Test Report for EAC 2005 VVSG Certification Testing
Clear Ballot Group ClearVote 1.5 Voting System

EAC Project Number: CBG1500

Version: Rev D

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U.S. Election Assistance Commission

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SIGNATURES

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REVISIONS

Revision	Description	Date
NR	Initial Release	12/4/2018
Rev A	Updated with comments from the EAC changes are highlighted	12/21/2018
Rev B	Updated TDP version numbers and highlights removed	02/13/2019
Rev C	Corrected incorrect date on cover page	03/05/2019
Rev C	Corrected Trusted Build Hash Values	03/12/2019

TABLE OF CONTENTS

1.0 INTRODUCTION

The purpose of this Test Report is to document the procedures that Pro V&V, Inc. followed to perform certification testing during a system modification campaign for the Clear Ballot Group (CBG) ClearVote 1.5 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. Certification testing of ClearVote 1.5 was performed to ensure the applicable requirements of the EAC VVSG 1.0 and the EAC Testing and Certification Program Manual, Version 2.0 were met. Additionally, all EAC Request for Interpretations (RFI) and Notices of Clarification (NOC) relevant to the system under test were incorporated in the test campaign.

Prior to submitting the voting system for testing, CBG submitted an application package to the EAC for certification of the ClearVote 1.5 Voting System. The application was accepted by the EAC and the project was assigned the unique Project Number of CBG1500.

1.1 Description and Overview of EAC System Being Modified

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

The following subsections describe the baselined ClearVote 1.4 System. The following sections contain a product description and an overview of the design methodology of the ClearVote 1.4 Voting System, as taken from the Clear Ballot Group technical documentation.

The ClearVote 1.4 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), ClearCast (precinct count and tabulation), 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 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 laptop or desktop running Windows 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-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 Fujitsu scanners. The ClearCount central-count system running 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.

- 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. 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 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 browser-based application that allows election officials to review and appropriately resolve unreadable voted ballots.

- User and Election Database Management through browser-based 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.

ClearCast

The ClearCast tabulator is a precinct count ballot scanning solution suitable for early and election in-person voting, including processing ballots printed by the ClearAccess accessible ballot marking device. The ClearCast application runs on the precinct count-based tabulator, and is used to scan, count and tally marked ballots. Its functionality is divided into three essential modes, Election Mode (Early Voting and/or Election Day), which is used to process voter cast ballots, Pre-Election Mode, this occurs prior to Election Mode, and is used to test all system functionality subsequent to the start of the election, and Post-Election Mode, which is used to perform administrative functions following the close of the 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 1.4 voting system uses both unmodified and modified off-the-self hardware. Laptop and desktop computers are combined with personal assistive devices, printers, and uninterruptible power supplies to form a ballot-marking device.

1.1.1 Baseline Certified System

The baseline system for this modification is the ClearVote 1.4 Voting System. The tables below describe the certified equipment and firmware versions.

Detailed descriptions of the ClearVote 1.4 test campaign are contained in Pro V&V Report No. TR-01-01-CBG-001-01.01, Rev. C, which is available for viewing on the EAC's website at www.eac.gov.

The individual components listed below are compiled to create the ClearVote 1.4 voting system (ClearCast 1.4, ClearCount 1.4, ClearDesign 1.4, and ClearAccess 1.4).

Table 1-1. Voting System Software

Firmware/Software	Version
ClearDesign Components, Version 1.4.3	
Windows	10 Pro 1607
Google Chrome	55.0.2883.87
Ubuntu	14.04.4 LTS
MySQL	5.5.55
Apache	2.4.7
libapache2-mod-fcgid	2.3.9
PhantomJS	1.9.0
Usbmount	0.0.22
Unzip	6.0.9
Samba	4.3.11
Python PIP	1.5.4
Zip	3.0.8

Table 1-1. Voting System Software *(continued)*

Firmware/Software	Version
Pyinstaller	3.0
Python JSMIN	2.2.1
Python	2.7.6
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 Object Module	2.0.10
OpenSSL (standard)	1.0.2g
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 1-1. Voting System Software *(continued)*

Firmware/Software	Version
PyInstaller	3.2
Python	2.7.10
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
ClearCast Components, Version 1.4.2	
scanner_control	0.0.28
UPSBatteryMontior	1.0
Ubuntu	14.04.5 LTS
google_chrome	62.0.3202.75-1
zeromq	4.2.0
arduino tools	1.8.0
adafruit tools	1.4.9
pyinstaller	3.2.1
OpenSSL FIPS Object Module	2.0.10
OpenSSL (standard)	1.0.1f
libPDIScan.so	7.1.0
pdi_ps3_drv_scanner.ko	2.0.5
DataTables	1.10.5
JTSage DateBox	4.0.0
jQuery.NumPad	1.4
jQuery	1.10.2
jquery.ui	1.11.3
ClearCount Components, Version 1.4.2	
Windows	10 Pro 1607
Google Chrome	55.0.2883.87
Ubuntu	16.04.1 LTS
Apache	2.4.18
libapache2-mod-fcgid	2.3.9

Table 1-1. Voting System Software *(continued)*

Firmware/Software	Version
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 FIPS Object Module	2.0.10
OpenSSL (standard)	1.0.2g
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
JavaScript LESS library	1.3.3
Fujitsu fi-6400	PaperStream 1.30.0
Fujitsu fi-6800	PaperStream 10.10.710
Fujitsu fi-7180	PaperStream 1.4.0

Table 1-2. Voting 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

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

Component	Model	Serial Number
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
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
Ergotron Stand for Dell OptiPlex 5250 AIO (portrait mode)	Neo Flex	1274839-0061 & 1358124-0005
Wurth Ferrite (for Oki printer)	742-416-33S	742-416-33S-CBG1
Wurth Ferrite (for Brother printer)	742-416-22S	742-416-22S-CBG1
3M EMI Copper Foil Shielding Tape, , ¼ inch	1181	1181-CBG1
Lexan or acrylic plastic cover (8 mm)	2"x4"	Cover-CBG1
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

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

Component	Model	Serial Number
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, 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
ClearCast Components		
ClearCast	Model: 1 Version A	Cast0011, Cast0014, Cast0015, Cast0017, Cast0018, and Cast0020
Ballot Box	1224UBB-CB	CBG-BB-001, CBG-BB-002

1.2   References

- Election Assistance Commission 2005 Voluntary Voting System Guidelines (VVSG) Version 1.0, Volume I, "Voting System Performance Guidelines", and Volume II, "National Certification Testing Guidelines"

- Election Assistance Commission Testing and Certification Program Manual, Version 2.0

- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 2.0

- National Voluntary Laboratory Accreditation Program NIST Handbook 150, 2016 Edition, "NVLAP Procedures and General Requirements (NIST Handbook 150-2016)", dated July 2016

- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, "Voting System Testing (NIST Handbook 150-22)", dated May 2008

- United States 107th Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002

- Pro V&V, Inc. Quality Assurance Manual, Revision 7.0

- Election Assistance Commission "Approval of Voting System Testing Application Package" letter dated July 12, 2018

- EAC Requests for Interpretation (RFI) (listed on www.eac.gov)

- EAC Notices of Clarification (NOC) (listed on www.eac.gov)

- Pro V&V Test Report No. TR-01-01-CBG-001-01.01 Rev. C, "Test Report for EAC 2005 VVSG Certification Testing Clear Ballot Group ClearVote 1.4 Voting System", dated 01/29/18

- Clear Ballot Group's Technical Data Package *(A listing of the ClearVote 15.5 documents submitted for this test campaign is listed in Section 3.1.2 of this Test Report)*

1.3 Terms and Abbreviations

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

"ADA" – Americans with Disabilities Act 1990

"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

 "PCA" – Physical Configuration Audit

"QA" – Quality Assurance

"RAM" – Random Access Memory

"RFI" – Request for Interpretation

"TDP" – Technical Data Package

"UPS" – Uninterruptible Power Supply

"VSTL" – Voting System Test Laboratory

"VVSG" – Voluntary Voting System Guidelines

2.0   CERTIFICATION TEST BACKGROUND

The ClearVote 1.5 is a modification of a previously certified system (ClearVote 1.4). 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 1.5. Based on this evaluation, Pro V&V determined that testing from the previous test campaign would establish the baseline and that the focus of this test campaign would be on the documented system updates.

2.1   Revision History

The table below details the version history of the ClearVote 1.5 System:

Table 2-1. ClearVote 1.5 System Revision History

System Version	Certification Type	Baseline System	Certification Number
ClearVote 1.4	New System	--- (Original System)---	CBG-CV-14
ClearVote 1.5	Modification	ClearVote 1.4	CBG-CV-1.5*

*Upon grant of certification by the EAC

2.2   Scope of Testing

The scope of testing focused on evaluating the modifications detailed in Section 2.2.1 of this Test Report. Primarily, these modifications focused on upgrades to the components of the previously certified ClearVote 1.4. To determine the ClearVote 1.5 test requirements, the submitted modifications were evaluated against each section of the EAC VVSG 1.0 to determine the applicable tests to be performed. Based on this assessment, it was determined that multiple areas within the EAC VVSG 1.0 would be evaluated to encompass the required tests.

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

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

o Technical Documentation Package (TDP) Review

- EAC VVSG 1.0 Volume 1, Section 5: Software Requirements

  ─ Source Code Review, Compliance Build, Trusted Build, and Build Document Review

  ─ Technical Documentation Package (TDP) Review

  ─ Functional Configuration Audit (FCA)

- EAC VVSG 1.0 Volume 1, Section 7: Security Requirements

  ─ Security Testing

  ─ Technical Documentation Package (TDP) Review

  ─ Functional Configuration Audit (FCA)

2.2.1 Modification Overview

The submitted modifications to the ClearVote 1.5 System consisted primarily of minor software changes to accommodate defect resolutions and enhancements. New hardware changes to ClearCast and ClearAccess were also submitted for this evaluation.

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. Additionally, Pro V&V functionally verified that any corrected issues from the baseline system were not present in the modified system and that all enhancements implemented did not adversely impact system performance.

2.2.1.1 Detailed List of Changes

The submitted modifications include the following:

Overview

- Added new support when ballots require judge's initials
- Added new merge device-count feature
- PA straight party rules
- Support for ballot stubs
- Support for consolidated precincts

ClearAccess

- Added two new hardware versions of the Elo Touchscreen computer
- Updated Brother printer
- Added a new barcode scanning feature that includes the following enhancements:
  - o Scanning a barcode that selects the precinct split

- o Processing input from a barcode scanner
- o Barcode scanner icon in the status bar
- o Changes to the voting workflow when ClearAccess detects a barcode scanner

ClearCast

- New ClearCast Precinct Tabulator hardware
- Improvements to the UI and minor clarifications
- Power-up sequence added
- New warning when a USB drive is low on space
- Upgraded to Ubuntu 18.04.1

ClearCount

- Merge of device counts and new reporting of merged units
- Added new client laptop and server hardware models
- Vote Centers page and outstanding merge results
- Updating the number of paper scanners in the BDF
- ContestFullName field removed from BDF
- Per election access levels
- Corrected issue concerning incorrect redaction of Statement of Votes Cast PDF report

ClearDesign

- Tracking the number of devices associated with each vote center
- Upgraded to Ubuntu 16.04.4
- Added new client laptop and server hardware models
- New Placement option for card headers: Front of First Card Only
- New abbreviation for the standard ballot set
- Password recovery for administrators
- Entity settings related to text for each configured language
- New Line Height options less than 1
- New options for the Entity Types filter in the System Logs view
- Flash is no longer needed on DesignStations
- Improvement to the audio editor
- Ensure that ovals on the front and back of a ballot do not line up
- Improvement to the process for translating language text files
- Ending the Contest/Header background color on the last line of text
- Support for North Carolina's SEIMS file format
- Support for Washington's EIMS VR file format
- For recorded audio, the "space" played for all device audio

2.2.2 Block Diagram

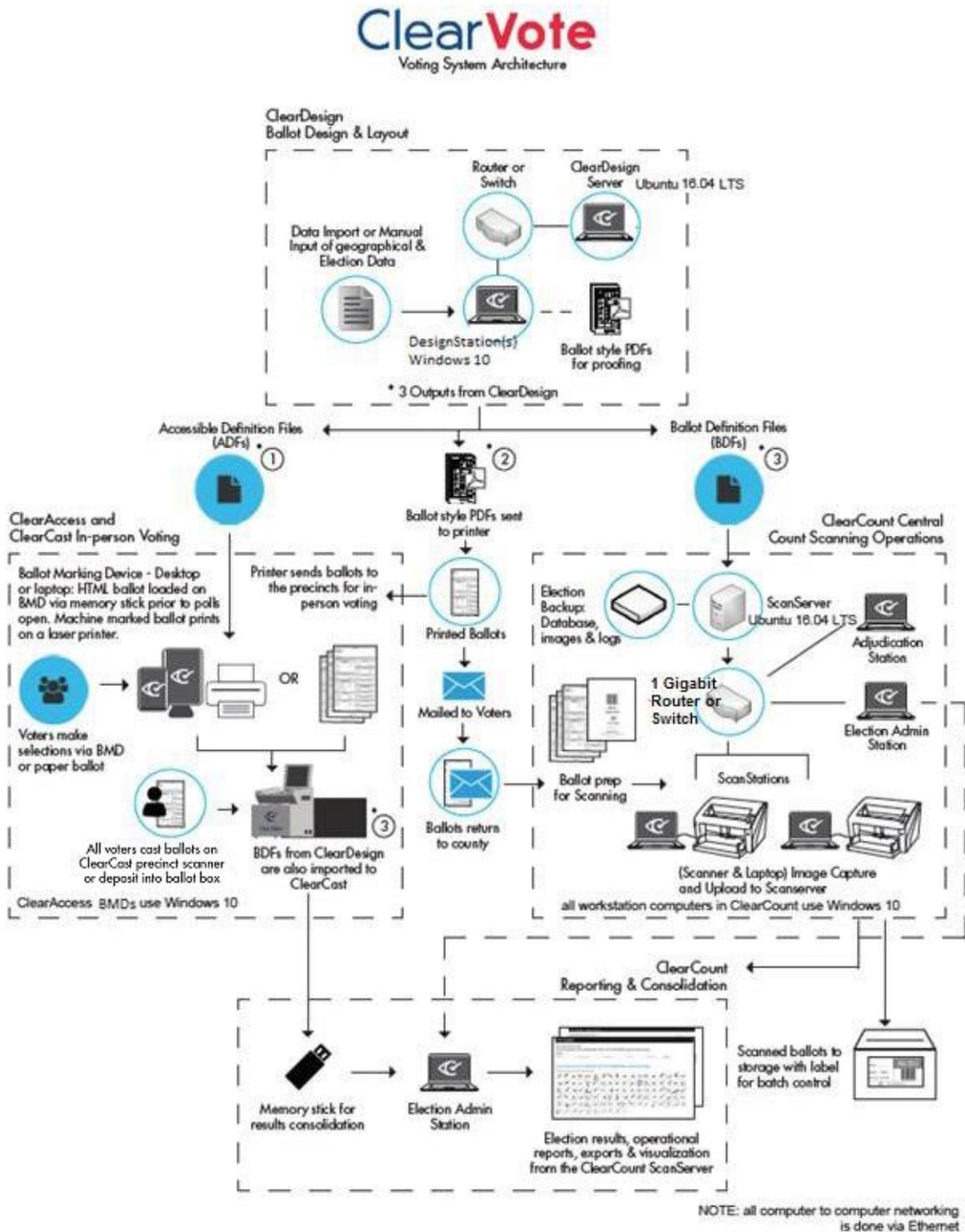The system overview of the submitted voting system is depicted in Figure 1-1.

Figure 1-1. ClearVote 1.5 System Overview

2.2.3 System Limits

The system limits that were verified to be supported by the ClearVote 1.5 Voting System during this test campaign or during testing of the baselined system are listed in the tables below.

Table 2-2. System Limits for ClearDesign

Characteristic	Limit
Precincts in an election	3200
Contests in an election	3200
Candidates/Counters in an election	3200
Ballot Styles in an election	3200
Contests in a ballot style	60
Candidates in a contest	300
Ballot styles in a precinct	50
Number of political parties	50
"vote for" in a contest	50
Supported languages in an election	15
Number of write-ins	50

The maximum ballot positions for the ClearVote 1.5 Voting System were verified to be as follows:

Table 2-3. Maximum Oval Positions for ClearDesign

Ballot Size	Oval positions per side
5 inch	60
11 inch	180
14 inch	240
17 inch	300
19 inch	360
22 inch	420

Table 2-4. System Limits for ClearCount

Scanner Model	Sustained (not burst speed) ballots per hour						Typical county size (central count)
	8.5x5	8.5x11	8.5x14	8.5x17	8.5x19	8.5x22	
fi-6400	5592	3624	2928	2448	2350	2236	Large (>100k voters)
fi-6800	7822	5508	4155	3352	3000	2800	Large (>100k voters)
fi-7180	3396	2040	1692	1400	1300	1200	Small (<25k voters)
ClearCount can have a maximum of 10 ScanStation/Scanner pairs							

2.2.4 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. Additionally, one character based language (Chinese) was tested during System Integration Testing.

2.2.5 Supported Functionality

The ClearVote 1.5 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

2.2.6 VVSG

The ClearVote 1.5 was evaluated against the relevant requirements contained in the EAC VVSG 1.0.

2.2.7 RFIs

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

2.2.8 NOCs

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

3.0 TEST FINDINGS AND RECOMMENDATION

The ClearVote 1.5 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 baselined 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 Testing, Accuracy Test, 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, a limited TDP Review, and a QA & CM System Review were performed, as described below.

3.1.1 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, Pro V&V shall review drawings, specifications, technical data, and test data associated with system hardware to establish system hardware baseline associated with software baseline

- Review manufacturer's documents of user acceptance test procedures and data against system's functional specifications; resolve any discrepancy or inadequacy in manufacturer's plan or data prior to beginning system integration functional and performance tests

- Subsequent changes to baseline software configuration made during testing, as well as system hardware changes that may produce a change in software operation are subject to re-examination

<u>Summary Findings</u>

During execution of the PCA, the components of the ClearVote 1.5 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.

3.1.2 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 on the TDP Review Checklist and reported to the manufacturer for disposition of any anomalies. This process was ongoing until all anomalies were resolved. Any revised documents during the TDP review process were compared with the previous document revision to determine changes made, and the document was re-reviewed to determine whether subject requirements had been met.

<u>Summary Findings</u>

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 1.5 TDP is provided in Table 3-1.

Table 3-1. TDP Documents

Document Number	Description	Version
ClearVote Documents		
100101	ClearVote 1.5 Approved Parts List	1.1.8
100067	ClearVote 1.5 Ballot Stock and Printing Specification	1.0.10
100057	ClearVote 1.5 Configuration Management Plan	1.0.15
100069	ClearVote 1.5 Glossary	1.0.9
100058	ClearVote 1.5 Personnel Deployment and Training Plan	1.0.10
100059	ClearVote 1.5 Quality Assurance Program	1.0.11
100086	ClearVote 1.5 Security Policy	1.0.11

Table 3-1. TDP Documents *(continued)*

Document Number	Description	Version
100071	ClearVote 1.5 System Overview	1.0.14
100073	ClearVote 1.5 Test and Verification Specification	1.0.11
100128	ClearVote 1.5 Change Notes	1.0.8
ClearDesign Documents		
100011	ClearDesign 1.5 Acceptance Test Checklist	1.0.5
100062	ClearDesign 1.5 Administration Guide	1.0.8
100083	ClearDesign 1.5 Build Procedures	1.0.6
100103	ClearDesign 1.5 Database Specifications	1.0.5
100046	ClearDesign 1.5 Functionality Description	1.0.11
100098	ClearDesign 1.5 Hardware Specification	1.0.9
100063	ClearDesign 1.5 Installation Guide	1.0.21
100082	ClearDesign 1.5 Maintenance Guide	1.0.9
100045	ClearDesign 1.5 Security Specification	1.0.11
100072	ClearDesign 1.5 Software Design and Specification	1.0.16
100043	ClearDesign 1.5 System Overview	1.0.12
100041	ClearDesign 1.5 User Guide	2.0.7
100074	ClearDesign 1.5 System Identification Guide	1.0.14
ClearCount Documents		
100102	ClearCount 1.5 Acceptance Test Checklist	1.0.8
100009	ClearCount 1.5 Build Procedures	1.4.6
100005	ClearCount 1.5 Database Specification	1.0.7
100004	ClearCount 1.5 Election Administration Guide	1.0.16
100006	ClearCount 1.5 Election Preparation and Installation Guide	1.2.5
100021	ClearCount 1.5 Functionality Description	1.0.11
100022	ClearCount 1.5 Hardware Specification	1.0.11
100023	ClearCount 1.5 Maintenance Guide	1.0.12
100070	ClearCount 1.5 Reporting Guide	1.0.10
100013	ClearCount 1.5 Scanner Operator Guide	1.1.5
100026	ClearCount 1.5 Security Specification	1.0.11
100019	ClearCount 1.5 Software Design and Specification	1.0.12

Table 3-1. TDP Documents *(continued)*

Document Number	Description	Version
100024	ClearCount 1.5 System Operations Procedures	1.0.10
100130	ClearCount 1.5 Quick Guide XML Report Conversion Tool	N/A
100047	ClearCount 1.5 System Identification Guide	1.0.8
100025	ClearCount 1.5 System Overview	1.0.11
	ClearCast Documents	
100095	ClearCast 1.5 Acceptance Test Checklist	1.2.5
100027	ClearCast 1.5 Poll Worker Quick Guide	N/A
100094	ClearCast 1.5 Build Procedures	1.2.2
100079	ClearCast 1.5 Functionality Description	1.5.1
100080	ClearCast 1.5 Installation Guide	1.3.2
100081	ClearCast 1.5 Hardware Specification	1.4.2
100089	ClearCast 1.5 Maintenance Guide	1.7
100090	ClearCast 1.5 Poll Worker Guide	1.6.3
100084	ClearCast 1.5 Security Specification	1.4.2
100093	ClearCast 1.5 Software Design and Specification	1.4.1
100100	ClearCast 1.5 Supervisor Guide	1.7.3
100078	ClearCast 1.5 System Overview	1.4.3
100097	ClearCast 1.5 System Identification Guide	1.0.4
	ClearAccess Documents	
100109	ClearAccess 1.5 Acceptance Test Checklist	1.0.3
100051	ClearAccess 1.5 Build Procedures	1.1
100049	ClearAccess 1.5 Functionality Description	1.5.2
100085	ClearAccess 1.5 Hardware Specification	1.5
100053	ClearAccess 1.5 Installation Guide	1.6.5
100052	ClearAccess 1.5 Maintenance Guide	1.7
100054	ClearAccess 1.5 Poll Worker Guide	1.7.1
100035	ClearAccess Poll Worker Instructions (poster)	1.0
100033	ClearAccess Poll Worker Instructions-Multi Day Voting (poster)	1.0
10020	ClearAccess Simplified Voter Instructions (poster)	1.0
100050	ClearAccess 1.5 Security Specification	1.4.4

Table 3-1. TDP Documents *(continued)*

Document Number	Description	Version
100099	ClearAccess 1.5 Software Design and Specification	1.4.3
100055	ClearAccess 1.5 Supervisor Guide	1.7.3
100038	ClearAccess 1.5 System Identification Guide	1.1.2
100044	ClearAccess 1.5 System Overview	1.6
100056	ClearAccess 1.5 Voter Guide	1.1.2
100126	ClearAccess Hardware Compliance Addendum	N/A

3.1.3   QA & CM System Review

The Clear Ballot Group Quality and Configuration Management Manuals were reviewed for their fulfillment of Volume I, Sections 8 and 9, and the requirements specified in Volume II, Section 2. The requirements for these sections establish the quality assurance and configuration standards for voting systems to which manufacturers must conform and require voting system manufacturers to implement a quality assurance and configuration management program that is conformant with recognized ISO standards. As part of the review process, the Clear Ballot Group TDP documents were reviewed to determine if the stated policies were being followed.

Summary Findings

This testing utilized the TDP Review in conjunction with the 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 and Configuration Management documentation focused on the Clear Ballot Group's adherence to its stated QA and CM processes. No discrepancies were noted during the reviews.

3.1.4   Source Code Review, Compliance Build, Trusted build, and Build Documentation 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

• Automated Source Code Review: The Automated Source Code Review was performed to review the changes in the source code from the previously certified ClearVote 1.4 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 Section 5.2.7. No source code issues were found during the Manual Source Code review.

- Compliance Build: The compliance build was performed following the compliance review. Once the compliance review was performed and the source was deemed stable enough to proceed with testing, the source code and all additional packages were compiled into a Compliance Build.

Trusted Build: The trusted build consisted of inspecting customer submitted source code, COTS, and Third Party software products and combining them to create the executable code. This inspection followed the documented process from the "United States Election Assistance Commission Voting System Test Laboratory Program Manual" Section 5.5 – 5.7. Performance of the trusted build includes the build documentation review. The Trusted Build was performed following the completion of the Functional Configuration Audit.

3.1.5   Security Testing

A complete security evaluation was performed on the baselined system. The evaluation of the baselined 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. During the execution of these test procedures, the 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 voting system; establishing and maintaining controls to minimize errors; protection from intentional manipulation, fraud and malicious mischief; identifying fraudulent or erroneous changes to the voting system; and protecting the secrecy in the voting process. Tests conducted verified that the security mechanisms specified in the TDP Security Specification were implemented and adequately protect the system. 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.

To meet the objectives of this test campaign, the modified components were evaluated to determine the effectiveness of their physical security measures and to determine if the modification adversely impacted results from the baseline test campaign.

Summary Findings

As a result of the Security Testing, it was determined that the ClearVote 1.5 met the requirements of the security review. Any deficiencies encountered during testing were successfully resolved.

3.1.6 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 1.4) remained unchanged for the submitted modifications. The ClearVote 1.5 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 1.5 EMS applications are as follows:

- ClearDesign
- ClearCount

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

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.

3.1.6.1 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 will be conducted to insure 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 tests-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.

  o Voting System Capabilities: These functional capabilities include all operations conducted at the polling place by voters and officials including the generation of status messages.

  o 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-Claims Testing: System user instructions and procedures found in the TDP were followed to verify their accuracy and completeness. In addition any functional claims discovered in the TDP that were not specifically examined in other areas or that were items of interest were also tested.

– FCA-Mapping: Any modified 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.

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 1.5 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 any issues communicated to Clear Ballot Group had been successfully reconciled.

3.1.6.2 Volume & Stress

The Volume & Stress Tests are utilized to investigate the system's response to conditions that tend to overload the system's capacity to process, store, and report data.

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

Summary Findings

Volume and stress testing was successfully performed on the Clear Ballot 1.5 voting system. No issues were encountered during the test.

3.1.6.3 Accuracy

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

Summary Findings

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

The ClearVote 1.5 System successfully passed the Accuracy Test. All 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 1.5 System successfully completed the test with all actual results obtained during test execution matching the expected results.

3.1.6.4 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 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.

<u>Summary Findings</u>

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

Three general elections with the following breakdowns:

— General Election GEN-01: A basic election held in 4 precincts, one of which is a split precinct. This election contains 19 contests compiled into 4 ballot styles.   5 of the contests are in all 4 ballot styles. The other 15 contests are split between at least 2 of the precincts with a maximum of 4 different contest spread across the 4 precincts.

— General Election GEN-02: A basic election held in 3 precincts. This election contains 15 contests compiled into 3 ballot styles. 10 of the contests are in all 3 ballot styles with the other five split across the 3 precincts.

— General Election GEN-03: A basic election held in 2 precincts. This election contains 8 contests and compiled into 2 ballot styles.   4 of the contests are in both ballot styles. The other 4 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 6 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 2 precincts. This election contains 10 contests and is compiled into 2 ballot styles.   2 of the contests are in both ballot styles. The other 8 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 1.5 System successfully passed the System Integration Test. All deficiencies encountered during the System Integration 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 1.5 System successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results.

3.1.7   Usability and Accessibility Testing

Usability & Accessibility testing was performed to evaluate the ClearVote 1.5 voting system to the applicable requirements. Testing specifically focused on the ClearAccess and ClearCast units and the modifications implemented since the certification of the baseline 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 1.5 voting system was configured as per the Clear Ballot TDP. 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.

<u>Summary Findings</u>

The ClearCast and ClearAccess components successfully met the requirements of the Usability and Accessibility evaluation. Any deficiencies encountered during testing were successfully resolved.

3.1.8   Hardware Testing

The hardware configuration and design for the modification are unchanged from the baseline system. The ClearVote 1.5 Voting System consists of the following major components: ClearDesign, ClearAccess, ClearCast, and ClearCount. ClearVote is comprised of one proprietary hardware component (ClearCast) and two COTS hardware components (ClearCount) and (ClearAccess). All ClearDesign functions are managed by proprietary software running on COTS PCs/laptops/servers, which is excluded from hardware testing.

Previous hardware examinations were performed on the certified baseline system (ClearVote 1.4). The updates to the modified system (ClearVote 1.5) required the full suite of hardware and electrical testing to be performed, as listed below:

Electrical Tests:

- Electrical Power Disturbance – ClearCast, ClearAccess
- Electromagnetic Radiation – ClearCast, ClearAccess
- Electrostatic Disruption – ClearCast, ClearAccess
- Electromagnetic Susceptibility – ClearCast, ClearAccess
- Electrical Fast Transient – ClearCast, ClearAccess
- Lightning Surge – ClearCast, ClearAccess
- Conducted RF Immunity – ClearCast, ClearAccess
- Magnetic Fields Immunity – ClearCast, ClearAccess
- Electrical Supply – ClearCast, ClearAccess

Environmental Tests:

- Bench Handling – ClearCast, ClearAccess
- Vibration – ClearCast, ClearAccess
- Low Temperature – ClearCast, ClearAccess
- High Temperature – ClearCast, ClearAccess

- Humidity – ClearCast, ClearAccess

- Temperature Power Variation - ClearCast, ClearAccess

- Acoustic – ClearAccess

- Safety - ClearCast

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. Safety Testing was conducted at Bureau Veritas Consumer Product Services located in Littleton, MA. All testing at the NTS Longmont facility 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.

Summary Findings

Electrical Testing was performed on the ClearVote 1.5 components listed above. The procedures and results for this testing are included in the following NTS Test reports:

- ETR-PR079580, presented in Attachment A

- ITR-PR079580, presented in Attachment A.

- ETR-PR085361, presented in Attachment A

- ETR-PR085361, presented in Attachment A

The test results from this testing are summarized below:

Table 3-2. 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	Normal Operation & No Data Loss	Class B	Pass
FCC 15.109 ICES-003 VVSG Vol. 1 4.1.2.9	Radiated Emissions	Normal Operation & No Data Loss	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 ***
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

Table 3-2. Electrical Hardware Test Results *(continued)*

Standard/Method	Description	Criteria	Class/Level	Result
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 the ClearCast unit. The unit was outside of the allowable range during the emissions test. Clear Ballot was notified of the issue and performed an analysis of the occurrence and implemented a corrective action by applying a ferrite and shielding around the HDMI and power cables of the LCD. For a detailed description of the corrective actions please refer to the NTS Report No: ETR-PR085361. 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 the ClearCast unit. The unit was outside of the allowable range during the emissions test. Clear Ballot was notified of the issue and performed an analysis of the occurrence and implemented a corrective action by applying ferrites on the USB and power cables of the internal components. For a detailed description of the corrective actions please refer to the NTS Report No: ETR-PR085361. 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, (The ELO E-series and the ELO X-series All-in-One computers). The units stopped functioning during +/-15 kV Air discharge. Clear Ballot was notified of the issues and performed an analysis. Clear Ballot implemented a corrective action of adding ¾ inch 3 mil Kapton tape around the CPU enclosures of both the ELO E-series and X-series computers. 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 ClearVote 1.5 components listed above. The procedures and results for this testing are included in the following NTS Test reports:

- ENV-PR079580, presented in Attachment A

- ENV-PR085361 Rev 1, presented in Attachment A

- ENV-PR088479, presented in Attachment A

The Safety Test results are included in the Bureau Veritas Test Report:

- SS2043-1, presented in Attachment A

The test results from this testing are summarized below:

Table 3-3. Environmental Hardware Test Results

Standard/Method	Description	Criteria	Result
MIL-STD-810D, 516.3, I-3.8 VVSG Vol. 1 4.1.2.14, VVSG Vol. 2 4.6.2	Shock – Bench Handling	Normal Operation & No Data Loss	Pass
MIL-STD-810D, 514.3, I-3.2.1 VVSG Vol. 1 4.1.2.14, VVSG Vol 2 4.6.3	Vibration - Basic Transportation	Normal Operation & No Data Loss	Pass
MIL-STD-810D, 502.2, II-3 VVSG Vol 1 4.1.2.14, VVSG Vol 2 4.6.4	Low Temperature - Storage	Normal Operation & No Data Loss	Pass
MIL-STD-810D, 501.2, I-3.2 VVSG Vol 1 4.1.2.14, VVSG Vol 2 4.6.5	High Temperature - Storage	Normal Operation & No Data Loss	Pass
MIL-STD-810D, 507.2, I-3.2 VVSG Vol 1 4.1.2.14, VVSG Vol 2 4.6.5	Humidity – Hot/Humid	Normal Operation & No Data Loss	Pass
MIL-STD-810D, 501.2/502.2 VVSG Vol 1 4.1.2.13, 4.3.3, VVSG Vol 2 4.7.1	Reliability, Temp-Power Variation Testing	Normal Operation & No Data Loss	Pass *
VVSG Vol. 1 3.1.7.1, 3.2.2.2 (c)	Acoustic Noise Level Test	Normal Operation & No Data Loss	Pass
VVSG Vol. 1 4.1.2.4	Electrical Supply	Normal Operation & No Data Loss	Pass
VVSG Vol. 1 4.7.2	Maintainability	Ease of Maintenance	Pass
UL Standard for Safety for Information Technology Equipment, UL 60950-1, Second Edition VVSG Vol. 1 4.3.8	Product Safety	Normal Operation & No Data Loss	Pass

* The Temperature Power Variation test was conducted for 85 hours as allowed by the EAC based on two components being under test. At the conclusion of the test, the election results of the test were not as expected. There were a number of overvotes present in the results of both ClearCast units. Pro V&V notified the Clear Ballot Technical Representative of the issue.

After the initial investigation, it was determined by CBG that there was a scanner calibration issue with the ClearCast units. The scanned images of the ballots were displaying darker than normal. The test election and the ballot images were turned over to the Technical Representative to perform a deeper analysis in which a Root Cause Analysis was required and provided by Clear Ballot to Pro V&V and the EAC. Upon completion of the analysis, mitigation included updating the source code to correct the calibration of the scanner, a review of the Root Cause Analysis, and additional testing on the new source code performed by CBG in Boston.

Both ClearCast units used during the test were provided to Pro V&V to repeat the test in which the test was completed successfully without further issue. These units were also used for the duration of the rest of the test campaign.

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. Any deficiencies encountered were logged throughout the test campaign into the Pro V&V tracking system (Mantis) for disposition and resolution. In each instance, if applicable, the resolutions were 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 3-4.

Table 3-4. Noted Deficiencies

ID#	Test Category	Deficiency	Resolution
456	FCA	ClearAccess: The accessible keypad and sip-and-puff will not page down through the vote selections on the review screen.	A source code update was required so the ClearAccess pages down on the review screen. Functional regression testing was performed to verify that the issue was resolved.
460	Hardware	ClearCast: The election results were incorrect with overvotes during the Temp/Power test.	A source code update was required to correct the calibration on the scanner. The Temperature Power Variation Test was performed a second time and the ClearCast component successfully completed the test.
461	FCA	ClearCast: A backup test election from ClearVote 1.4 was restored in 1.5 ClearDesign, That election was used to generate a BDF file for use in ClearCast FCA testing. The restored election caused the ClearCast unit to print gibberish on the write-in report.	A source code update was required so that write-in report printed correctly. Functional regression testing was performed to verify that the issue was resolved.
462	FCA	ClearCast: When a party selected in a Straight Party contest is not the first party of a Cross-Endorsed candidate listed in a contest, that Straight Party selection is not counted.	A source code update was required so that the Straight Party section is counted for all parties. Functional regression testing was performed to verify that the issue was resolved.

Table 3-4. Noted Deficiencies *(continued)*

ID#	Test Category	Deficiency	Resolution
463	FCA	ClearCount: When a party selected in a Straight Party contest is not the first party of a Cross-Endorsed candidate listed in a contest, that Straight Party selection is not counted	A source code update was required so that the Straight Party section is counted for all parties. Functional regression testing was performed to verify that the issue was resolved.
465	Hardware	Radiated Emissions: ClearCast	This issue was resolved by adding shielding around the HDMI and power cables of the LCD and ferrites on USB and power cables of the internal components.
466	Hardware	Electrostatic Disruption: ClearAccess: ELO E series	This issue was resolved by adding ¾ inch 2 Mil Kapton tape around the CPU housing of the computers. This can only be performed by qualified CBG personnel prior to initial use. For detailed instructions please see document # 100126-10013: ClearAccess Hardware Compliance Addendum
467	Hardware	Electrostatic Disruption: ClearAccess: ELO X series	This issue was resolved by adding ¾ inch 2 Mil Kapton tape around the CPU housing of the computers. This can only be performed by qualified CBG personnel prior to initial use. For detailed instructions please see document # 100126-10013: ClearAccess Hardware Compliance Addendum

4.0   RECOMMENDATION FOR CERTIFICATION

The ClearVote 1.5 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 1.5 functioned as a complete system during System Integration Testing. Based on the test findings, Pro V&V recommends the EAC grant the ClearVote 1.5 system, as identified in Tables 4-1 and 4-2, certification to the EAC 2005 VVSG.

Table 4-1. ClearVote 1.5 Voting System Software

Firmware/Software	Version
ClearDesign Components, Version 1.5.1	
Windows	10 Pro 1607
Google Chrome	55.0.2883.87

Table 4-1. ClearVote 1.5 Voting System Software *(continued)*

Firmware/Software	Version
Ubuntu	16.04.4 LTS
MySQL	5.7.21
Apache	2.4.18
libapache2-mod-fcgid	2.3.9
PhantomJS	1.9.8
Usbmount	0.0.22
Unzip	6.0.20
Samba	4.3.11
Python PIP	8.1.1
Zip	3.0.11
Pyinstaller	3.2.1
Python JSMIN	2.2.1
Python	2.7.12
Python webpy	0.38
Python MySQL DB	1.3.7
SQLAlchemy	1.0.15
Python Pillow	3.1.2
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)	2.0.10
OpenSSL	1.0.2g
DataTable	1.10.16
DataTable Buttons	1.4.2
DataTable Buttons JSZip	2.5.0
DataTable Buttons Pdfmake	0.1.32
DataTablePlugins	1.10.16
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

Table 4-1. ClearVote 1.5 Voting System Software *(continued)*

Firmware/Software	Version
libmp3lame	0.5.0
jszip	3.1.2
papaparse	4.1.2
jsmin	12/4/2003
ClearAccess Components, Version 1.5.1	
Windows	10 Pro 1607
Google Chrome	61.0.3163.100
nsis	3.01
PyInstaller	3.2
Python	2.7.10
webpy	0.38
Python-future	0.15.2
pefile	2016.3.28
pywin	223
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
Zebra CoreScanner Driver	3.03.0001
ClearCast Components, Version 1.5.1	
scanner_control	0.0.33
Ubuntu	18.04.1 LTS
google_chrome	70.0.3538.110
zeromq	4.2.3
pyinstaller	3.2.1
openssl-fips	2.0.10
openssl	1.1.0g
libScanAPI.a	1.1.3
DataTables	1.10.5
JTSage DateBox	4.0.0
jQuery.NumPad	1.4
jQuery	1.12.4
jquery.ui	1.11.3

Table 4-1. ClearVote 1.5 Voting System Software *(continued)*

ClearCount Components, Version 1.7.1	
Firmware/Software	**Version**
Windows	10 Pro 1607
Google Chrome	55.0.2883.87
Ubuntu	16.04.1 LTS
Apache	2.4.18
libapache2-mod-fcgid	2.3.9
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	0.8
JavaScript tooltip library	1.3
JavaScript pep library	1.0
JavaScript LESS library	1.3.3
Fujitsu fi-6400	PaperStream 1.30.0
Fujitsu fi-6800	PaperStream 10.10.710
Fujitsu fi-7180	PaperStream 1.4.0

Table 4-2. ClearVote 1.5 Voting System Equipment

Component	Model	Serial Number
ClearDesign Components		
Dell Latitude (client)	5590	9W5D1N2
Dell Precision (client)	T3620	GSKRMV2 & GSKSMN2
Dell PowerEdge (server)	T440	H6JZLN2
Dell PowerEdge (server)	T130	5G0YLN2
Dell 24 inch Monitor	SE2416H	FVWV5G2
Dell 22 inch Monitors	E2216HV	36765D2 & 90665D2
Cisco 8-Port Switch	SG250-08	PSZ21451MLJ
Lenovo USB DVD Burner	LN-8A6NH11B	8SSDX0H33226L1CB7107099
Sabrent 13 port USB 2.0 Hub	HB-U14P	1996
Zebra Technologies Bar Code Scanner	DS457	18059000501984, 18059000501981, 18095000500487, 18095000500491
SySTOR Multiple USB Duplicator	SYS-USBD-11	ES-27095
ClearAccess Components		
ELO 15 inch AIO	E-Series (15E2)	A18C004079, A18C004075, A18C004071, A18C004077, A18C004080, L17C014810, & K17C012858
ELO 20 inch AIO	X-Series (20X2)	D18Q000334, D18Q000335, B18Q001601, B18Q001599 & B18Q000597
Brother Laser Printer	HL-L2350DW	U64964A8N238333 & U64964A8N238334
Oki Data Laser Printer	B432dn	AK5B007647A0
Storm EZ Access Keypad	EZ08-222013	15000005, 15000007, 15020478
Origin Instruments Sip/Puff Breeze with Headset	AC-0313-H2	CBG-SP-001, 002, 003
Monoprice Over the Ear Pro Headphones	8323	CBG-mono-001, 002, 003
ElectionSource Table Top Voting Booth (Privacy Screen)	VB-60B	CBG-VB-001
3M EMI Copper Foil Shielding Tape, , ¼ inch	1181	1181-CBG1
Lexan or acrylic plastic cover (8 mm)	2"x4"	Cover-CBG1
3/4" 2 mil Kapton tape	S-17213	CBG-KAP01
APC Smart-UPS	SMT2200C	AS1809160852

Table 4-2. ClearVote 1.5 Voting System Equipment *(continued)*

Component	Model	Serial Number
ClearCount Components		
Dell Latitude (client)	5590	5M5D1N2, 3T8D1N2, 4P4F1N2, B5TD1N2, DP5D1N2, FV8D1N2
Dell Precision (client)	T3620	GSKQMN2
Dell PowerEdge (server)	T440	H6J5MN2
Dell PowerEdge (server)	T130	5G0ZLN2
Fujitsu Scanner	fi-7180	A20DC10302 & A20D000798
Fujitsu Scanner	fi-6800	A9HCA00737 & A9HCC00543
Fujitsu Scanner	fi-6400	AKHCC00362 & AKHCC00609
Lenovo USB DVD Burner	LN-8A6NH11B	8SSDX0H33226L1CB7107099
Western Digital 4 TB External HD	WDBFJK0040HBK-NESN	WCC7K7YF11ZD
Western Digital 8 TB External HD	WDBFJK0080HBK-NESN	75H4PXJD
Netac Keypad Encryption Portable Hard Disk	K390	R4JT22619T
CORSAIR Flash Padlock 3	CMFPLA3B-32GB	CBG-Pad-002
Dell 24 inch Monitor	P2415Q	3TZSJ92
Dell 22 inch Monitor	P2217	7818672
Dell 22 inch Monitor	S2240M	CN-0CFGKT-64180-58B-0X3T
Cisco 8-Port Switch	SG250-08	PSZ21451MYX
Cisco 26-Port Switch	SG250-26	DNI203400A6 & DNI203400AW
NETGEAR 8-Port Gigabit VPN Firewall	FVS318G	40F266BA00280
TP-LINK 5-Port Gigabit Switch	TL-SG105E	216C319009010
Sabrent 13 port USB 2.0 Hub	HB-U14P	1997
APC Smart-UPS	SMT1500	3S1525X07491
Lenovo USB DVD Burner	LN-8A6NH11B	8SSDX0H33226L1CB7107099
EZ Scanning Shelves	Model: WorkEZ	CBG-EZ-001, 002,003, & 004
ClearCast Components		
ClearCast	Model D, Revision 4	CCD1902007 CCD1902009, CCD1902010, CCD1902013
Ballot Bag	CBG-BAG-002	BAG001 through BAG004
CORSAIR Flash Padlock 3	CMFPLA3B-32GB	CBG-Pad-001 through 010
Wurth ferrites	74271142,74275812 74275813,74271132 ,74271722	FRT001 through FRT020

APPENDIX A

Hardware Test Reports

(Provided Separately)

Electrical Test Reports

NTS - ETR-PR079580

NTS - ITR-PR079580

NTS - ETR-PR085361

NTS - ITR-PR085361

Environmental Test Reports

NTS - ENV-PR079580

NTS - ENV-PR085361 Rev 1

NTS - ENV-PR088479

Safety Report

Veritas - SS2043-1

APPENDIX B

Trusted Builds

Trusted Builds

The ClearVote 1.5 Voting System Trusted Build was performed using the steps described in section 5.5 of the EAC Voting System Testing and Certification Program Manual, Version 2.0. The Trusted Build yielded the following software outputs which are described below along with their associated Filenames and Hash Values in SHA 256 format:

ClearAccess Version 1.5.1 – The ClearAccess trusted build was performed using the "ClearAccess 1.5 Build Procedures" document Version 1.1, dated 08/15/2018, provided by Clear Ballot Group. The trusted build yielded the following output file and the associated Hash Value:

- ClearAccess-1.5.1 Installer.exe
  SHA256: 7158be2d7106c53751d075ef849bab1d2b7851a6022569d9151e1ee28f66d854

ClearCast Version 1.5.1– The ClearCast trusted build was performed using the "ClearCast 1.5 Build Procedures" document Version 1.2.2, dated 11/20/2018, provided by Clear Ballot Group. The trusted build yielded the following output file and the associated Hash Value:

- ClearCastImage_151b35e5af_20181130.iso
  SHA256: 5a09475172ea6159e8cffb1d6c9224358f229d215013aac644e4686a22f93a38

ClearCount Version 1.7.1 – The ClearCount trusted build was performed using the "ClearCount 1.5 Build Procedures" document Version 1.4.6, dated 08/15/2018, provided by Clear Ballot Group. The trusted build yielded the following output file and the associated Hash Value:

- clearcount.iso
  SHA256: b0626484ee3e1d3bb532ec9fbeae81cd8148ff3d08e1151b195a17b42780428b

ClearDesign Version 1.5.1 – The ClearDesign trusted build was performed using the "ClearDesign 1.5 Build Procedures" document Version 1.0.5, dated 08/30/2018, provided by Clear Ballot Group. The trusted build yielded the following output files and their associated Hash Values:

- clearDesign-1.5.1.zip
  SHA256: 53a6dcd0951ff9e26834af3e2aa8e2694c2e312ea9909006593089fd789c1787

- install-setup.zip
  SHA256: 584e174a1206c7cf3c2957758e7428ae790e5f1da7a5a576cc208099e7c15b49

APPENDIX C

Warrant of Accepting Change Control Responsibility

November 19, 2018

Mr. Michael Walker
Pro V and V
700 Boulevard South, Suite 102
Huntsville, Alabama 35802

Re: Clear Ballot Group Warrant of Accepting Change Control Responsibility as defined in Appendix B of the EAC VSTL Program Manual and NOC 09-004

Mr. Walker

In agreement with and concerning the requirement referenced above, Clear Ballot Group, Inc. warrants to incorporate all changes made to the ClearVote 1.5 voting system during the test campaign to any deployed voting system, and its components before a mark of EAC Certification is applied to the system and or its components.

Sincerely,

Afua Twumasi-Ankrah
Certification Manager

APPENDIX D

AS-RUN TEST PLAN

(Provided Separately)

CBG ClearVote 1.5 Test Plan TP-CBG-2018-01.01 As-Run Rev B