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Test Plan for EAC 2005 VVSG Certification Testing Clear Ballot Group ClearVote 2.0 Voting System

EAC Project Number: CBG-CV-20

Version: 03

Date: 09/25/2019

U.S. Election Assistance Commission

VSTL

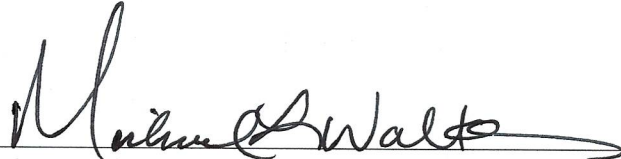
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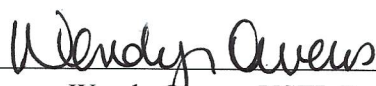
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REVISIONS

Revision	Description	Date
00	Initial Release	05/28/2019
01	Updates per EAC comments (added Appendix, added hardware updates, added serial numbers, and corrected information)	06/18/2019
02	As-Run Test Plan	08/30/2019
03	Updated with EAC comments	09/25/2019

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1.0 INTRODUCTION

The purpose of this Test Plan is to document the procedures that Pro V&V, Inc. will follow to perform certification testing during a system modification campaign for the Clear Ballot Group (CBG) ClearVote 2.0 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. Prior to submitting the voting system for testing, CBG submitted an application package to the EAC for certification of the ClearVote 2.0 Voting System. The application was accepted by the EAC and the project was assigned the unique Project Number of CBG-CV-20.

At test conclusion, the results of all testing performed as part of this test campaign will be submitted to the EAC in the form of a national certification test report.

1.1 Description and Overview of EAC 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 1.5 System. The following sections contain a product description and an overview of the design methodology of the ClearVote 1.5 Voting System, as taken from the Clear Ballot Group technical documentation.

The ClearVote 1.5 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.
- **Network Switch:** Used to connect the DesignStations to the DesignServer using a wired, closed Ethernet-based network.

ClearCount

ClearCount is a central, high-speed, optical scan ballot tabulator coupled with ballot processing applications. The ClearCount software runs on unmodified COTS laptop or desktop computers running the Windows operating system and supports specific models of 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.
- Network Switch: Used to connect the ScanStations to the ScanServer using a wired, closed Ethernet.
- Election Administration Station: One or more Windows laptop or desktop computers installed with browser software, linked by a wired Ethernet connection to the ScanServer using the network switch. This station can serve multiple uses: user administration, election administration, adjudication, and reporting. This station is also used to consolidate the vote totals and ballot images from the ClearCast precinct tabulator. The vote totals and ballot images are consolidated by the ClearCount Software via the ClearCast USB drive.

All files that make up the ClearCount software reside on a single 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 counts the ballots and adjudicates the vote for the ballots scanned on that ScanStation. Upon completion of a batch of ballots, the Tabulator application sends its results and the associated card images to the central election database on the ScanServer
- Election Database: A centralized election database that resides on the ScanServer and collects the output of each Tabulator.
- Election Reports: A suite of reports that provides election results and analysis and allows election officials to review individual ballot images.
- Card Resolutions tool: A web application that allows election officials to review and appropriately resolve unreadable voted ballots.
- User and Election Database Management through web applications: On the User Administration dashboard, the administrator can add, rename, or delete users, assign permissions, and change user passwords. On the Election Administration dashboard, the administrator can create or delete an election, set an election as active, merge ClearCast election results, and backup or restore an election.

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 voting system consist of computers 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 1.5 Voting System. The tables below describe the certified equipment and firmware versions.

Detailed descriptions of the ClearVote 1.5 test campaign are contained in Pro V&V Report No. TR-CBG-2018-01.01 Rev D, 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 1.5 voting system (ClearCast 1.5.1, ClearCount 1.7.1, ClearDesign 1.5.1, and ClearAccess 1.5.1).

Table 1-1. Voting System Software

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

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

Firmware/Software	Version
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
libmp3lame	0.5.0
jszip	3.1.2
papaparse	4.1.2
jsmin	12/4/2003
<i>ClearAccess Components, Version 1.5.1</i>	
Windows	10 Pro 1607
Google Chrome	61.0.3163.100
Nsis	3.01
PyInstaller	3.2
Python	2.7.10

Table 1-1. Voting System Software (continued)

Firmware/Software	Version
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
<i>ClearCast Components, Version 1.5.1</i>	
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
<i>ClearCount Components, Version 1.7.1</i>	
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

Table 1-1. Voting System Software (continued)

Firmware/Software	Version
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 1-2. Voting System Equipment

Component	Model	Serial Number
<i>ClearDesign Components</i>		
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
SySTOR Multiple USB Duplicator	SYS-USBD-11	ES-27095
Zebra Technologies Bar Code Scanner	DS457	18059000501984, 18059000501981, 18095000500487, 18095000500491

Table 1-2. Voting System Equipment (continued)

<i>ClearAccess Components</i>		
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
<i>ClearCount Components</i>		
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

Table 1-2. Voting System Equipment (continued)

<i>ClearCount Components</i>		
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
<i>ClearCast Components</i>		
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
Würth ferrites	74271142,74275812 74275813,74271132 ,74271722	FRT001 through FRT020

1.1.2 Description of Modification

The ClearVote 2.0 is a modified voting system configuration that includes upgrades to the ClearCast, ClearAccess, ClearCount, and ClearDesign components of the ClearVote 1.5 system. The modifications include the following specific changes between the ClearVote 2.0 system and the previously certified baseline ClearVote 1.5 system, as taken from the change notes. Detailed information on how the modifications will be addressed is included in Section 1.1.5. Note: For a more detailed listing of the changes, please refer to Appendix B of this Test Plan and/or the *ClearVote 2.0 Change Notes, Clear Ballot Part Number: 100128-10016*.

The submitted modifications include the following summarized changes from version 1.5 to 2.0:

ClearAccess

- A minor UI enhancement
- Enhanced security: encryption of the ADF
- Support for printing of ballot stubs with serial numbers
- Defect fixes

- New UPS

ClearCast

- Various UI enhancements
- Workflow enhancements
- Report printing enhancements
- Security enhancements
- Other enhancements
- Code maintenance
- Defect fixes
- Hardware enhancements

ClearCount

- UI enhancements
- XML and report enhancements
- Security enhancements
- Single-row cross endorsement
- Code maintenance
- Defect fixes

ClearDesign

- UI enhancements
- Ballot enhancements
- Performance enhancements
- Security enhancements
- Other enhancements
- Code maintenance
- Defect fixes

1.1.3 Initial Assessment

An initial assessment on the submitted modifications was performed to determine the scope of testing. Testing from the previous test campaign was used to establish the baseline. Based on the assessment, it was determined the following tasks would be required to verify compliance of the modifications:

- Source Code Review, Compliance Build, Trusted Build, and Build Document Review
- System Level Testing
 - System Integration
 - Accuracy

- Technical Documentation Package (TDP) Review
- Functional Configuration Audit (FCA)
- Hardware Testing
- Usability and Accessibility Testing
- Security Testing

1.1.4 Regression Test

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

1.1.5 System Modification Evaluation

The submitted modifications to the ClearVote 2.0 System consist primarily of software changes to accommodate defect resolutions, enhancements, and improved security and user interface features. Hardware modifications to ClearCast and ClearAccess are also submitted for this evaluation.

To verify the modifications are successfully addressed throughout the test campaign, each modification will be tracked and verified during the execution of the relevant test area. For example, source code changes will be verified during the source code review. Modifications requiring functional test verification will be evaluated by executing the standard Accuracy Test, the System Integration Test, or during performance of the FCA. Modifications that are not adequately evaluated during the performance of these tests will be subjected to specifically designed test cases.

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
- 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
- Pro V&V Test Report No. TR-CBG-2018-01.01 Rev D, “Test Report for EAC 2005 VVSG Certification Testing Clear Ballot Group ClearVote 1.5 Voting System”, dated 03/12/19
- EAC Requests for Interpretation (RFI) (listed on www.eac.gov)
- EAC Notices of Clarification (NOC) (listed on www.eac.gov)
- Clear Ballot Group’s Technical Data Package (*A listing of the ClearVote 2.0 documents submitted for this test campaign is listed in Section 4.6 of this Test Plan*)

1.3 Terms and Abbreviations

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

- “ADA” – Americans with Disabilities Act 1990
- “BMD” – Ballot Marking Device
- “CBG” – Clear Ballot Group
- “CM” – Configuration Management
- “COTS” – Commercial Off-The-Shelf
- “EAC” – United States Election Assistance Commission
- “EMS” – Election Management System
- “FCA” – Functional Configuration Audit
- “HAVA” – Help America Vote Act
- “ISO” – International Organization for Standardization
- “NOC” – Notice of Clarification
- “PC” – Personal Computer
- “PCA” – Physical Configuration Audit
- “QA” – Quality Assurance
- “RAM” – Random Access Memory
- “RFI” – Request for Interpretation
- “TDP” – Technical Data Package
- “UPS” – Uninterruptible Power Supply
- “VSTL” – Voting System Test Laboratory
- “VVSG” – Voluntary Voting System Guidelines

1.4 Project Schedule

The Project Schedule for the test campaign is located in Appendix A. The dates on the schedule are not firm dates but planned estimates based on the anticipated project work flow.

1.5 Scope of Testing

The scope of testing focused on evaluating the modifications detailed in Section 1.1.2 of this Test Plan. Primarily, these modifications focused on upgrades to the components of the previously certified ClearVote 1.5. To determine the ClearVote 2.0 test requirements, the submitted modifications were evaluated against each section of the EAC VVSG 1.0 to determine the applicable tests to be performed. Based on this assessment, it was determined that multiple areas within the EAC VVSG 1.0 would be evaluated to encompass the required tests. A breakdown of the areas and associated tests is listed below:

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

1.5.1 Block Diagram

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

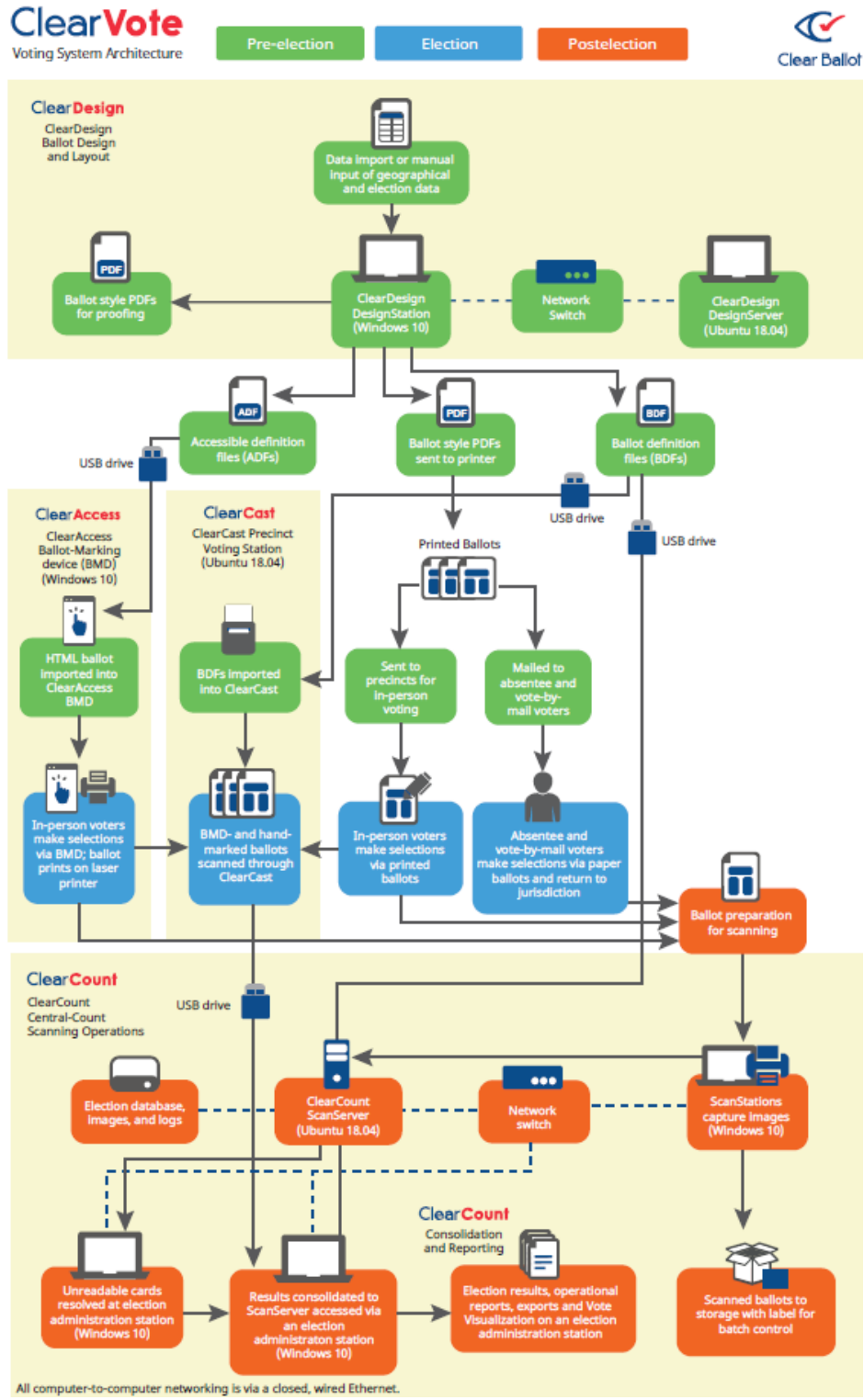


Figure 1-1. ClearVote 2.0 System Architecture

1.5.2 System Limits

The system limits that CBG has stated to be supported by the ClearVote 2.0 Voting System are listed in the tables below.

Table 1-3. 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 2.0 Voting System are as follows:

Table 1-4. 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 1-5. 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							

1.5.3 Supported Languages

The submitted voting system supports:

- English
- Spanish
- Chinese
- Korean
- Vietnamese
- Danish
- Dutch
- Flemish
- French
- German
- Italian
- Japanese
- Norwegian
- Portuguese
- Swedish

Due to the limited scope of testing, only English and Spanish language ballots will be cast during the performance of functional testing. Additionally, one character based language (Chinese) will be tested during System Integration Testing.

1.5.4 Supported Functionality

The ClearVote 2.0 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
- Cross-party endorsement
- Judge initials

1.5.5 VVSG

The ClearVote 2.0 shall be evaluated against the relevant requirements contained in the EAC VVSG 1.0.

1.5.6 RFIs

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

1.5.7 NOCs

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

2.0 PRE-CERTIFICATION TESTING AND ISSUES

This section describes previous testing performed prior to submitting the voting system to the EAC.

The following pre-certification testing has been performed on an “At-Risk” basis:

Technical Data Package (TDP) Review

An initial TDP review was performed on the documents submitted for this test campaign. The initial review is an abbreviated review performed in order to determine if the documents contain sufficient information.

Physical Configuration Audit (PCA)

An initial PCA has been performed to baseline the system prior to test campaign commencement. The PCA was performed by documenting each hardware and software component of the voting system by name, model, serial number, major component, and any other relevant information needed for identification. Photographs of each hardware component were also taken.

2.1 Evaluation of Prior VSTL Testing

Pro V&V evaluated to the published Final Test Report for the ClearVote 1.5 in order to baseline the current system under test.

2.2 Evaluation of Prior Non-VSTL Testing

No prior non-VSTL testing of the ClearVote 2.0 modifications were considered for this test campaign

2.3 Known Field Issues

The ClearVote 2.0 is a modification to a previously certified system and has not been fielded for use.

3.0 MATERIALS REQUIRED FOR TESTING

The following sections list all materials needed to enable the test engagement to occur.

The materials required for testing of the ClearVote 2.0 Voting System include all materials to enable the test campaign to occur. This includes the applicable hardware and software as well as the TDP, test support materials, and deliverable materials, as described in the following subsections.

3.1 Software

This subsection lists the proprietary and COTS software to be provided by the manufacturer as part of the test campaign. The individual components are compiled to create the ClearVote 2.0 Voting System (ClearCast 2.0, ClearCount 2.0, ClearDesign 2.0, and ClearAccess 2.0).

Table 3-1. ClearVote 2.0 Voting System Software

Firmware/Software	Version
<i>ClearDesign Components, Version 2.0.1</i>	
Google Chrome	55.0.2883.87
Ubuntu	18.04.01 LTS
MySQL	5.7.26
Apache	2.4.18
libapache2-mod-fcgid	2.3.9
PhantomJS	1.9.8
Unzip	6.0.21
Samba	4.7.6
Python PIP	9.0.1
Zip	3.0.11
Pyinstaller	3.2.1
Python JSMIN	2.2.1
Python	2.7.15
Python webpy	0.38
Python MySQL DB	1.3.10
SQLAlchemy	1.0.15
Python Pillow	5.1.0
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)	2.0.10

Table 3-1. ClearVote 2.0 Voting System Software (continued)

Firmware/Software	Version
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
libmp3lame	0.5.0
jszip	3.1.2
papaparse	4.1.2
jsmin	12/4/2003
ClearAccess Components, Version 2.0.1	
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	2018.8.8
pywin	223
jquery	1.10.2
DataTables	1.10.16
jsmin	2003-12-04
Zebra scanner driver	3.04.0007
ClearCast Components, Version 2.0.0	
scanner_control	0.0.33
Ubuntu	18.04.1 LTS
google_chrome	76.0.3809.87-1

Table 3-1. ClearVote 2.0 Voting System Software (continued)

Firmware/Software	Version
zeromq	4.2.3
pyinstaller	3.2.1
openssl-fips	2.0.10
openssl	1.0.2g
libScanAPI.a	1.1.4
DataTables	1.10.16
JTSage DateBox	4.0.0
jQuery.NumPad	1.4
jQuery	1.12.4
jquery.ui	1.11.3
<i>ClearCount Components, Version 2.0.1</i>	
Windows	10 Pro 1607
Google Chrome	55.0.2883.87
Ubuntu	18.04.1 LTS
Apache	2.4.29
libapache2-mod-fcgid	2.3.9
Python(part of Ubuntu)	2.7.15
MySQLdb (part of Ubuntu)	5.7.26
PyInstaller	3.2.1
PollyReports	1.7.6
OpenSSL	1.1.0g
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	10.10.710

Table 3-1. ClearVote 2.0 Voting System Software (continued)

Firmware/Software	Version
Fujitsu fi-7180	PaperStream 1.4.0
Aptitude	1.6.11
auditd	2.8.2
debconf	1.5.66
pmount	0.9.23
Samba	4.7.6
udisks	2.7.6

3.2 Equipment

This subsection lists the proprietary and COTS equipment provided by the manufacturer as part of the test campaign.

For COTS equipment, every effort will be made to verify that the COTS equipment has not been modified for use. This will be accomplished by performing research using the COTS equipment manufacturer's websites based on the serial numbers and service tag numbers for each piece of equipment. Assigned test personnel will evaluate COTS hardware, system software and communications components for proven performance in commercial applications other than voting. For PCs, laptops, and servers, the service tag information will be compared to the system information found on each machine. Physical external and internal examination will also be performed when the equipment is easily accessible without the possibility of damage. Hard drives, RAM memory, and other components will be examined to verify that the components match the information found on the COTS equipment manufacturer's websites.

Table 3-2. ClearVote 2.0 Voting System Equipment

Component	Model	Serial Number
<i>ClearDesign Components</i>		
Dell Latitude Laptop (client)	5580, 5590	CF3L3G2, B5TD1N2
Dell Optiplex (client)	7440	JXDFHH2
Dell Precision Tower (client)	T3620	GSKRMV2 & GSKSMN2
Dell PowerEdge Server (server)	T130, T140, T440, T630	5G0YLN2, 8BFH3W2, H6JZLN2, GCHLHL2
Dell 24 inch Monitor	SE2416H	FVWV5G2
Dell 22 inch Monitors	E2216HV	36765D2 & 90665D2
Cisco 8-Port Switch	SG250-08	PSZ21451MLJ
LG DVD Burner	GP65NB60	LG-DVD-001
Anker 10 port USB 3.0 Hub	AK-68ANHUB-B10A	22XGHFWC, 22XGHGKX
SySTOR Multiple USB Duplicator	SYS-USBD-11	ES-27095

Table 3-2. ClearVote 2.0 Voting System Equipment (continued)

Component	Model	Serial Number
Corsair Flash Padlock 3 32 GB	Secure USB 3.0 Flash Drive	CMFPLA3B-32GB
SanDisk Extreme Go 64 GB USB	3.1 USB Drive	SDCZ800-064G-G46
SanDisk Ultra Flair 32 GB USB	3.0 Drive	SDCZ73-032G-A46, SDCZ73-032G-G46
<i>ClearAccess Components</i>		
ELO 15 inch AIO	E-Series (ESY15E2)	L17C014810 & A18C004080
Dell OptiPlex AIO	5250	HCGMGK2
Oki Data Laser Printer	B432dn	AK5B007647A0 & AK91021454C0
ELO 20 inch AIO	X-Series (ESY20X2)	D18Q000334, D18Q000335, B18Q001601, B18Q001599 & B18Q000597
Oki Data Laser Printer	B432dn-B	AK8C017016C0, AK8C017022C0
Dell Inspiron 15"	7000 Series	80S1YD2
Brother Laser Printer	HL-L2340DW	U63879M4N62861
Brother Laser Printer	HL-L2350DW	U6496A8N238333
Micrologic Tray Kit	B432TrayKit	CBG-MTK-001
Zebra Technologies Bar Code Scanner	DS457-SR, CBL-58926-05	18059000501984, 18059000501981, 18095000500487, 18095000500491
Storm EZ Access Keypad	EZ08-222013	15000005, 15000007, 15020478
Samson Over-Ear Stereo Headphones	SASR350	SR350J8G390 & SR350J8G396
Clear Ballot Privacy Screen	CB-1097-1.5	CBG-PVS-001
Ergotron Neo-Flex	Widescreen Lift Stand	33-329-085
Corsair Flash Padlock 3 32 GB	Secure USB 3.0 Flash Drive	CMFPLA3B-32GB
SanDisk Extreme Go 64 GB USB	3.1 USB Drive	SDCZ800-064G-G46
SanDisk Ultra Flair 32 GB USB	3.0 Drive	SDCZ73-032G-A46, SDCZ73-032G-G46
Würth	742-711-32, 742-712-22, 742-717-22	FRT021 through FRT025
Polymide Film Tape	1" 2 mil	CV-1210-2.0
Polymide Film Tape	2" 2 mil	CV-1211-2.0
Polymide Film Tape	4" 2 mil	CV-1212-2.0
APC Smart-UPS	SMT2200C	AS1809160852

Table 3-2. ClearVote 2.0 Voting System Equipment (continued)

Component	Model	Serial Number
Lifetime 4-Foot Folding Table	4428	FT-001
LG DVD Burner	GP65NB60	LG-DVD-002
CyberPower Smart App UPS	PR1500RT2U	PY3HZ2002933, PY3HZ2003000
ClearCount Components		
Dell Latitude Laptops (ScanStation)	5580, 5590	2F3L3G2, 9W5D1N2
Dell Precision Tower (Election Administration)	T3620	GSKQMN2
Dell Latitude Laptops (Election Administration)	5580, 5590	C9S22G2, 5M5D1N2
Dell PowerEdge Server (ScanServer)	T130, T140, T330, T440	5G0ZLN2, 8BFJ3W2, FHV9RD2, H6J5MN2
Dell OptiPlex (Election Administration)	7440	JXDFHH2
Fujitsu Scanner	fi-7180	A20DC10302 & A20D000798
Fujitsu Scanner	fi-6800	A9HCA00737 & A9HCC00543
Fujitsu Scanner	fi-6400	AKHCC00362 & AKHCC00609
LG DVD Burner	GP65NB60	LG-DVD-003
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
Dell 24 inch Monitor	P2415Q	3TZSJ92
Dell 22 inch Monitor	P2217	7818672
Cisco 8-Port Switch	SG250-08	PSZ21451MYX
Cisco 26-Port Switch	SG250-26	DNI203400A6 & DNI203400AW
Corsair Flash Padlock 3 32 GB	Secure USB 3.0 Flash Drive	CMFPLA3B-32GB
SanDisk Extreme Go 64 GB USB	3.1 USB Drive	SDCZ800-064G-G46
SanDisk Ultra Flair 32 GB USB	3.0 Drive	SDCZ73-032G-A46, SDCZ73-032G-G46
Anker USB Hub	AK-68ANHUB-B10A)	22XGHFWC, 22XGHGKX
APC Smart-UPS	SMT-1500C	3S1831X12280
EZ Scanning Shelves	Model: WorKEZ	CBG-EZ-001, 002,003, & 004
StarTech 4-Port VGA KVM Switch w/Hub	SV431USB	G73011TG80247

<i>ClearCast Components</i>		
ClearCast	Model D Revision 5	041902446, 041902447, 041902453
Corsair Flash Padlock 3 32 GB	Secure USB 3.0 Flash Drive	CMFPLA3B-32GB
SanDisk Extreme Go 64 GB USB	3.1 USB Drive	SDCZ800-064G-G46
SanDisk Ultra Flair 32 GB USB	3.0 Drive	SDCZ73-032G-A46, SDCZ73-032G-G46
Ballot Bag	CV-1032-1.5, CV-113-1.5	bag001, bag002
Ballot Box	CV-1082-2.0	box001
Wurth Ferrites	74271142,74275812 74275813,74271132 ,74271722	FRT001 through FRT020

3.3 Test Materials

This subsection lists the test materials required to execute the required tests throughout the test campaign.

The following materials are expected to be supplied by Clear Ballot to facilitate testing:

- USB flash drives
 - CORSAIR Flash Padlock 32 GB
 - SanDisk Extreme Go, 64 GB
 - SanDisk Ultra Flair 32 GB
- test decks, 3 in. thermal paper, 24 lb. bond or similar paper for results reports
- ballot paper (60 lb. cover stock, 65 lb. cover stock, 90 lb. index stock)
- power cords, monitor cables, USB cables, and Ethernet cables
- security seals, security ties, and ballot marking devices.
- Other materials and equipment as required

3.4 Deliverable Materials

This subsection lists the materials identified by the manufacturer as materials deliverable to the end user for the system being tested.

Table 3-3. Voting System Deliverables

Material	Version	Description
ClearDesign	2.0.1	EMS Software
ClearAccess	2.0.1	BMD software
ClearCount	2.0.1	Central Count and Tabulation Software
ClearCast	2.0.0	Precinct Count Software
ClearVote 2.0 TDP*	2.0	Technical Data Package

*Listed in Section 4.6

3.5 Proprietary Data

All data and documentation considered by the manufacturer to be proprietary will be identified and documented in an independent submission along with a Notice of Protected Information.

4.0 TEST SPECIFICATIONS

Certification testing of the Clear Ballot Group ClearVote 2.0 Voting System submitted for evaluation will be performed to ensure the applicable requirements of the EAC 2005 VVSG and the EAC Testing and Certification Program Manual, Version 2.0, are met. Additionally, all EAC Requests for Interpretation (RFI) and Notices of Clarification (NOC) relevant to the system under test will be incorporated in the test campaign. A complete listing of the EAC RFIs and NOCs is available on the EAC website.

4.1 Requirements (Strategy of Evaluation)

To evaluate the ClearVote 2.0 test requirements, the submitted modifications were evaluated against each section of the EAC VVSG 1.0 to determine the applicable tests to be performed. Based on this assessment, it was determined the following evaluations would be required to verify compliance of the modifications:

Limited Technical Documentation Package (TDP) Review

A limited TDP Review will be performed to ensure that all submitted modifications are accurately documented and that the documents meet the requirements of the EAC 2005 VVSG.

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

The source code review will be based on the source code changes made since the previous system was certified.

Physical Configuration Audit (PCA)

A PCA will be performed to compare the voting system submitted for certification testing to the manufacturer's technical documentation. The purpose of the PCA will be to verify that the submitted hardware is unmodified from the previously certified voting system

Limited Functional Configuration Audit (FCA)

The FCA for this test campaign will include an assessment of the submitted modifications and will include inputs of both normal and abnormal data during test performance. This evaluation will utilize baseline test cases as well as specifically designed test cases and will include predefined election definitions for the input data. As part of the FCA, one primary and one general election will be executed to verify that each of the submitted modifications have been successfully implemented.

Hardware Testing

The hardware tests specified in the VVSG are divided into two categories: non-operating and operating. The non-operating tests apply to the elements of the system that are intended for use at poll site locations and are intended to simulate the storage and transport of equipment between

the storage facility and the polling location. The Operating tests apply to the entire system, including hardware components that are used as part of the voting system telecommunications capability, and are intended to simulate conditions that the voting system may encounter during operation. Prior to and immediately following each required non-operating and operating test, the system shall be subjected to an operational status check.

The requirements in this section shall be tested and/or evaluated by personnel verified by Pro V&V to be qualified to perform the testing.

System Integration Test

The system integration tests will be performed to ensure the ClearVote 2.0 functions as a complete system. The system integration testing addresses the integration of the hardware and software. This testing focuses on the compatibility of the voting system software components and subsystems with one another and with other components of the voting system. During test performance, the system is configured as would be for normal field use.

Accuracy Test

An Accuracy Test will be performed to ensure the ClearVote 2.0 correctly captures, stores, consolidates, and reports the specific ballot selections, and absence of selections, for each ballot position. Due to the limited scope of testing, Accuracy testing will be performed on the ClearCount component only; results from the previous certification campaign will be used to satisfy this requirement for the unmodified system components.

Usability and Accessibility

The requirements in this section shall be tested during the Usability and Accessibility Testing. This evaluation will utilize baseline test cases as well as specifically designed test cases and will include predefined election definitions for the input data.

The usability testing focuses on the usability of the system being tested. Usability is defined generally as a measure of the effectiveness, efficiency, and satisfaction achieved by a specified set of users with a given product in the performance of specified tasks. In the context of voting, the primary user is the voter, the product is the voting system, and the task is the correct recording of the voter ballot selections. Additional requirements for task performance are independence and privacy: the voter should normally be able to complete the voting task without assistance from others, and the voter selections should be private. Accessibility evaluates the requirements for accessibility. These requirements are intended to address HAVA 301 (a) (3) (B).

Security

The requirements in this section shall be tested during the source code review, security tests, and FCA.

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

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

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

- Confirm the module (model and version) that is used and implemented is present on the NIST CMVP validated products list.
- Confirm the module in all five instances is configured and used per the NIST published security policy for that module.

4.1.1 Rationale for ‘Not Applicable’ Requirements

All requirements that were excluded from the previous test campaign (ClearVote 1.5) were also deemed not applicable to this test campaign due to the submitted modifications not impacting the specific requirements.

4.2 Hardware Configuration and Design

Though some of the hardware components have changed, the configuration and design of the system are unchanged from the baseline system. The ClearVote 2.0 Voting System is a paper-based voting system that 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.

ClearCast – The ClearCast component will be subjected to the full suite of hardware and electrical testing required by the EAC 2005 VVSG as well as Usability, Security, Maintainability, Availability, and Accuracy Testing.

ClearAccess – The ClearAccess component will be subjected to the full suite of hardware and electrical testing required by the EAC 2005 VVSG as well as Usability, Security, Maintainability, Availability, and Accuracy Testing.

ClearCount – The ClearCount component is unmodified COTS equipment and is exempt from non-operational hardware testing. ClearCount was previously subjected to Temperature/Power Variation Testing in conjunction with the ClearCast and ClearAccess in addition to being utilized in functional and system level testing such as accuracy, volume and stress, and system integration during the test campaign, the results of which are contained in the final certification test report for the baselined system.

4.3 Software System Functions

The ClearVote 2.0 Election Management System (EMS) consists of a set of applications responsible for all pre-voting and post-voting activities used in election definition and management process. The ClearVote 2.0 EMS applications are as follows:

- ClearDesign
- ClearCount

4.4 Test Case Design

Test cases are designed based on the manufacturer's design specifications and the relevant technical requirements set forth by the VVSG. Test cases shall be examined based on the following aspects of the voting system:

- Hardware qualitative examination design
- Hardware environmental test case design
- Software module test case design and data
- Software functional test case design
- System level test case design

Test cases shall provide information regarding the sequence of actions to be performed for the execution of a test, the requirements being met, the test objective, test configuration, equipment needed, special requirements, assumptions, and pass/fail criteria. Once the test cases are finalized, they will be validated and published for use in the test campaign. The validation of the test case will be accomplished by Technical Review and Approval. This validation will include the following: confirmation of adequate test coverage of all requirements; confirmation that test case results are not ambiguous and gave objective pass/fail criteria; and conformation that any automated test suites will produce valid results.

Prior to execution of the required test cases, the system under test will undergo testing initialization. The testing initialization will seek to establish the baseline for testing and ensure that the equipment submitted for testing matches the expected testing candidate and that all equipment and supplies are present.

The following will be 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 formatted and does not contain any data.
- 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.

4.4.1 Hardware Qualitative Examination Design

Previous hardware examinations were performed on the certified baseline system (ClearVote 1.5). The updates to the modified system (ClearVote 2.0) require the following hardware testing to be performed.

Electrical Tests:

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

Environmental Tests:

- Bench Handling – ClearCast
- Vibration – ClearCast
- Temperature Power Variation - ClearAccess
- Acoustic – ClearAccess

4.4.2 Hardware Environmental Test Case Design

Previous hardware examinations were performed on the certified baseline system (ClearVote 1.5). The updates to the modified system (ClearVote 2.0) shall be subjected to the tests specified in Section 4.4.1. Testing will be performed by personnel verified by Pro V&V to be qualified to perform the test. Pro V&V will utilize NTS Longmont for the performance of the electrical and environmental tests. All pre/post-tests shall be conducted by Pro V&V personnel.

4.4.3 Software Module Test Case Design and Data

Pro V&V shall review the manufacturer's program analysis, documentation, and module test case design and shall evaluate the test cases for each module with respect to flow control parameters and entry/exit data. As needed, Pro V&V shall design additional test cases to satisfy the coverage criteria specified in Volume II, Section 7.2.1.

Component Level Testing will be implemented during the FCA for each component and subcomponent. During the Source Code Review and Compliance Builds, Pro V&V will utilize

limited structural-based techniques (white-box testing). Additionally, specification-based techniques (black-box testing) will be utilized for the individual software components.

Pro V&V shall define the expected result for each test and the ACCEPT/REJECT criteria for certification. If the system performs as expected, the results will be accepted. If the system does not perform as expected, an analysis will be performed to determine the cause. The test will be repeated in an attempt to reproduce the results. If the failure can be reproduced and the expected results are not met, the system will have failed the test. If the results cannot be reproduced, the test will continue. All errors encountered will be documented and tracked through resolution.

4.4.4 Software Functional Test Case Design and Data

Pro V&V shall review the manufacturer-submitted test plans and data to verify that the individual performance requirements specified in the EAC 2005 VVSG and the TDP are reflected in the software. As part of this process, Pro V&V shall review the manufacturer's test case design and prepare a detailed matrix of system functions and the test cases that exercise them. During this review, emphasis shall be placed on those functions where the manufacturer data on module development reflects significant debugging problems, and on functional tests that resulted in high error rates.

Pro V&V shall also prepare a test procedure describing all test ballots, operator procedures, and the data content of output reports. Pro V&V shall define abnormal input data and operator actions and then design test cases to verify that the system is able to handle and recover from these abnormal conditions. Pro V&V shall define the expected result for each test and the ACCEPT/REJECT criteria for certification. If the system performs as expected, the results will be accepted. If the system does not perform as expected, an analysis will be performed to determine the cause. The test will be repeated in an attempt to reproduce the results. If the failure can be reproduced and the expected results are not met, the system will have failed the test. If the results cannot be reproduced, the test will continue. All errors encountered will be documented and tracked through resolution.

4.4.5 System-Level Test Case Design

System Level testing will be implemented to evaluate the complete system. This testing will include all proprietary components (software, hardware, and peripherals) and COTS components (software, hardware, and peripherals) in a configuration of the system's intended use. For software system tests, the tests shall be designed according to the stated design objective without consideration of its functional specification. The system level hardware and software test cases shall be prepared independently to assess the response of the hardware and software to a range of conditions.

4.5 Security Functions

The objective of the Security Testing is to evaluate the effectiveness of the voting system in detecting, preventing, recording, reporting, and recovering from security threats. To evaluate the integrity of the system, Pro V&V shall develop specifically designed test cases in an attempt to defeat the access controls and security measures documented in the system TDP. The submitted threat matrix identifying the system's risks and vulnerabilities shall be evaluated for completeness and to determine that mitigating controls are adequately implemented. An evaluation of the system shall be accomplished by utilizing a combination of functional testing and source code review. All findings will be reported to the EAC and CBG.

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

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

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

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

4.6 TDP Evaluation

In order to determine compliance of the modified TDP documents with the EAC 2005 VVSG, a limited TDP review shall be conducted. This review will focus on TDP documents that have been modified since the certification of the baseline system. The review will consist of a compliance review to determine if each regulatory, state, or manufacturer-stated requirement has been met based on the context of each requirement. Results of the review of each document will be entered on the TDP Review Checklist and reported to the manufacturer for disposition of any anomalies. This process will be ongoing until all anomalies are resolved. Any revised documents during the TDP review process will be compared with the previous document revision to determine changes made, and the document will be re-reviewed to determine whether subject requirements have been met.

A listing of all documents contained in the ClearVote 2.0 TDP is provided in Table 4-1.

Table 4-1. TDP Documents

Document Number	Description	Version
<i>ClearVote Documents</i>		
100128	ClearVote 2.0 Change Notes	1.1
100101	ClearVote 2.0 Approved Parts List	1.1.13
100067	ClearVote 2.0 Ballot Stock and Printing Specification	1.0.11
100057	ClearVote 2.0 Configuration Management Plan	1.0.16
100069	ClearVote 2.0 Glossary	1.0.10

Table 4-1. TDP Documents (continued)

Document Number	Description	Version
100058	ClearVote 2.0 Personnel Deployment and Training Plan	1.0.11
100059	ClearVote 2.0 Quality Assurance Program	1.0.12
100086	ClearVote 2.0 Security Policy	1.0.12
100071	ClearVote 2.0 System Overview	1.1
100073	ClearVote 2.0 Test and Verification Specification	1.0.12
<i>ClearDesign Documents</i>		
100011	ClearDesign 2.0 Acceptance Test Checklist	1.0.6
100133	ClearDesign 2.0 Accessible Definition File Guide	1.0
100062	ClearDesign 2.0 Administration Guide	1.0.9
100131	ClearDesign 2.0 Ballot Definition File Guide	1.0
100083	ClearDesign 2.0 Build Procedures	1.0.7
100103	ClearDesign 2.0 Database Specification	1.0.6
100046	ClearDesign 2.0 Functionality Description	1.0.12
100098	ClearDesign 2.0 Hardware Specification	1.0.10
100063	ClearDesign 2.0 Installation Guide	1.0.23
100082	ClearDesign 2.0 Maintenance Guide	1.0.10
100045	ClearDesign 2.0 Security Specification	1.0.12
100072	ClearDesign 2.0 Software Design and Specification	1.0.18
100043	ClearDesign 2.0 System Overview	1.0.13
100074	ClearDesign 2.0 System Identification Guide	1.1
100041	ClearDesign 2.0 User Guide	2.0.11
<i>ClearCount Documents</i>		
100102	ClearCount 2.0 Acceptance Test Checklist	1.0.10
100009	ClearCount 2.0 Build Procedures	1.5
100005	ClearCount 2.0 Database Specification	1.0.9
100004	ClearCount 2.0 Election Administration Guide	1.0.17
100006	ClearCount 2.0 Election Preparation and Installation Guide	1.2.8
100021	ClearCount 2.0 Functionality Description	1.0.12
100022	ClearCount 2.0 Hardware Specification	1.0.12
100023	ClearCount 2.0 Maintenance Guide	1.0.13

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

Document Number	Description	Version
100070	ClearCount 2.0 Reporting Guide	1.0.12
100013	ClearCount 2.0 Scanner Operator Guide	1.1.6
100026	ClearCount 2.0 Security Specification	1.0.12
100019	ClearCount 2.0 Software Design and Specification	1.0.13
100024	ClearCount 2.0 System Operations Procedures	1.0.11
100025	ClearCount 2.0 System Overview	1.0.12
100130	ClearCount 2.0 Quick Start Guide XML Report Conversion Tool	---
100047	ClearCount 2.0 System Identification Guide	1.1
<i>ClearCast Documents</i>		
100094	ClearCast 2.0 Build Procedures	1.2.4
100079	ClearCast 2.0 Functionality Description	1.5.4
100134	ClearCast 2.0 Hardware Acceptance Test Checklist	1.1
100081	ClearCast 2.0 Hardware Specification	1.5.1
100080	ClearCast 2.0 Installation Guide	1.4.1
100089	ClearCast 2.0 Maintenance Guide	1.8.1
100090	ClearCast 2.0 Poll Worker Guide	1.7.1
100084	ClearCast 2.0 Security Specification	1.4.4
100135	ClearCast 2.0 Software Acceptance Test Checklist	1.1
100093	ClearCast 2.0 Software Design and Specification	1.4.3
100097	ClearCast 2.0 System Identification Guide	1.2
100100	ClearCast 2.0 Supervisor Guide	1.8.2
100078	ClearCast 2.0 System Overview	1.4.5
<i>ClearAccess Documents</i>		
100109	ClearAccess 2.0 Acceptance Test Checklist	1.1.1
100051	ClearAccess 2.0 Build Procedures	1.1.1
100049	ClearAccess 2.0 Functionality Description	1.5.3
100085	ClearAccess 2.0 Hardware Specification	1.5.1
100053	ClearAccess 2.0 Installation Guide	1.7.5
100052	ClearAccess 2.0 Maintenance Guide	1.8.1
100054	ClearAccess 2.0 Poll Worker Guide	1.8.1

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

Document Number	Description	Version
100050	ClearAccess 2.0 Security Specification	1.4.6
100099	ClearAccess 2.0 Software Design and Specification	1.5.1
100055	ClearAccess 2.0 Supervisor Guide	1.8.1
100044	ClearAccess 2.0 System Overview	1.6.4
100056	ClearAccess 2.0 Voter Guide	1.1.3
100126	ClearAccess 2.0 Hardware Compliance Addendum	---
100038	ClearAccess 2.0 System Identification Guide	1.2

4.7 Source Code Review

Pro V&V will review the submitted source code to the EAC 2005 VVSG and the manufacturer-submitted coding standards. Prior to initiating the software review, Pro V&V shall verify that the submitted documentation is sufficient to enable:

(1) A review of the source code and (2) Pro V&V to design and conduct tests at every level of the software structure to verify that design specifications and performance guidelines are met.

4.8 QA & CM System Review

The Clear Ballot Group Quality and Configuration Management Manuals shall be 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 will be reviewed to determine if the stated policies are being followed.

4.9 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

4.10 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.

4.11 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.

4.12 Volume & Stress

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

4.13 System Integration

System Level test for the integrated operation of both hardware and software. Compatibility of the voting system software components or subsystems with one another, and with other components of the voting system environment, shall be determined through functional tests integrating the voting system software with the remainder of the system.

Additionally, the system shall be configured exactly as it would for normal field use. This includes connecting all supporting equipment and peripherals including ballot boxes, voting booths (regular and accessible), and any physical security equipment such as locks and ties.

Pro V&V personnel shall properly configure and test the system by following the procedures detailed in the ClearVote 2.0 voting system technical documentation.

5.0 TEST DATA

The following subsections provide information concerning test data recording, criteria, and reduction.

5.1 Data Recording

All equipment utilized for test data recording shall be identified in the test data package. The output test data shall be recorded in an appropriate manner as to allow for data analysis. For source code and TDP reviews, results shall be compiled in reports and submitted to Clear Ballot Group for resolution.

5.2 Test Data Criteria

The ClearVote 2.0 Voting System shall be evaluated against all applicable requirements contained in the EAC 2005 VVSG. The acceptable range for system performance and the expected results for each test case shall be derived from the manufacturer-submitted technical documentation and the EAC 2005 VVSG.

5.3 Test Data Reduction

Test data shall be processed and recorded in the test log book and the relevant Test Cases.

6.0 TEST PROCEDURE AND CONDITIONS

The following subsections detail the facility requirements, test setup conditions, and sequence of testing.

6.1 Facility Requirements

Unless otherwise annotated, all testing shall be conducted at the Pro V&V test facility located in Huntsville, AL, by personnel verified by Pro V&V to be qualified to perform the test.

Unless otherwise specified herein, testing shall be performed at the following standard ambient conditions and tolerances:

- Temperature: 68-75° F ($\pm 4^\circ$ F)
- Relative Humidity: Local Site Humidity
- Atmospheric Pressure: Local Site Pressure
- Time Allowable Tolerance: $\pm 5\%$

Testing performed at third-party laboratories will be subject to the test parameters and tolerances defined by VVSG. If not specified in VVSG, the test facilities' standard parameters and tolerances will be used. These will be reported in the final Test Report.

6.2 Test Set-up

All voting system equipment shall be received and documented using Pro V&V proper QA procedures. Upon receipt of all hardware, an inspection will be performed to verify that the

equipment received is free from obvious signs of damage and/or degradation that may have occurred during transit. If present, this damage shall be recorded, photographed, and reported to the Clear Ballot Group Representative. Additionally, a comparison shall be made between the recorded serial numbers/part numbers and those listed on shipper's manifest and any discrepancies shall be reported to the Clear Ballot Group Representative. TDP items and all source code received shall be inventoried and maintained by Pro V&V during the test campaign.

During test performance, the system shall be configured as would be for normal field use. This includes connecting all supporting equipment and peripherals.

6.3 Test Sequence

The ClearVote 2.0 Voting System will be evaluated against all applicable requirements in the EAC 2005 VVSG. There is no required sequence for test performance.

6.4 Test Operations Procedure

Pro V&V will identify PASS/FAIL criteria for each executed test case. The PASS/FAIL criteria will be based on the specific expected results of the system. In the case of an unexpected result that deviates from what is considered standard, normal, or expected, a root cause analysis will be performed.

Pro V&V will evaluate every applicable EAC 2005 VVSG requirement. Any deficiencies noted will be reported to the EAC and the manufacturer. If it is determined that there is insufficient data to determine compliance, this test plan will be altered and additional testing will be performed.

APPENDIX A
PROJECT SCHEDULE

Task Name	Start Date	End Date	Assigned To
- EAC Application & TRR	04/11/19	04/18/19	SH Stephen H
Application Submitted to EAC	04/11/19	04/11/19	
TRR	04/15/19	04/16/19	
Application Approval from EAC	04/17/19	04/18/19	
- TDP	04/19/19	08/27/19	A alan.simm
Initial Review	04/19/19	05/17/19	
Compliance Review	05/20/19	08/13/19	
Final review	08/14/19	08/27/19	
- Test Plan	04/22/19	07/18/19	WO Wendy Ow
Test Plan Creation	04/22/19	05/03/19	
Vendor Review & Comments	05/06/19	05/07/19	
EAC Submission and Review	05/28/19	06/24/19	
VSTL Comment Review & Update	06/25/19	06/28/19	
EAC Submission & Review of Revision	07/01/19	07/16/19	
EAC Approved Test Plan	07/17/19	07/18/19	
- Source Code	04/19/19	04/29/19	JC Jack Cobb
Automated Review	04/19/19	04/22/19	
Source Code Review	04/19/19	04/25/19	
Source Code Re-Review	04/23/19	04/24/19	
Document Review	04/25/19	04/25/19	
Compliance Build	04/26/19	04/29/19	
- System Delivery & Setup	04/11/19	06/14/19	SH Stephen H
PCA	04/11/19	06/07/19	
System Setup	06/10/19	06/11/19	
System Loads & Hardening	06/12/19	06/14/19	

- Hardware Testing	04/22/19	07/26/19	SH Stephen H.
Electrical Testing (2 configurations 1 CA full and 1 CC partial)	04/22/19	04/26/19	
Environmental Testing (Bench and Vibe CC only)	04/22/19	04/23/19	
Electrical Testing (2 configurations 1 CA full and 1 CC partial)	07/15/19	07/23/19	
Temp Power (85 hours based on 2 of the configurations total of 2 units under test)	07/22/19	07/26/19	
Electrical Supply	06/12/19	06/13/19	
Maintainability	06/14/19	06/17/19	
- System Level Testing	05/06/19	08/19/19	SH Stephen H.
FCA	05/06/19	06/07/19	
Usability	06/10/19	06/11/19	
Accessibility	06/10/19	06/11/19	
Accuracy	07/29/19	08/01/19	
Regression Testing	08/02/19	08/02/19	
Trusted Build	08/05/19	08/07/19	
System Loads & Hardening	08/08/19	08/12/19	
System Integration	08/13/19	08/19/19	
- Test Report	08/13/19	10/17/19	WO Wendy Ow
Test Report Creation	08/13/19	08/27/19	
Vendor Review & Comments	08/28/19	08/29/19	
EAC Submission & Review	08/30/19	09/27/19	
VSTL Comment Review & Update	09/30/19	10/02/19	
EAC Submission & Review of Revision	10/03/19	10/16/19	
EAC Approved Test Report	10/17/19	10/17/19	

**APPENDIX B
MODIFICATION TABLE**

Table B-1. System Modifications

Enhancement Area	Description
<i>ClearAccess</i>	
UI Enhancement	Change the Settings, Zoom option label from "Normal" to "Default".
Security Enhancement	Import encrypted ADF files into ClearAccess.
	Do not allow the system administrator to close the election before polls are closed.
	Require a poll worker or election administrator to log in before the start of voting.
	Retain the last ballot status when the system restarts.
General Enhancement: Printing stubs and serial numbers	Enabling and disabling the printing of stubs.
	Printing a unique number on a stub.
Fixed Defects	On log pages, the icon for the sorting direction is no longer missing.
<i>ClearCast</i>	
UI Enhancements	Make the use of the Back and Close buttons consistent on all screens.
	Improve the handling of long election and jurisdiction names in pop-up windows.
	Improve the handling of long vote center and "voter group"/counter group names.
	Previously, when the Vote Suspended report printed, the buttons in the pop-up windows, such as Pause printing and Cancel printing, were misaligned. The release has aligned these buttons.
	Provide a UI cue when the Submit button is pushed.
	Use the Language button to display translated language names.
	Make the terminology consistent for UI text edits.
	Improve the alignment of the LAT Testing screen footer.
	Update the graphics on Election Management screens for handling USB drives.
	Improve the Voter Screen UI for the Language button.
	This release contains improved icons for showing the battery status on the voter-facing UI screen.
	When an election has one language, remove the Language button.
	Move the language selections down on the Voter screen.
	The loading icon no longer shows our company logo and has a new graphic animation.
Workflow Enhancements	Improve the workflow for changing the maintenance password.
	Closing an election logs out a user.
	Always display the warning "storage media almost full" message when this situation occurs.
	Change the "ballot successful cast" screen to two seconds.
	Do not show the Results buttons before voting for L&A testing.
	Remove extraneous buttons from the Repeat Scan page.
	Remove "Pause Printing" from ClearCast.

Table B-1. System Modifications (continued)

Enhancement Area	Description
Report Enhancements	Display the BDF version on an Open election/polls report.
	Add an Election Closed report
	Ensure that long log entries not cut off.
	List precincts by PrecinctOrder in the Precinct Totals report.
	Reports by precinct show only the applicable contests.
	Enhance Report By Precinct.
	Add "Straight Party Option" to reports.
	The Results by Precinct report shows card counts for each precinct.
	The Write-ins report shows only the appropriate contests for each precinct.
	Add text to the "print out of paper" message to remind the user to remove the plastic core of the old roll.
	Print the "resume" header when the printer continues after running out of paper.
	Display the "Level" header when printing the system log.
	Reduce the height of the Write-ins report to improve the display the actual write-in candidates.
	Improve the handling of out-of-paper situations to ensure no loss of printed data.
Security Enhancements	Load elections from encrypted BDF files.
	Encrypt ballot images and tabulation results on ClearCast USB drives.
	Adjust role permissions.
	Do not allow the system administrator to close an election before polls are closed.
	Add password-complexity rules for the System Administrator and Maintenance roles.
	Do not allow the Maintenance role to change the System Administrator password.
	Log the make and model of all connected devices.
	ClearCast will decrypt the encryption password for each login.
General Enhancements	Display the low disk space message before scanning the ballot.
	Changed the ClearCast install grub menu text.
	Automatically shut down the machine when the splash screen appears and the machine is using battery power.
	Save the serial number and protected counter when a reinstallation occurs.
	Modified the Installer to retain the contents of the /pcos partition during the upgrade process
	Detect when the thermal paper roll is removed.

Table B-1. System Modifications (*continued*)

Enhancement Area	Description
Code Maintenance	Update the copyright year.
	Modify ClearCount imports based on modules.
	Remove the eject_usb code.
	Remove the PDI scanner source and tools from ClearCast source and build.
	Remove the Cyberpower 650 UPS source and tools from ClearCast source and build.
	Remove the web.py session object because it is not used.
	Fix bare exceptions in src-pcos.
	ClearCast templates (printer and HTML) now have inputs, outputs, and calls listed in the source code.
	Remove the message variable from input.html template.
Fixed Defects	An unhandled exception in the system log no longer causes the DataTable in the front-end JavaScript to crash.
	The Election Closed Report will print multiple times if the USB drive is removed just before closing the election.
	Setting the Date/Time back in the ClearCast UI no longer causes "a stop job is running for MYSQL ...(xmin/ 10min)" message.
	The image accompanying the rejection message for judge's initials no longer disappears if the language changes.
	On ballots with multiple errors, some error messages previously failed to appear. This situation no longer occurs.
	The write-ins report will now filter out overvoted choices.
	Clear Ballot has corrected errors that were previously in the ballot_styles.html printer template
	Canceling the printing of a report now adds an end blank space.
	The UI bottom border line on various screens was in wrong place and is now correct.
	The L&A testing Print Write-Ins report now prints correctly.
	When a user changes a password, ClearCast authenticates the old password before the user enters a new password.
	Reporting data is no longer lost when the paper is removed and not replaced for 48 hours or more.
	ClearCast no longer shows a "shutting down" message during transition states.
	When canceling printing when out of paper, the buffer no longer needs to be cleared before the gray box dismisses.
	This release has fixed some formatting issues in summary total reports.
This release corrects the error message that appears when using four characters or fewer as the Machine Name on ClearCast.	
<i>ClearCount</i>	
UI Enhancements	On the Side (Card Information) page, change the label "Style ID" to be "Card Style ID".
	Remove the pop-up message asking for confirmation of a modification: "This already got adjudicated by an algorithm."

Table B-1. System Modifications (continued)

Enhancement Area	Description
XML and Report Enhancements	Import the Contest District from BDF.
	Add District to the Contest elements in XML.
	Add Candidate Party Subtotals to ClearCount XML.
	Change choice (candidate) short name to the long name in reports.
Security Enhancements	Updated BDF content needs a password and bypass option.
	Create elections from encrypted and unencrypted BDFs.
	ClearCount can merge encrypted ballot images and results from ClearCast.
	Disable the display of vote totals as the default option.
	Limit network connections to known voting system components.
	Upgrade ClearCount to Ubuntu 18.04.1 LTS.
General Enhancement: Single-Row Cross Endorsement	Count Straight Party Votes for Single Row Cross-Endorsed Candidate.
	Support Single Row Cross-Endorsed Candidates.
Code Maintenance	Update Copyright Year.
	Add <code>__init__.py</code> files to ClearCount.
	Run pylint on all files on commits.
Fixed Defects	The message for votes rejected due to missing judge's initials previously appeared incorrectly in non-votes section of Vote Visualization page.
	Clear Ballot has adjusted Oval Visualization so that the ballot-image thumbnail size accurately reflects the available space after the load of the oval is complete.
ClearDesign	
UI Enhancements	The terms "under vote" and "over vote" have changed to "undervote" and "overvote" throughout the UI.
	ClearDesign has added the word "Warn" to the "Straight Voter Group Overvote" column header of the Device Types report.
	Version 2.0 contains enhanced error messages around voter group limits for candidates.
	On the Device Type screens, the term "PIN" has changed to "Password".
Ballot Enhancements	Do not cover ovals with the margin background color specified in the layout styles for the entity types.
	Add a macro for the stub number to iterate upon when printing from PrintNow or ClearAccess.
	Enhance the Sample Ballot (Provisional Ballot) to use most layout style formatting.
	Include an option to allow "Write-in" to appear on the line.
Performance Enhancements	Allow cancellation of ballot printing to PDFs.
	Turn off database auto-flush for read-only queries.
	Place the datatable data in the HTML file as a JSON array to improve the performance with loading large datasets.
	Specify joinedload for entities when loading list data.

Table B-1. System Modifications (continued)

Enhancement Area	Description
Security Enhancements	The export of encrypted BDF files.
	The export of encrypted ADF files.
	Show the encryption key in view mode of device type entity.
	Create Python crypto API for RSA key pair generation and RSA encryption.
	Upgrade ClearDesign to Ubuntu Version 18.04.1 LTS.
	Set minimum password lengths for poll worker and election PINS.
General Enhancements	Both Sound Off and Screen Off should not be allowed for the ClearAccess default settings.
	Print stubs are not on by default.
	The Stubs button is now off by default when viewing cards.
	Layout options now inherit consistently in the detail pane for contests and headers.
	ClearDesign issues a warning when you import large images so that you can avoid performance issue when printing PDFs.
	Pasting as plain text in the HTML editor is the default.
	District Association was added to Contests.csv in the BDF.
	Re-enable Straight Party Voting with the Cross Endorsed Type: Once on Ballot.
	Modify the BDF to include "once on ballot" multi-endorsed candidates.
	Remove invalid macros from the default welcomeText for ClearAccess.
	Update ClearCast default messages to match recent changes.
	When printing cards, ClearDesign issues a warning that the BDF cannot be created when no vote center is present.
Code Maintenance	Update the copyright Year.
	Fix cbg.js jshint error.
	Clean up EnumModel so pylint understands it.
	Remove task.import_election_task dependency from Election.
	Change the @hybrid_property decorator to a simple @property decorator.
<i>Fixed Defects</i>	
Fixed Defects	Copy and pasted images have absolute URLs rather than relative URLs.
	A reset of device messages does not always update messages correctly.
	OCRv throws an error when processing the "é" character.
	Editing of the full name of a Contest results in invalidated cards for templated elections.
	Borders for Entity Style Contest Questions previously appeared around the response set in addition to the question.