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Test Report for State of Colorado Certification Testing
Clear Ballot Group ClearVote 1.4.1 System

Version: Revision A

Date: 12/7/17

SIGNATURES

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FOR Michael Walker, VSTL Project Manager — Date

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REVISIONS

Revision	Description	Date
NR	Initial Release	11/22/2017
A	Corrected typo and reported information for Electromagnetic Susceptibility Test	12/7/2017

1.0 INTRODUCTION

The purpose of this Test Report is to document the procedures that Pro V&V, Inc. followed to perform certification testing of the Clear Ballot Group ClearVote 1.4.1 System to the requirements set forth for Systems by the State of Colorado.

1.1 Scope

The scope of this testing event incorporated a sufficient spectrum of physical and functional tests to verify that the ClearVote 1.4.1 System conformed to the State of Colorado Requirements. Specifically, the testing event had the following goals:

- Verify that the ClearVote 1.4.1 System meets the applicable Colorado-specific requirements for Systems

- Evaluate the ClearVote 1.4.1 System to the applicable requirements of the FEC 2002 VSS *(Note: Testing was performed per the EAC 2005 VVSG, which encompasses the requirements for the evaluation of Systems set forth in the FEC 2002 VSS; therefore, systems tested to the EAC 2005 VVSG will satisfy the requirements of the FEC 2002 VSS).*

- Ensure the ClearVote 1.4.1 System provides support for all Colorado election management requirements (i.e. ballot design, results reporting, recounts, etc.).

- Simulate pre-election, Election Day, absentee, recounts, and post-election activities on the ClearVote 1.4.1 System and corresponding components of the EMS.

The Colorado Requirements Matrix dated June 30, 2017, was reviewed to determine the scope of this testing. All required tests identified in the matrix were evaluated against the federal test campaign to determine which tests were met during state level testing and which tests were covered as part of the current federal campaign. When feasible, tests performed at the federal level were utilized to meet state requirements. For example, hardware testing was performed as part of the federal test campaign; however, this testing satisfied the state requirements as well. In cases where federal testing did not cover state requirements, specific gap testing was conducted.

To evaluate the test requirements, each section of the EAC 2005 VVSG was analyzed, along with the Colorado Requirements Matrix, to determine the applicable tests. The EAC 2005 VVSG Volume I Sections, along with the strategy of evaluation, are described below:

Section 2: Functional Requirements
The requirements in this section were tested during the FCA, Accuracy, and System Integration Tests. This evaluation utilized baseline test cases as well as specifically designed test cases and included predefined election definitions for the input data.

Section 3: Usability and Accessibility Requirements
The requirements in this section were tested during the Usability and Accessibility Testing. This evaluation utilized baseline test cases as well as specifically designed test cases and included predefined election definitions for the input data.

Section 4: Hardware Requirements
The requirements in this section were tested and/or evaluated by personnel verified by Pro V&V to be qualified to perform the testing.

Section 5: Software Requirements
The requirements in this section were tested utilizing a combination of review and functional testing during the Source Code Review, and FCA.

Section 6: Telecommunications Requirements
The requirements in this section were tested utilizing baseline test cases as well as specifically designed test cases.

Section 7: Security Requirements
The requirements in this section were tested during the Source Code Review, Security Tests, and FCA.

Section 8: Quality Assurance Requirements
The requirements in this section were tested throughout the test campaign. This testing utilized a Source Code Review and PCA to determine compliance to the EAC 2005 VVSG requirements and the requirements stated in the Clear Ballot Group technical documentation. The review of the Quality Assurance documentation focused on Clear Ballot Group's adherence to its stated QA processes.

Section 9: Configuration Management Requirements
The requirements in this section were tested throughout the test campaign. This testing utilized a Source Code Review and PCA to determine compliance to the EAC 2005 VVSG requirements and the requirements stated in the Clear Ballot Group technical documentation. The review of the Configuration Management documentation focused on Clear Ballot Group's adherence to its stated CM processes.

As testing was performed, the Colorado Requirements Matrix was updated to reflect that each requirements was being met and which campaign (Federal or State) the requirements were addressed in.

1.2 References

- Pro V&V, Inc. Document "Test Plan for State of Colorado Certification Testing Clear Ballot Group ClearVote 1.4.1 System", Initial Release, dated 09/29/17
- Colorado Secretary of State Election Rules [8 CCR 1505-1] Rule 21 dated August 11, 2017
- Clear Ballot ClearVote Colorado Requirements Matrix dated June 30, 2017.
- Federal Election Commission (FEC) 2002 Systems Standards (VSS)
- Election Assistance Commission 2005 Voluntary System Guidelines (VVSG) Version 1.0, Volume I, "System Performance Guidelines", and Volume II, "National Certification Testing Guidelines"
- Election Assistance Commission Testing and Certification Program Manual, Version 2.0
- Election Assistance Commission System Test Laboratory Program Manual, Version 2.0
- National Voluntary Laboratory Accreditation Program NIST Handbook 150, 2016 Edition, "NVLAP Procedures and General Requirements (NIST Handbook 150)", dated July 2016
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, "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
- Clear Ballot Group's Technical Data Package *(A listing of the ClearVote 1.4.1 documents submitted for this test campaign is listed in Section 2.4 of this Test Report.)*

1.2 Terms and Abbreviations

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

"ADA" – Americans with Disabilities Act 1990

"BMD" – Ballot Marking Device

"CBG" – Clear Ballot Group

"CM" – Configuration Management

"COTS" – Commercial Off-The-Shelf

"DRE" – Direct Record Electronic

"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

"TDP" – Technical Data Package

"UPS" – Uninterruptible Power Supply

"VSS" – Voting System Standards

"VSTL" – Voting System Test Laboratory

"VVSG" – Voluntary Voting System Guidelines

1.3 Background

The ClearVote 1.4.1 System is a new system that has not previously been evaluated for Colorado certification. It has been submitted for evaluation against the requirements set forth for Systems by the State of Colorado. To start the process, Clear Ballot submitted an Application for Certification to the Colorado Secretary of State Elections Division.

2.0 TESTING OVERVIEW

The evaluation of the ClearVote 1.4.1 System was designed to achieve the goals set forth in the *Test Plan*. These goals were constructed to verify that the ClearVote 1.4.1 System conforms to the State of Colorado Requirements. The evaluation successfully addressed each of the test goals in the following manner:

Table 2-1: Testing Overview

Test Goal	Testing Response
Verify that the ClearVote 1.4.1 System meets the applicable Colorado-specific requirements for Systems	This was tested by evaluating the ClearVote 1.4.1 System to specific election scenarios using a combination of different ballot programming approaches, ballot designs, ballot sizes, languages, and tabulators.
Verify that the ClearVote 1.4.1 System meets the applicable requirements of the FEC 2002 VSS	Testing was performed per the EAC 2005 VVSG, which encompasses the requirements for the evaluation of Systems set forth in the FEC 2002 VSS. To evaluate the test requirements, each section of the EAC 2005 VVSG was analyzed, along with the Colorado Requirements Matrix, to determine the applicable tests.

Table 2-1: Testing Overview *(continued)*

Test Goal	Testing Response
Verify that the ClearVote 1.4.1 System provides support for all Colorado election management requirements (i.e. ballot design, results reporting, recounts, etc.).	This was tested by evaluating the ClearVote 1.4.1 System against the applicable requirements of the Colorado Gap Analysis Matrix for Systems.
Simulate pre-election, Election Day, absentee, recounts, and post-election activities on the ClearVote 1.4.1 System and corresponding components of the EMS	The components of the ClearVote 1.4.1 System were tested in pre-election, Election Day, post-election and recount situations and evaluated against documented behavior and expected results for all scenarios.

2.1 Test Candidate

The ClearVote 1.4.1 System is a paper-based optical scan System consisting of the following major components: ClearDesign (ballot design and EMS), ClearCount (central count, tabulation, and reporting), and ClearAccess (accessible voting and ballot marking device).

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 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 the ClearDesign software and hosting its election database and the web server that serves its election reports.
- DesignStation(s): One or more laptop or desktop computers used to connect to the DesignServer. A browser is used to perform the necessary tasks. A user with administration privileges will be able to define users and manage the elections.
- Router: Used to connect the DesignStations to the DesignServer using a wired, closed Ethernet.

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 Fujitsu scanners. The ClearCount central-count 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.

- ScanServer: A 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 laptop or desktop/scanner pairs used to scan and tabulate ballots.
- Router: Used to connect the ScanStations to the ScanServer using a wired, closed Ethernet.
- Election Administration Station and/or Adjudication Station: One or more Windows laptop or desktop computers installed with browser software, linked by a wired Ethernet connection to the ScanServer using the router. This station can serve multiple uses: user administration, election administration, adjudication, and reporting.

All files that make up the ClearCount software reside on a single ScanServer that is shared by all client ScanStations. The Tabulator software is executed by the ScanStations at run-time from files that reside on the ScanServer. The only software programs that have to be installed on ScanStations, apart from the Windows operating system, are the Fujitsu ScandAll Pro 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 ScanServer and an instance of Tabulator runs on each ScanStation. The Tabulator program analyzes the incoming image and transfers them to the local output folder named CBGBallotImages. The ScanServer retrieves the images from the folder and uploads them into the Election database.
- Election Database: A centralized election database that resides on the ScanServer and collects the output of each Tabulator.
- Election Reports: A browser-based suite of reports that provides election results and analysis and allows election officials to review individual ballot images. A web server on the ScanServer serves the reports.
- Card Resolutions tool: A web application that allows election officials to review and appropriately resolve unreadable voted ballots.
- 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, 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 ClearCount. The ClearAccess software runs on unmodified COTS laptop computers / tablets running a Windows operating system and supports specific models of accessible input devices.

2.2 Block Diagrams

The system overviews of the submitted System components are depicted in Figures 1-1 through 1-4.

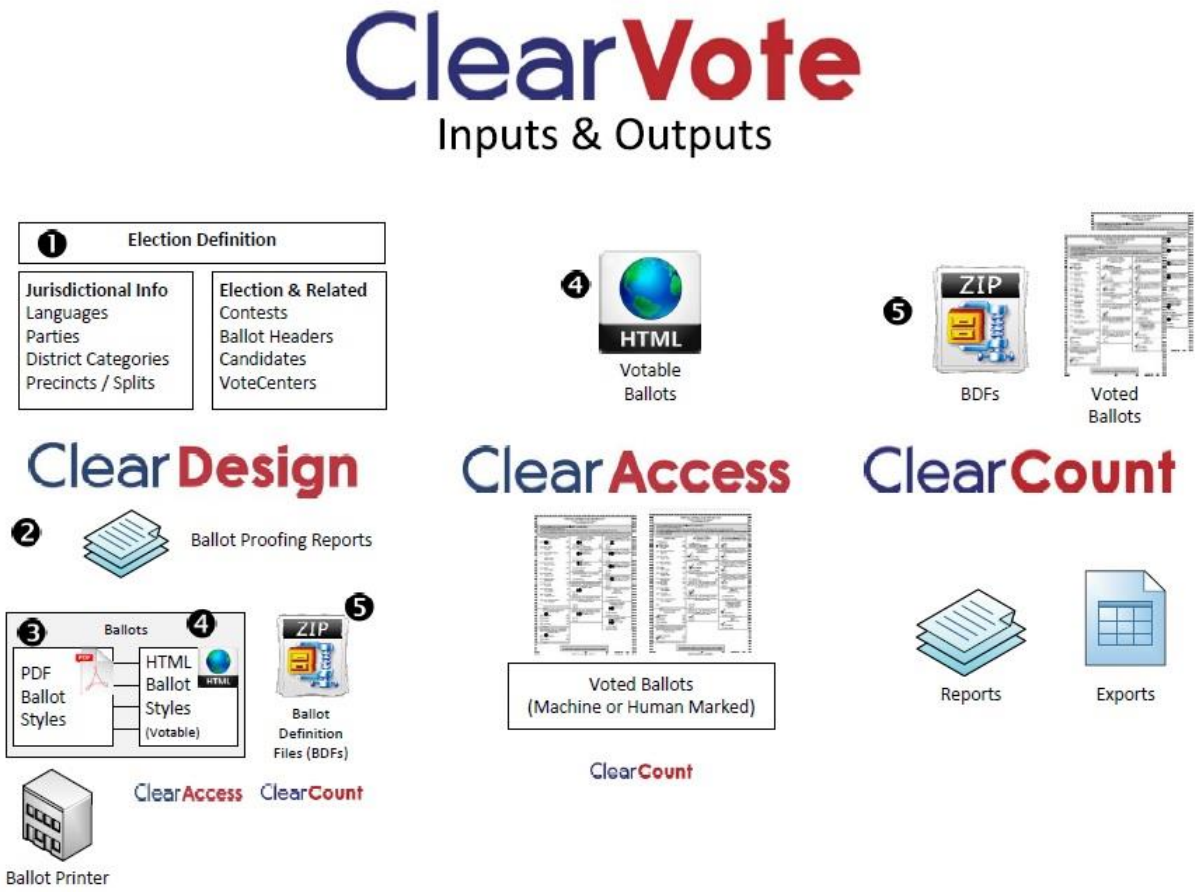

Figure 1-1. ClearVote 1.4.1 Inputs & Outputs

The inputs and outputs of the ClearVote System depicted in Figure 1-1 are listed below:

- Inputs: Election Definition

- Outputs: Ballot proofing reports, PDF ballot styles, HTML Anywhere ballot marking files, Ballot Definition files

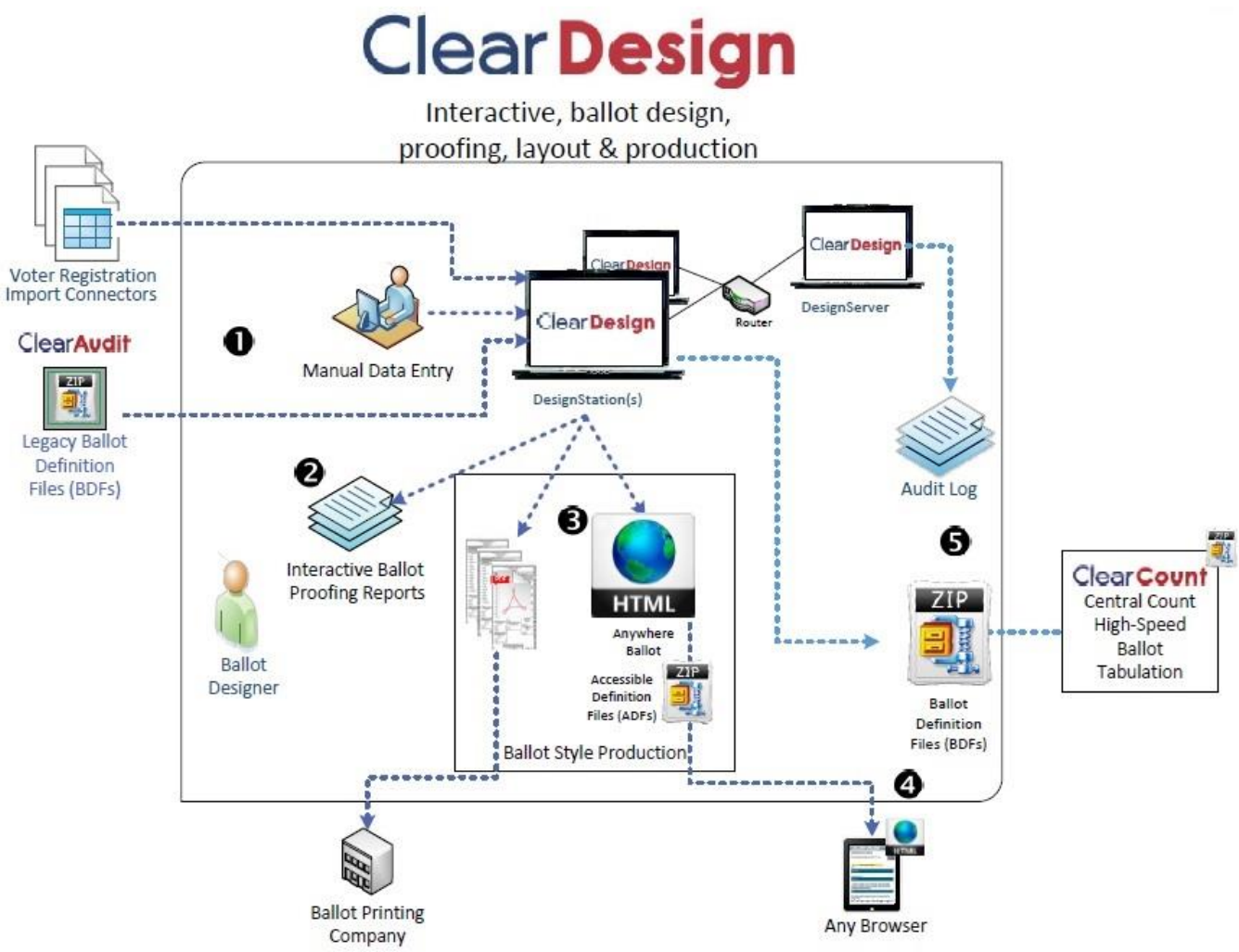

Figure 1-2: ClearDesign

As illustrated in Figure 1-2, ballot design, proofing, layout, and production are accomplished in ClearDesign, the ballot design component of the ClearVote product family. The ClearDesign system consists of the following physical components (all of which are unmodified COTS hardware and are connected via closed, wired Ethernet connections): DesignServer, DesignStation(s), and router.

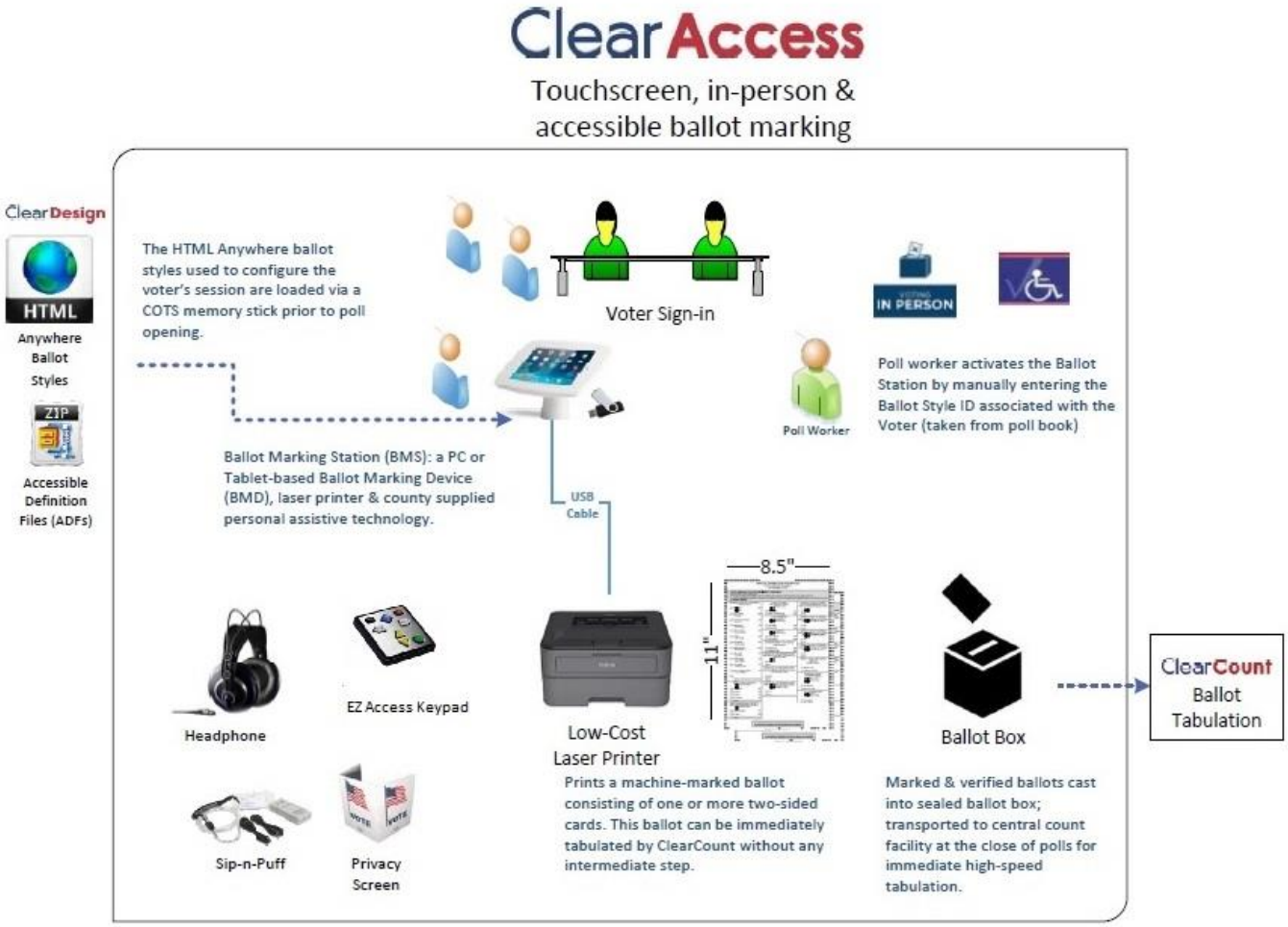

Figure 1-3: ClearAccess

ClearAccess, depicted in figure 1-3, is an accessible touchscreen ballot marking device (BMD) used for the creation of paper ballots that can be scanned and tabulated by ClearCount. The ClearAccess ballot marking system consists of one or more Ballot Marking Stations (BMS) having the following physical components (all of which consist of standalone, unconnected, unmodified COTS hardware): Ballot Marking Device (BMD), privacy screen, Personal Assistive Technology Devices (PATS), ballot style transfer stick, and laser printer.

Tabulation and reporting at the central location is accomplished by ClearCount, as depicted in Figure 1-4.

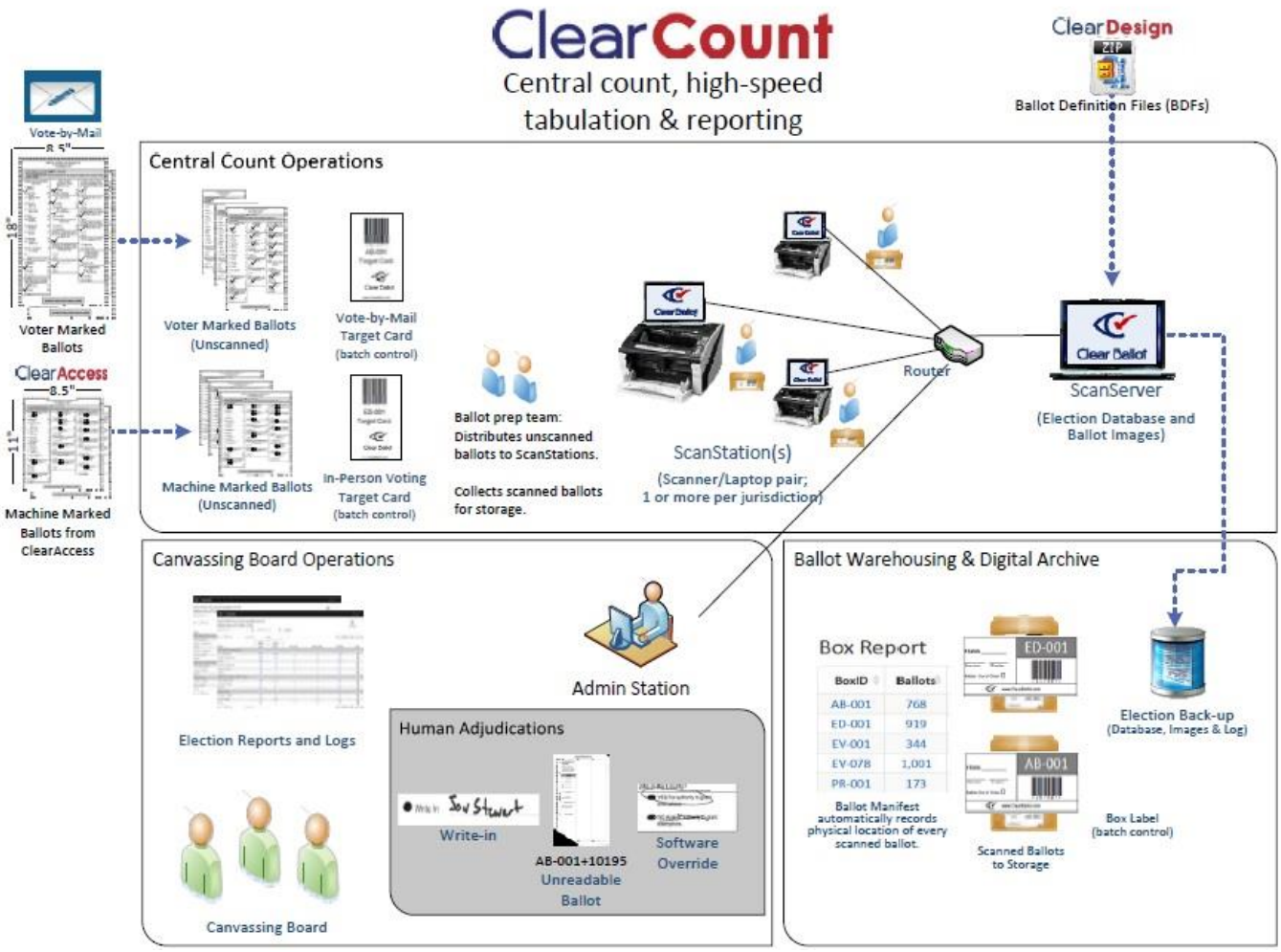

Figure 1-4: ClearCount

The follow tables provides the software and hardware components of the ClearVote 1.4.1 System that were evaluated during this test effort.

Table 2-2. System Software

Firmware/Software	Version
ClearDesign Components, Version 1.4.3	
Python webpy	0.38
Python MySQL DB	1.2.3
SQLAlchemy	1.0.15
Python Pillow	2.3.0
Python Flup	1.0.2
Python DBUtils	1.1
Python XLRD	0.9.4
Python FontTools library	3.0
Python RTF	0.2.1
OpenSSL (FIPS)	2.0.5
OpenSSL	1.0.1f
DataTable	1.10.5
DataTable-TableTools	2.2.3
DataTable-ColVis	1.1.1
DataTable-ColReorder	1.1.2
DataTablePlugins	1.10.10
bootstrap	3.0.0
jquery	1.10.2
jquery-impromptu	5.2.3
jquery-qrcode	1.0
jquery-splitter	0.14.0
jquery-ui	1.10.4
jscolor	1.4.2
tinymce	4.1.9
fastclick	1.0.4
libmp3lame	0.5.0
jszip	3.1.2
papaparse	4.1.2
jsmin	12/4/2003
ClearAccess Components, Version 1.4.1	
Windows	10 Pro 1607
Google Chrome	61.0.3163.100
nsis	3.01

Table 2-2. System Software *(continued)*

Firmware/Software	Version
PyInstaller	3.2
Python	2.7.10
ClearAccess Components, Version 1.4.1	
webpy	0.38
Python-future	0.15.2
pefile	2016.3.28
pywin	220
jquery	1.10.5
DataTables	1.10.5
ColVis	1.1.1
ColReorder	1.1.2
jsmin	2003-12-04
Brother printer driver	1.0.1.0
Okidata printer driver	1.0.0.0
ClearCount Components, Version 1.4.2	
Windows	10 Pro 1607
Google Chrome	55.0.2883.87
Ubuntu	16.04.1 LTS
Python(part of Ubuntu)	2.7.12
Pillow (part of Ubuntu)	3.1.2
MySQLdb (part of Ubuntu)	1.3.7
PyInstaller	3.2.1
PollyReports	1.7.6
OpenSSL	1.0.2g
OpenSSL FIPS Object Module	2.0.10
JavaScript Bootstrap library	2.3.2
JavaScript Chosen library	1.0.0
JavaScript jQuery library	1.10.2
J JavaScript jQuery-migrate library	1.2.1
JavaScript DataTables library	1.9.4
ColVis	1.0.8
JavaScript TableTools library	2.1.5
ZeroClipboard	1.0.4-TableTools2
JavaScript FixedHeader library	2.0.6
JavaScript hotkeys library	1.0
JavaScript tooltip library	1.3
JavaScript pep library	1.0

Table 2-2. System Software *(continued)*

Firmware/Software	Version
JavaScript LESS library	1.3.3
Fujitsu fi-6400	PaperStream 1.30.0
Fujitsu fi-6800	10.10.710
Fujitsu fi-7180	PaperStream 1.4.0

Table 2-3. System Equipment

Component	Model	Serial Number
ClearDesign Components		
Dell Latitude Laptop	5580	7L6M3G2
Dell PowerEdge Server	T630	2K5YFK2, JLPYHK2, & JLPXWK2
Dell 24 inch Monitor	SE2416H	FVWV5G2
Dell 22 inch Monitor	E2216HV	36765D2 & 90665D2
Dell Mini Tower	T3620	IHCLXK2 & IHCKXK2
TP-LINK VPN Router	TL-R600VPN	2149342000209, 2166306000413, & 2168351001114
Lenovo USB Portable DVD Burner	LN-8A6NH11B	8SSDX0H33226L1CB7107099
Brother Printer	HL-L2340DW	U63879A7N416353
ClearAccess Components		
Dell OptiPlex AIO	5250	6PW4GK2, BPYXCH2, HGCMGK2, & 6PWZFK2
Dell 15” Inspiron	7000 series	80S1YD2, 7TT1YD2, & 22S1YD2
Brother Laser Printer	HL-L2340DW	U63879M4N62861, U63879M4N628617, U63879A7N416353, & U63879M4N628535
Oki Data Laser Printer	B432dn	AK5B007647A0, AK76030925A0, AK76030928A0, AK62030437A0, AK62030440A0, & AK76030928A0
Storm EZ Access Keypad	EZ08-222013	15000005, 15000007, & 15020478
Origin Instruments Sip/Puff Breeze with Headset	AC-0313-H2	CBG-SP-001, CBG-SP-002, & CBG-SP-003(0500)
Hamilton Buhl Over-Ear Stereo Headphones	HA7	CBG-HP-001 & CBG-HP-002
ElectionSource Table Top Voting Booth (Privacy Screen)	VB-60B	CBG-VB-001
APC Smart-UPS	SMT2200	AS1602232215, AS1721142050, AS1638230963, AS1721132721, & AS1625141816

Table 2-3. System Equipment *(continued)*

Component	Model	Serial Number
Ergotron Stand for Dell OptiPlex 5250 AIO (portrait mode)	Neo Flex	1274839-0061 & 1358124-0005
ClearCount Components		
Dell Latitude Laptop (multiple units)	5580	2F3L3G2, C9S22G2, CF3L3G2, 90356H2, BDH46H2, 8TM46H2, 4PM46H2, 4QM46H2, 3CH46H2, & FPM46H2
Dell PowerEdge Server	T330	5RRFGK2, 5712JK2, & FHV9RD2
Dell OptiPlex AIO	7440	JXDFHH2, JXDFDH2, & 64WPXG2
Dell Precision Workstation	T3620	GW6XHH2 & H0PZFK2
Fujitsu Scanner	fi-7180	A20DC10302, A20DC10378, A20D000798, & A20DC08933
Fujitsu Scanner	fi-6800	A9HCC00543, A9HCC00535, & 100295
Fujitsu Scanner	fi-6400	AKHCC00609, AKHCC00337, & AKHCC00362
Lenovo USB Portable DVD Burner	LN-8A6NH11B	8SSDX0H33226L1CB7107099
Dell 22 inch Monitor	E2216HV	GD965D2
Dell 22 inch Monitor	P2217	7818672
Dell 22 inch Monitor	S2240M	CN-0CFGKT-64180-58B-0X3T
Dell 27 inch Monitor	P2717H	CDMS672 & HPWD072
Cisco Catalyst Switch (1 Gigabit Router or Switch)	2960-X Series	FCW2039B6QF & FCW2110A1E0
TP-LINK Easy Smart Switch (1 Gigabit Router or Switch)	TL-SG108E	216C319009010 & 216C319009012
NetGear ProSafe VPN Firewall (1 Gigabit Router or Switch)	FVS318G	40F266BA00280
APC Smart-UPS	SMT1500	3S1525X07491, 3S1525X07452, 3S1525X07421, & 4B1448P39979
Western Digital External Hard Drive	WDBBGB0040HBK	WCC7K5CHA3DK
EZ Scanning Shelf (fi-6400 or fi-6800)	Model: WorkEZ	CBG-EZ-001, CBG-EZ-002, CBG-EZ-003, & CBG-EZ-004

2.2 Test Configuration

The testing event utilized several setups of the ClearVote 1.4.1 System and its components. The following is a breakdown of the ClearVote 1.4.1 System components and configurations for the test setup:

Standard Testing Platform:

The standard testing platform consisted of one ClearVote 1.4.1 System in a standalone configuration. In the pre-election phase of testing, ballots were created utilizing ClearDesign, the EMS component of the ClearVote 1.4.1 System. Ballot styles were then imported into ClearAccess for ballot marking. Once ballots were marked and the polls were closed, ballot reconciliation procedures were performed and the ballots were tabulated by ClearCount, the central count tabulation and reporting component of the ClearVote 1.4.1 System.

2.3 Test Support Equipment/Materials

All test support equipment/ materials required to facilitate testing were supplied by Clear Ballot.

2.4 Technical Data Package

This subsection lists the manufacturer provided documentation that was provided as part of the ClearVote 1.4.1 System. TDP review was outside of the scope for this project.

Table 2-4. TDP Documents

Material	Version	Description
ClearAccess 1.4.1 Acceptance Test Checklist	1.0.1	TDP Document
ClearAccess 1.4.1 Build Procedures	1.0.3	TDP Document
ClearAccess 1.4.1 Change Notes 1.1 to 1.4.1	1.0	TDP Document
ClearAccess 1.4.1 Functionality Description	1.1	TDP Document
ClearAccess 1.4.1 Hardware Specification	1.2	TDP Document
ClearAccess 1.4.1 Installation Guide	1.1.1	TDP Document
ClearAccess 1.4.1 Maintenance Guide	1.1.1	TDP Document
ClearAccess 1.4.1 Poll Worker Guide	1.2	TDP Document
ClearAccess 1.4.1 Security Specification	1.3	TDP Document
ClearAccess 1.4.1 Software Design and Specification	1.2.1	TDP Document
ClearAccess 1.4.1 Supervisor Guide	1.2	TDP Document
ClearAccess 1.4.1 System Overview	1.1	TDP Document
ClearAccess 1.4.1 Voter Guide	1.0.3	TDP Document
ClearCount 1.4.1 Acceptance Test Checklist	1.0.3	TDP Document
ClearCount 1.4.1 Change Notes 1.1 to 1.4.1	1.0	TDP Document
ClearCount 1.4.1 Database Specification	1.0.2	TDP Document
ClearCount 1.4.1 Election Administration Guide	1.0.6	TDP Document
ClearCount 1.4.1 Election Preparation and Installation Guide	1.0.6	TDP Document
ClearCount 1.4.1 Functionality Description	1.0.4	TDP Document
ClearCount 1.4.1 Hardware Specification	1.0.4	TDP Document
ClearCount 1.4.1 Maintenance Guide	1.0.4	TDP Document
ClearCount 1.4.1 Reporting Guide	1.0.4	TDP Document

Table 2-4. TDP Documents *(continued)*

Material	Version	Description
ClearCount 1.4.1 Scanner Operator Guide	1.0.1	TDP Document
ClearCount 1.4.1 Security Specification	1.0.4	TDP Document
ClearCount 1.4.1 Software Design and Specification	1.0.5	TDP Document
ClearCount 1.4.1 System Operations Procedures	1.0.3	TDP Document
ClearCount 1.4.1 System Overview	1.0.3	TDP Document
ClearDesign 1.4.1 Acceptance Test Checklist	1.0.4	TDP Document
ClearDesign 1.4.1 1.0 to 1.4.1 Change Notes	1.0	TDP Document
ClearDesign 1.4.1 Administration Guide	1.0.5	TDP Document
ClearDesign 1.4.1 Database Specification	1.0.4	TDP Document
ClearDesign 1.4.1 Functionality Description	1.0.7	TDP Document
ClearDesign 1.4.1 Hardware Specification	1.0.5	TDP Document
ClearDesign 1.4.1 Installation Guide	1.0.9	TDP Document
ClearDesign 1.4.1 Maintenance Guide	1.0.5	TDP Document
ClearDesign 1.4.1 Security Specification	1.0.7	TDP Document
ClearDesign 1.4.1 Software Design and Specification	1.0.7	TDP Document
ClearDesign 1.4.1 System Overview	1.0.6	TDP Document
ClearDesign 1.4.1 User Guide	1.0.6	TDP Document
ClearVote 1.4.1 Approved Parts List	1.0.5	TDP Document
ClearVote 1.4.1 Ballot Stock and Printing Specification	1.0.2	TDP Document
ClearVote 1.4.1 Configuration Management Plan	1.0.4	TDP Document
ClearVote 1.4.1 Glossary	1.0.2	TDP Document
ClearVote 1.4.1 Personnel Deployment and Training Plan	1.0.3	TDP Document
ClearVote 1.4.1 Quality Assurance Program	1.0.2	TDP Document
ClearVote 1.4.1 Security Policy	1.0.5	TDP Document
ClearVote 1.4.1 System Overview	1.0	TDP Document
ClearVote 1.4.1 Test and Verification Specification	1.0.2	TDP Document

3.0 TEST PROCESS AND RESULTS

The following sections outline the test process that was followed to evaluate the ClearVote 1.4.1 System against the test goals defined in Section 2.

3.1 General Information

All testing was conducted at the Pro V&V, Inc. test facility located in Huntsville, AL by Pro V&V personnel verified by Pro V&V to be qualified to perform the testing with the exception of hardware testing. Pro V&V utilized third party testing during the performance of hardware testing. Additional information regarding hardware testing can be found in section 3.3.8 of this report.

3.2 Test Cases/Procedures

Certification testing of the Clear Ballot Group ClearVote 1.4.1 System submitted for evaluation was performed to verify that the ClearVote 1.4.1 System conformed to the State of Colorado Requirements. The Colorado Requirements Matrix dated June 30, 2017, was used as a guide to determine the specific tests to be performed. Pro V&V developed test procedures designed to evaluate the system being tested against the stated requirements. Prior to execution of the required test procedures, the system under test was subjected to testing initialization to establish the baseline for testing and ensure that the testing candidate matches the expecting testing candidate and that all equipment and supplies are present.

The following tasks were completed during the testing initialization:

- Ensure proper system of equipment. Check network connections, power cords, keys, etc.
- Check version numbers of (system) software and firmware on all components.
- Verify the presence of only the documented COTS.
- Ensure removable media is clean.
- Ensure batteries are fully charged.
- Inspect supplies and test decks.
- Record protective counter on all tabulators.
- Review physical security measures of all equipment.
- Record basic observations of the testing setup and review.
- Record serial numbers of equipment.
- Retain proof of version numbers.

3.3 Test Results

The procedures that were utilized during the test engagement and the results obtained are summarized in the following paragraphs. During the evaluation, the test team made observations of general system behavior.

3.3.1 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 as a system. In addition, tests were conducted to insure all applicable EAC 2005 VVSG requirements are met. Also the various options of software counting logic that are claimed in the manufacturer's documentation were tested during the system-level FCA.

Generic test ballots or test entry data for voting, representing particular sequences of ballot-counting events, were used in conjunction with other testing to examine the counting logic during this audit. The error recovery capabilities of the system were assessed to ensure that the System could recover from a non-catastrophic failure of a device or any error or malfunction within the operator's ability to correct. The Systems' error messaging was also assessed to ensure that the System generated error messages, logged them, and reported them to the user. This assessment verified that the error messaging provided to the user described the error condition, provided clear messaging regarding the error encountered, and instructed the user on what actions to take to address the error condition.

Copies of all of the manufacturer's test cases generated for module or unit testing, integration testing, and system testing were submitted to the VSTL for review. Relevant FCA results also acted as exploratory assessments for other testing.

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 tests-cases were performed while any non-applicable test-cases (e.g. VVPAT requirements, etc.) 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:
    - Pre-voting Capabilities: These functional capabilities are used to prepare the 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.
    - 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; tabulation of paper ballots at the central location; accumulation of results from all voting methods; obtaining consolidated reports; and obtaining reports of audit trails.
- FCA-Limits Testing: System limits were tested and verified.
- FCA-Claims Testing: System user instructions and procedures were followed to verify their accuracy and completeness. In addition any functional claims discovered that were not specifically examined in other areas or that were items of interest were also tested.
- FCA-Mapping: All functional paths (buttons, dropdowns, etc.) were mapped by qualified VSTL personnel, to help ensure all functional options had been noted and exercised. Any items of interest were examined and/or tested.

Issues found during these efforts were tracked using an issue tracking software program and issue tracking spreadsheets.

<u>Summary Findings</u>

All functional tests were eventually successfully executed. During execution of the test procedure, it was verified that the ClearVote 1.4.1 System successfully completed the FCA Testing, with the exception of the following discrepancies:

Table 3-1. FCA Discrepancies

Colorado Rule & Statute	Description	Discrepancy
10.5.1(a)	The total number of active registered electors on election day.	The system has no means to intake inactive registered electors
10.5.1(b)	The total number of registered electors (active and inactive) on election day.	The system has no means to intake inactive registered electors"
21.4.9(a)(5)	Hardware events – add hardware, remove hardware, initialize hardware and change hardware properties.	The system log does not meet this requirement. *Note: PVV has not seen a log that meets this*
21.4.10.b.3	The voting system must include provisions for updating security patches, software and/or service packs without access to the open network.	System can do, but if done it does not comply with EAC.
21.4.10.d.3	The voting system provider must use a virus protection/prevention application on the election management server(s)/workstations which must be capable of manual updates without the use of direct connection to the internet.	System can do, but if done it does not comply with EAC.

3.3.2 Accuracy

The accuracy test ensured that each component of the System could each process 1,549,703 consecutive ballot positions correctly within the allowable target error rate. The Accuracy test was 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 was defined as an error rate. This rate is the maximum number of errors allowed while processing a specified volume of data. For paper-based Systems, such as the ClearVote 1.4.1 System, the ballot positions on a paper ballot must be scanned to detect selections for individual candidates and contests and the conversion of those selections detected on the paper ballot converted into digital data. In an effort to achieve this and to verify the proper functionality of the units under test, the following methods were used to test components of the System:

The accuracy requirements for the ClearCount were met by the execution of the standard accuracy test utilizing pre-marked ballots of each ballot length supported and ClearAccess produced ballots. For the accuracy test, voting sessions were started using manual session activation.

The ClearCount was tested by utilizing a combination of hand marked (70%) and pre-marked (30%) ballots to achieve accuracy rate greater than 1,549,703 correct ballot positions.

Summary Findings

The ClearVote 1.4.1 System under test successfully passed the accuracy test. No functional issues were noted during the execution of this test and all results were imported, tabulated, and validated via the ClearCount reporting function.

3.3.3 System Integration

System Integration is a system level test for the integrated operation of both hardware and software. Compatibility of the System software components or subsystems with one another, and with other components of the System environment, were determined through functional tests integrating the System software with the remainder of the system. During performance of the System Integration, the ClearVote 1.4.1 System was configured 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. Pro V&V personnel configured and tested the system by following the procedures detailed in the ClearVote 1.4.1 System technical documentation.

Summary Findings

Three General Elections and three Primary Elections were successfully exercised on the System, as described below:

Three general elections with the following breakdowns:

- General Election GEN-01: A basic election held in four precincts, one of which is a split precinct. This election contains 19 contests compiled into four ballot styles. Five of the contests are in all four ballot styles. The other 15 contests are split between at least two of the precincts with a maximum of four different contest spread across the four precincts.
- General Election GEN-02: A basic election held in three precincts. This election contains 15 contests compiled into three ballot styles. While 10 of the contests are in all three ballot styles with the other five split across the three precincts.
- General Election GEN-03: A basic election held in two precincts. This election contains eight contests and compiled into two ballot styles with four of the contests in both ballot styles. The other four contests are split between the two precincts. This election is designed to functionally test the handling of multiple ballot styles, support for at least three languages including a character-based language, support for common voting variations, and audio support for at least three languages and an ADA binary input device.

Three primary elections with the following breakdowns:

- Primary Election PRIM-01: Open Primary Election in two precincts. This election contained thirty contests compiled into five ballot styles. Each ballot style contains six contests.
- Primary Election PRIM-02: Open Primary Election held in two precincts. This election contained thirteen contests compiled into three ballot styles. One contest is in all three ballot styles; all other contests are independent.
- Primary Election PRIM-03: A basic election held in two precincts. This election contains 10 contests and is compiled into two ballot styles with two of the contests in both ballot

styles. The other eight contests are split between the two parties' ballots. This Primary Election is designed to functionally test the handling of multiple ballot styles, support for at least three languages including a character-based language, support for common voting variations, and audio support for at least three languages and an ADA binary input device.

The ClearVote 1.4.1 System successfully passed the System Integration Test. During execution of the test procedure, it was verified that the ClearVote 1.4.1 System successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results.

3.3.4 Physical Configuration Audit (PCA)

The physical configuration audit compares the System components submitted for qualification to the manufacturer's technical documentation, and included the following activities:

- Establish a configuration baseline of software and hardware to be tested; confirm whether manufacturer's documentation is sufficient for the user to install, validate, operate, and maintain the System
- Verify software conforms to the manufacturer's specifications; inspect all records of manufacturer's release control system; if changes have been made to the baseline version, verify manufacturer's engineering and test data are for the software version submitted for certification
- If the hardware is non-COTS, Pro V&V reviewed drawings, specifications, technical data, and test data associated with system hardware to establish a system hardware baseline associated with software baseline
- Review the 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

<u>Summary Findings</u>

During execution of the test procedure, the components of the ClearVote 1.4.1 System were documented by component name, model, serial number, major component, and any other relevant information needed to identify the component. For COTS equipment, every effort was made to verify that the COTS equipment had not been modified for use. Additionally, each technical document submitted in the TDP was recorded by document name, description, document number, revision number, and date of release. At the conclusion of the test campaign, test personnel verified that any changes made to the software, hardware, or documentation during the test process were fully and properly documented.

3.3.5 Security

The objective of the security testing was to evaluate the effectiveness of the System in detecting, preventing, recording, reporting, and recovering from security threats and to determine the overall security posture of each system component. During the security evaluation of the system, test cases were specifically designed to evaluate the following:

- confirm compliance with Telecommunication and Security Sections of the VVSG 1.0 (2005), including EAC RFI 2012-05 and EAC RFI 2008-03
- verify depth, breadth, completeness, clarity, and conformance in the manufacturer's TDP System Security Specification
- verify implementation of the security mechanisms specified in the TDP System Security Specification on each system component
- attempt to defeat the access controls and security measures documented in the system TDP

The evaluation of the system was accomplished by utilizing a combination of documentation review, functional testing, source code review, automated network and vulnerability scanners, as well as manual inspection. Test cases were developed in an attempt to defeat the access controls and security measures documented in the system TDP. Tests conducted verified that the security mechanisms specified in the TDP Security Specification were implemented and adequately protect the system.

During the execution of these test procedures physical, technical, and administrative security controls were evaluated to determine if the security posture of the system components meet the objectives of the security standards which include: protection of the critical elements of the System; establishing and maintaining controls to minimize errors; protection from intentional manipulation, fraud and malicious mischief; identifying fraudulent or erroneous changes to the System; and protecting the secrecy in the voting process.

The security evaluation was conducted by a credentialed security expert utilizing System components that had been configured during other phases of their certification process. The security assessor evaluated the System for use and functionality to verify that the documented controls were in place, adequate, and met the stated requirements.

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

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

Logical Security was tested as part of FCA by conducting the following tests on system components: Vulnerability Scans, SCAP Scans, and Physical Bypass Attempts.

Summary Findings

Removable Media Security

	Linux – Ubuntu			Windows 10			
	Design Server	Count Server	Cast	Design Station	Count Station	Count Admin	Access
Auto Recognize	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Auto Mount	Yes	No	No	No	No	No	No
Auto Play	No	No	No	No	No	No	No

For consistency, the tests were conducted and are reported using the following definitions of behavior:

Auto Recognize - Drive is recognized by file system
Windows – volume is displayed in disk manager
Linux – volume is displayed using fdisk –l and / or df
Auto Mount
Windows – Drive is automatically assigned a drive letter
Linux – Drive is automatically mounted to a /media/ file
Auto Play
File explorer is launched upon insertion of USB and/or autoplay file is launched

Other Observations
Upon insertion of a USB in any ports on Design Server, the USB drive is automatically mounted to a file in /media/. In /media there are usb0, usb1, usb2, usb3, usb4, usb5, and usb6. Each subsequent USB drive plugged in gets mounted to the sequentially open /media/usb* file. Further examination of installed packages on this component confirmed the package installation of usbmount 0.0.22. The USB behavior on this component is consistent with that provided by this package.

Configuration Compliance Checking:

Clear Ballot products running on Windows were examined using the SCAP Compliance Checker (SCC) version 4.2 tool with the following Security Technical Implementation Guide (STIG) content:

U_Windows_10_V1R4_STIG_SCAP_1-1_Benchmark
U_Windows_Firewall_V1R5_STIG_SCAP_1-1_Benchmark
U_Microsoft_DotNet_Framework_4_V1R4_STIG_SCAP_1-1_Benchmark
U_Google_Chrome_Current_Windows_V1R1_STIG_SCAP_1-1_Benchmark

Clear Ballot products running on Ubuntu were manually examined for compliance with the guidelines presented in the CIS_Ubuntu_Linux_14.04_LTS_Benchmark_v2.0.0 published by the Center for Internet Security. All products were found to have an adequate level of compliance in accordance with the published guidelines.

Vulnerability Assessment

All components were scanned with Nessus version 6.11.2 utilizing the plugin set 201711140615. Two “High” severity vulnerabilities were found on the Design Server Component:

- OpenSSL Heartbeat Information Disclosure (Heartbleed) (CVE-2014-0160)
- OpenSSL 'ChangeCipherSpec' MiTM Vulnerability (CVE-2010-5298, CVE-2014-0076, CVE-2014-0195, CVE-2014-0198, CVE-2014-0221, CVE-2014-0224, CVE-2014-3470)

Risks associated with these vulnerabilities are mitigated by the administrative suggested policy that the system only be operated in a closed private network.

FIPS 140-2 / EAC RFI 2012-05 Compliance – Cryptography: An analysis was performed to verify if libraries providing cryptographic functions were compliant to EAC RFI 2012-05. This

was evaluated by verifying providers of documented cryptographic functions, examining source code and system settings as configured per the manufacturer's documentation. Testing determined that the system and components used are fully compliant to VVSG 1.0, Section 7 and RFI 2012-05. Examination verified that Clear Design Server running on Ubuntu uses OpenSSL FIPS version 2.0.5. Examination verified that Clear Count Server running Ubuntu uses OpenSSL FIPS version 2.0.10. Clear Cast also running on Ubuntu does not utilize Open SSL FIPS and does not have an Ethernet port to perform telecommunications. Both OpenSSL FIPS 2.0.5 and 2.0.10 are certified under CMVP certificate #1747. The libraries were also confirmed to be built in conformance with the security policy defined in the certification process. Examination verified that Clear Ballot products running on Windows 10 use the cryptographic system provided by the Windows 10 operating system which is verified by CMVP certificate #2605. Windows 10 group policy settings were also verified to ensure the enforcement of FIPS Mode at the operating system

3.3.6 Usability & Accessibility

Usability & Accessibility testing was performed to evaluate the ClearVote 1.4.1 System to the applicable requirements. The usability testing focused on the usability of the ClearVote 1.4.1 System. Usability was 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. The Accessibility portion of testing evaluated the requirements for accessibility. These requirements are intended to address HAVA 301 (a) (3) (B).

During test performance, the ClearVote 1.4.1 System was configured as per Clear Ballot. The configured system was tested to the VVSG 1.0 requirements utilizing TestLink which maintains all applicable test cases. Utilization of both negative and positive inputs were entered into the system and documented into TestLink to allow for traceability and reproducibility. All components were evaluated for applicable requirements in which all deficiencies were documented within TestLink and Mantis for tracking purposes. Regression testing was performed on all identified issues to ensure resolution and compliance to the requirements.

Summary Findings

The ClearVote 1.4.1 System successfully met the requirements of the Usability & Accessibility evaluation, with the exception of the following discrepancies:

Table 3-2. Usability & Accessibility Discrepancies

Colorado Rule & Statute	Description	Discrepancy
1-5-704(1)(h)	For voice signals transmitted to the elector, the System shall provide a gain adjustable up to a minimum of twenty decibels with at least one intermediate step of twelve decibels.	If passes EAC then fails CO's "12 decibel step".
1-5-704(1)(o)(III)	The ballot marking device shall have multiple output connections to accommodate various headsets so that the elector is able to use the headset provided with the ballot marking device or his or her own headset.	Only the 3.5mm output was tested.

3.3.7 Source Code Review

Pro V&V reviewed the submitted source code to 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 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.

Summary Findings

CBG submitted three components source code packages as part of the ClearVote 1.4.1 System. These packages were ClearAccess, ClearCount, and ClearDesign. Each package was reviewed using automated tools with a proprietary configuration. Pro V&V reviewed the configuration files that were in clear text to determine if any false positive suppression violated the EAC 2005 VVSG.

All tools ran successfully, and no violations of the EAC 2005 VVSG or the PEP 8 coding standard were noted. After execution of the automated tools Pro V&V conducted a manual review of 10% of all comments and headers to ensure the commenting convention followed the EAC 2005 VVSG Volume I Section 5.2. All source code was found to be in compliance.

3.3.8 Hardware Testing

The ClearVote 1.4.1 System hardware consists of the following major components: ClearAccess ADA BMD, ClearCount central count scanner, and ClearDesign EMS.

ClearAccess - All components of ClearAccess are COTS.

ClearCount - All components of ClearCount are COTS.

ClearDesign - All components of ClearDesign are COTS.

A list of hardware tests, and the components which were subjected to each hardware test, are listed below:

Electrical Tests:

- Electrical Power Disturbance – ClearAccess
- Electromagnetic Radiation – ClearAccess
- Electrostatic Disruption – ClearAccess
- Electromagnetic Susceptibility – ClearAccess
- Electrical Fast Transient – ClearAccess
- Lightning Surge – ClearAccess
- Conducted RF Immunity – ClearAccess
- Magnetic Fields Immunity – ClearAccess
- Electrical Supply – ClearCount (fi-6400, fi-6800, fi-7180), ClearAccess

Environmental Tests:

- Bench Handling – ClearAccess
- Vibration – ClearAccess
- Low Temperature – ClearAccess
- High Temperature – ClearAccess
- Humidity – ClearAccess
- Temperature Power Variation - ClearCount (fi-6400, fi-6800, fi-7180), ClearAccess
- Acoustic – ClearAccess

Pro V&V utilized third party testing during the performance of hardware testing. All hardware testing was performed at the NTS Longmont facility located in Longmont, Colorado. All testing was witnessed on-site by Pro V&V personnel, with the exception of Temperature Power Variation in which Pro V&V qualified staff executed all testing at the NTS Longmont facility, with NTS personnel providing only support services for this test.

Summary Findings

Electrical Testing was performed on the components listed above. The procedures and results for this testing are presented in Attachment B, Part 1. The test results from this testing are summarized below:

Table 3-3. Electrical Hardware Test Results

Standard/Method	Description	Criteria	Class/Level	Result
FCC 15.107 ICES-003 VVSG Vol. 1 4.1.2.9	Power Line Conducted Emissions	N/A	Class B	Pass
FCC 15.109 ICES-003 VVSG Vol. 1 4.1.2.9	Radiated Emissions	N/A	Class B	Pass *
EN61000-4-11 VVSG Vol. 1 4.1.2.5	Electrical Power Disturbance	Normal Operation & No Data Loss	Various	Pass
EN61000-4-4 VVSG Vol. 1 4.1.2.6	Electrical Fast Transient	Normal Operation & No Data Loss	±2kV - Mains	Pass
EN61000-4-5 VVSG Vol. 1 4.1.2.7	Lightning Surge	Normal Operation & No Data Loss	±2kV Line - Line ±2kV Line - Ground	Pass
EN61000-4-2 VVSG Vol. 1 4.1.2.8	Electrostatic Disruption	Normal Operation & No Data Loss	±8kV Contact ±15kV Air	Pass **

Table 3-3. Electrical Hardware Test Results *(continued)*

Standard/Method	Description	Criteria	Class/Level	Result
EN61000-4-3 VVSG Vol. 1 4.1.2.10	Electromagnetic Susceptibility	Normal Operation & No Data Loss	10 V/m, 80 MHz – 1 GHz	Pass ***
EN61000-4-6 VVSG Vol. 1 4.1.2.11	Conducted RF Immunity	Normal Operation & No Data Loss	10 Vrms, 150 kHz – 80 MHz	Pass
EN61000-4-8 VVSG Vol. 1 4.1.2.12	Magnetic Immunity	Normal Operation & No Data Loss	30 A/m	Pass

* During test performance, an issue was detected with ClearAccess (Dell AIO and the Oki Printer). Clear Ballot was notified of the issue and performed an analysis of the occurrence and implemented a corrective action by adding a ferrite (Wurth 742-716-33S) to the printer USB cable on the computer end. This configuration was successfully tested and regression testing was performed on the system to verify that the change did not adversely impact previous test results.

** During test performance, an issue was detected with ClearAccess components, Oki Printer and the APC UPS. Clear Ballot was notified of the issues and performed an analysis. The LCD display on both the printer and UPS went out during the 15 kV Air. Both the printer and UPS continued to fully function during the issues. Clear Ballot implemented a corrective action of adding a plastic cover over the LCDs and copper tape around the LCDs. This configuration was successfully tested and regression testing was performed on the system to verify that the change did not adversely impact previous test results.

*** During test performance, an issue was detected with ClearAccess (Dell AIO and the Brother Printer). Clear Ballot was notified of the issue and performed an analysis of the occurrence and implemented a corrective action by adding a ferrite (Wurth 742-716-22S) to the printer USB cable at the printer side. This configuration was successfully tested and regression testing was performed on the system to verify that the change did not adversely impact previous test results.

Environmental Testing was performed on the components listed above. The procedures and results for this testing are included in reports presented in Attachment B, Part 2. The test results from this testing are summarized below:

Shock - Bench Handling (MIL-STD-810D, 516.3, I-3.8)

The ClearAccess component was subjected to Shock – Bench Handling Testing. Using one edge as a pivot, the opposite edge of the chassis of each unit was lifted until the face reached 45° with horizontal bench top, or 4 inches above bench top (whichever occurred first). This was repeated with each practical edge, of the same horizontal face. At the conclusion of testing, the components were subjected to a visual inspection and an operational status check was performed.

Test Result – Pass

Vibration – Basic Transportation (MIL-STD-810D, 514.3, I-3.2.1)

The ClearAccess component was subjected to Vibration – Basic Transportation Testing. Testing was performed at ambient/room temperature (20ºC +/-3 ºC) in the X, Y and Z axis at the levels

identified in Figure 3-1. At the conclusion of testing, a visual inspection and an operational status check was performed.

Test Result – Pass

Low Temperature - Storage (MIL-STD-810D, 502.2, II-3)

The ClearAccess component was subjected to Low Temperature – Storage Testing. Samples were subjected to a temperature of -4ºF (-20ºC +/-3 ºC) for a duration of 4 hours, after which operation was confirmed by Pro V&V. Samples were not powered, and were left in their packaging for the duration of the test. They were removed from the boxes for operational verification after the test. At the conclusion of testing, a visual inspection of the components and the packaging, and an operational status check was performed.

Test Result – Pass

High Temperature - Storage (MIL-STD-810D, 501.2, I-3.2)

The ClearAccess component was subjected to High Temperature – Storage Testing. Samples were subjected to a temperature of 140ºF (60ºC +/-3 ºC) for a duration of 4 hours, after which operation was confirmed by Pro V&V. Samples were not powered, and were left in their packaging for the duration of the test. They were removed from the boxes for operational verification after the test. At the conclusion of testing, a visual inspection of the components and the packaging, and an operational status check was performed.
Test Result – Pass

Humidity – Hot/Humid (MIL-STD-810D, 507.2, I-3.2)

The ClearAccess component was subjected to Humidity – Hot/Humid Testing. Samples were subjected as per Table 507.2-I, Hot-Humid (Cycle 1), for a duration of 240 hours (10 days), after which operation was confirmed by Pro V&V. Samples were not powered/operational, and were left in their packaging for the duration of the test, and were removed from the boxes for operational verification. At the conclusion of testing, a visual inspection of the components and the packaging, and an operational status check was performed.

Test Result – Pass

Temp-Power Variation Testing (MIL-STD-810D, 501.2/502.2)
The ClearAccess and ClearCount system components were subjected to Temperature/Power Variation Testing. Samples completed 85 hours per the following environment profile:

The ClearAccess and ClearCount system components were powered and being operated by Pro V&V for the duration of the environmental profile, to confirm operation. The following issue was encountered during test performance, as described below:

- The ClearAccess HP printer under test was experiencing a lost connection during testing. The unit was restarted and all connections were verified. The unit passed the pre-operational status check without issue. The HP printer was able to resume, but only for a short period of time until connection was lost again. The issues were logged into the engineering notebook and Clear Ballot was notified of the issue. After the hourly run was performed the test was

halted for a short period of time to allow the Clear Ballot Technical Representative to enter the test camber to observe the activity and after discussion Clear Ballot determined it was in the best interest to remove the HP printer from the test chamber and from the system configuration submitted for this test campaign. The HP unit was removed from the test chamber and returned to Clear Ballot.

Test Result – Pass

4.0 CONDITIONS OF SATISFACTION

The System was evaluated against the Clear Ballot ClearVote Colorado Requirements Matrix, which incorporates the 2002 VSS requirements and the Colorado-specific requirements in the Colorado Secretary of State Election Rules [8 CCR 1505-1] Rule 21. Throughout this test campaign, as tests were executed, resultant data was inspected and technical documentation reviews were performed to ensure that each applicable requirement was met; therefore fulfilling the conditions of satisfaction. The Requirements Matrix including verification that the conditions of satisfaction were met is included in Attachment A.

5.0 CONCLUSIONS

Based on the results obtained during the test campaign, Pro V&V determines that the ClearVote 1.4.1 System, as presented for evaluation, meets the requirements for Systems of the State of Colorado as prescribed in the Colorado Secretary of State Election Rules [8 CCR 1505-1] Rule 21 dated August 11, 2017.