XDB03, 6461SY3
Dell Latitude Laptop (CountStation, ScanStation)	5590, 5500, 5511, 5521, 5540, 5550	DP5D1N2, 76YL9Y2, 13KWY33, JM3WSG3, 31XXYW3, 70RS824
Lenovo ThinkPad Laptop (CountStation, ScanStation)	E14 G4	PF-48B509
Fujitsu/Ricoh Scanner	fi-7180	A20DC10301
Fujitsu/Ricoh Scanner	fi-6800	100295
Fujitsu/Ricoh Scanner	fi-6400	AKHCC00609
Fujitsu/Ricoh Scanner	fi-7800	C39C000034
Fujitsu/Ricoh Scanner	fi-7900	C30C000270
APC Smart-UPS	SMT-1500C	3S1831X12280