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Test Plan for EAC 2005 VVSG Certification Testing Clear Ballot Group ClearVote 2.3 Voting System

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SIGNATURES

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REVISIONS

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00	Initial Release	04/18/2022
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TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
1.1	Description and Overview of EAC System Being Modified	1
1.1.1	Baseline Certified System.....	3
1.1.2	Description of Modification	10
1.1.3	Initial Assessment	13
1.1.4	Regression Test.....	13
1.1.5	System Modification Evaluation.....	14
1.2	References.....	14
1.3	Terms and Abbreviations	15
1.4	Project Schedule	16
1.5	Scope of Testing	16
1.5.1	Block Diagram.....	17
1.5.2	System Limits	17
1.5.3	Supported Languages.....	18
1.5.4	Supported Functionality.....	19
1.5.5	VVSG	19
1.5.6	RFIs.....	19
1.5.7	NOCs	20
2.0	PRE-CERTIFICATION TESTING AND ISSUES	20
2.1	Evaluation of Prior VSTL Testing.....	20
2.3	Evaluation of Prior Non-VSTL Testing.....	20
2.3	Known Field Issues.....	20
3.0	MATERIALS REQUIRED FOR TESTING.....	20
3.1	Software	21
3.2	Equipment	21
3.3	Test Materials	24
3.4	Deliverable Materials	24
3.5	Proprietary Data	24
4.0	TEST SPECIFICATIONS	25
4.1	Requirements (Strategy of Evaluation).....	25

4.1.1	Rationale for ‘Not Applicable’ requirements.....	26
4.2	Hardware Configuration and Design	26
4.3	Software System Functions.....	27
4.4	Test Case Design	27
4.4.1	Hardware Qualitative Design.....	28
4.4.2	Hardware Environmental Test Case Design	28
4.4.3	Software Module Test Case Design and Data	28
4.4.4	Software Functional Test Case Design and Data.....	29
4.4.5	System-Level Test Case Design	29
4.5	TDP Evaluation.....	29
4.6	Source Code Review.....	32
4.7	PCA.....	33
4.8	System Level Testing.....	33
4.8.1	FCA.....	34
4.8.2	Accuracy	34
4.8.3	System Integration	35
5.0	TEST DATA	35
5.1	Test Data Recording	36
5.2	Test Data Criteria.....	36
5.3	Test Data Reduction.....	36
6.0	TEST PROCEDURES AND CONDITIONS	36
6.1	Facility Requirements	36
6.2	Test Set-Up	36
6.3	Test Sequence	37
6.4	Test Operations Procedure.....	37
PROJECT SCHEDULE.....		A-1

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 2.3 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 2.3 Voting System. The application was accepted by the EAC and the project was assigned the unique Project Number of CBG-CV-23.

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 baseline system for this modification is the ClearVote 2.2 System. Detailed descriptions of the ClearVote 2.2 test campaign are contained in Pro V&V Report No. TR-CBG-004-01.03, which is available for viewing on the EAC's website at www.eac.gov.

The ClearVote 2.3 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).

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

ClearDesign

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

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

ClearCount

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

- CountServer **An Ubuntu Linux** laptop or desktop computer running the ClearCount software and hosting its election database and the web server that serves its election reports.
- ScanStation(s): One or more **Windows** laptop or desktop/scanner pairs used to scan and tabulate ballots.
- Network Switch: Used to connect the ScanStations to the CountServer using a wired, closed Ethernet.
- CountStation: One or more Windows laptop or desktop computers installed with browser software, linked by a wired Ethernet connection to the CountServer using the network switch. This station can serve multiple uses: user administration, election administration, adjudication, and reporting. This station is also used to consolidate the vote totals and ballot images from the ClearCast precinct tabulator. The vote totals and ballot images are consolidated by the ClearCount Software via the ClearCast USB drive.

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

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

ClearCast

The ClearCast tabulator is a precinct count ballot scanning solution suitable for early and election day 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 prior 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 tables below detail the certified ClearVote 2.2 equipment and firmware versions.

Table 1-1. ClearVote 2.2 Voting System Software

Firmware/Software	Version
<i>ClearDesign Components, Version 2.2.4</i>	
Windows	10 Pro 1607
Google Chrome	87.0.4280.141
Ubuntu	18.04.5
MySQL	5.7.31
Apache	2.4.29
libapache2-mod-fcgid	2.3.9-1
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

Table 1-1. ClearVote 2.2 Voting System Software (continued)

Firmware/Software	Version
SQLAlchemy	1.3.3
Python Pillow	5.1.0
Python Flup	1.0.2
Python DBUtils	1.3
Python XLRD	1.2.0
Python FontTools library	3.4.1
Python RTF	0.2.1
OpenSSL (FIPS)	2.0.10
OpenSSL	1.1.1
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	2.2.4
jquery-impromptu	6.2.3
jquery-qrcode	1.0
jquery-splitter	0.27.1
jquery-ui	1.12.1
jscolor	1.4.2
tinymce	4.1.9
jslibbmp3lame	0.5.0
jszip	3.2.0
paparser	4.6.0
jsmin	4.6
ClearAccess Components, Version 2.2.2	
Windows	10 Pro 1607
Google Chrome	93.0.4577.63
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

Table 1-1. ClearVote 2.2 Voting System Software (continued)

Firmware/Software	Version
DataTables	1.10.16
jsmin	2019-10-30
Zebra scanner driver	3.07.0004
EloPOS driver pack	12/5/2019
pyserial	3.2.1
ClearCast Components, Version 2.2.9	
Ubuntu	18.04.5 LTS
chromium-browser	92.0.4515.159
pyinstaller	3.2.1
openssl-fips	2.0.10
openssl	1.0.2g
libScanAPI.a	2.0.0.0
DataTables	1.10.16
JTSage DateBox	4.0.0
jQuery.NumPad	1.4
jQuery	1.12.4
jquery.ui	1.11.3
ClearCast Go Components, Version 2.2.a	
Ubuntu	18.04.6 LTS
Linux kernel	5.4.52
U-boot	2020.10
rk3399_loader	1.24.126
rk3399_bl31	1.35
trust_merger	1.0 (2015-06-15)
boot_merger	1.31
Rk3399_ddr-800MHz	1.25
Rk3399_miniloader	1.26
rkdeveloptool	1.2
chromium-browser	92.0.4515.159
libssl	1.0_1.0.2n
openssl	1.0.0_1.0.2n
libScanAPI.a	1.0.0.1
DataTables	1.10.16
JTSage DateBox	4.0.0
jQuery.NumPad	1.4
jQuery	1.12.4
jquery.ui	1.11.3

Table 1-1. ClearVote 2.2 Voting System Software (continued)

Firmware/Software	Version
<i>ClearCount Components, Version 2.2.4</i>	
Windows	10 Pro 1607
Google Chrome	87.0.4280.141
Ubuntu	18.04.5 LTS
sqlalchemy	1.3.4
six	1.15.0
Python-dateutil	2.8.1
Apache	2.4.29
libapache2-mod-fcgid	2.3.9-1
Python(part of Ubuntu)	2.7.15~rcl-1
MySQLdb (part of Ubuntu)	5.7.31
PyInstaller	3.2.1
PollyReports	1.7.6
OpenSSL	1.1.1
OpenSSL FIPS Object Module	2.0.10
JavaScript Bootstrap library	2.3.2, & 4.3.1
JavaScript Chosen library	1.8.7
JavaScript jQuery library	1.10.2J
J JavaScript jQuery-migrate library	1.2.1
JavaScript jQuery hotkeys library	0.8
JavaScript jQuery tooltip library	1.3
JavaScript jQuery spllter library	0.28.3
JavaScript DataTables library	1.10.18
JavaScript DataTables Buttons	1.5.6
JavaScript DataTables Buttons ColVis Library	1.0.8
JavaScript DataTables Buttons html5 library	1.3.3
JavaScript DataTables FixedHeader library	3.1.4
JavaScript DataTables pdfmaker library	0.1.36
JavaScript vue library	2.6.10
JavaScript bootstrap-vue library	2.0.2
Fujitsu fi-6400	PaperStream IP (TWIN) 2.10.3
Fujitsu fi-6800	PaperStream IP (TWIN) 2.10.3
Fujitsu fi-7180	PaperStream IP (TWIN) 2.10.3
Fujitsu fi-7800	PaperStream IP (TWIN) 2.10.3
Fujitsu fi-7900	PaperStream IP (TWIN) 2.10.3
auditd	2.8.2-1
debconf	1.5.66

Table 1-1. ClearVote 2.2 Voting System Software (continued)

Firmware/Software	Version
pmount	0.9.23
Samba	4.7.6
udisks	2.7.6

Table 1-2. ClearVote 2.2 Voting System Equipment

Component	Model	Serial Number
<i>ClearDesign Components</i>		
Dell Latitude Laptop (client)	5580, 5590, 5500, 5511	2F3L3G2, 9W5DIN2, JV3WXY2, 13KWY33
Dell OptiPlex (client)	7440	JXDFHH2, 93VDB03
Dell Precision Tower (client)	T3620	GSKRMV2
Dell PowerEdge Server (server)	T130, T140, T440, R440, T630	5G0YLN2, 8BFH3W2, H6JZLN2, 55BGB03, GCHLHL2
Cisco 8-Port Switch	SG250-08	PSZ21451MLJ
Cisco Catalyst 8-Port Switch	C1000-8T-2G-L	PSZ240319T3
NetGear 8-Port Switch	FVS318G	40F266BA00280
TP-LINK 4-Port Switch	TL-R600VPN	2157090000334
TRENDNet 8-Port Switch	TEG-S80G	C217Z28001195
Corsair Flash Padlock 3 32 GB	Secure USB 3.0 Flash Drive	CMFPLA3B-32GB
Corsair Flash Voyager GTX	3.1 USB Drive	CMFVYGTX3C-128GB
Kingston Data Traveler Elite G2	3.0 USB Drive	DTEG2/64GB
SanDisk Extreme Go 64 GB USB	3.0 USB Drive	SDCZ800-064G-G46
SanDisk Extreme Pro 64 GB USB	3.0 USB Drive	SDCZ880-128G-G46
SanDisk Ultra Flair 32 GB USB	3.0 USB Drive	SDCZ73-032G-A46, SDCZ73-032G-G46
<i>ClearAccess Components</i>		
ELO 15 inch EloPOS	EPS15E3	J193011873
ELO 15 inch AIO	E-Series (ESY15E2)	A18C004080
Dell OptiPlex AIO	5250	HCGMGK2
ELO 20 inch AIO	X-Series (ESY20X2)	D18Q000334

Table 1-2. ClearVote 2.2 Voting System Equipment *(continued)*

Component	Model	Serial Number
Dell Inspiron 15”	7573	80S1YD2
Oki Data Laser Printer	B432dn	AK5B007647A0 & AK91021454C0
Zebra Technologies Bar Code Scanner	DS457-SR	18059000501984
Storm EZ Access Keypad	EZ08-22201	15000005, 15000007, 15020478
Storm EZ Access Keypad	EZ08-22000	20010073
Origin Instruments Sip/Puff Breeze with Headset	AC-0313-MUV, AC-0300-MU	CBG-SP-001, 002, 003
Samson Over-Ear Stereo Headphones	SASR350	SR350J8G390 & SR350J8G396
Monoprice Over the Ear Pro Headphones	8323	CBG-mono-001, 002, 003
Hamilton Buhl Over-Ear Stereo Headphones	HA7	CBG-HP-001 & CBG-HP-002
Ergotron Neo-Flex	Widescreen Lift Stand	33-329-085
Wearson LCD Stand	Adjustable LCD Monitor Stand	WS-03A
Corsair Flash Padlock 3 32 GB	Secure USB 3.0 Flash Drive	CMFPLA3B-32GB
Corsair Flash Voyager GTX	3.1 USB Drive	CMFVYGTX3C-128GB
Kingston Data Traveler Elite G2	3.0 USB Drive	DTEG2/64GB
SanDisk Extreme Go 64 GB USB	3.0 USB Drive	SDCZ800-064G-G46
SanDisk Extreme Pro 64 GB USB	3.0 USB Drive	SDCZ880-128G-G46
SanDisk Ultra Flair 32 GB USB	3.0 USB Drive	SDCZ73-032G-A46, SDCZ73-032G-G46
CyberPower Smart App UPS	PR1500RT2U	PY3HZ2002933, PY3HZ2003000
APC Smart-UPS	SMT2200	AS1602232215
<i>ClearCount Components</i>		
Dell PowerEdge Server (ScanServer)	T130, T140, T330, T440, R440	5G0ZLN2, 8BFJ3W2, FHV9RD2, H6J5MN2, 55FDB03
Lenovo ThinkServer (ScanServer)	TS140	MJ0472UV
Dell Precision Tower (CountStation)	T3620	GSKQMN2
Dell OptiPlex (CountStation)	7440, XE3 SFF	JXDFHH2, 93YDB03

Table 1-2. ClearVote 2.2 Voting System Equipment (continued)

Component	Model	Serial Number
Dell Latitude Laptop (ScanStation, CountStation)	5580, 5590, 5500, 5511	2F3L3G2, 5M5DIN2, 35YL9Y2, 13KWY33
Fujitsu Scanner	fi-7180	A20DC10302 & A20D000798
Fujitsu Scanner	fi-6800	A9HCA00737 & A9HCC00543
Fujitsu Scanner	fi-6400	AKHCC00362 & AKHCC00609
Fujitsu Scanner	fi-7800	C39C000034
Fujitsu Scanner	fi-7900	C30C000270
SanDisk Extreme Go 64 GB USB	3.0 USB Drive	SDCZ800-064G-G46
SanDisk Extreme Pro 64 GB USB	3.0 USB Drive	SDCZ880-128G-G46
SanDisk Ultra Flair 32 GB USB	3.0 USB Drive	SDCZ73-032G-A46, SDCZ73-032G-G46
CyberPower Smart App UPS	PR1500RT2U	PY3HZ2002933, PY3HZ2003000
Cisco 8-Port Switch	SG250-08	PSZ21451MYX
Cisco Catalyst 8-Port Switch	C1000-8T-2G-L	PSZ240319T3
Cisco 24-Port Switch	C1000-24T-4X-L	FCW2417A0E6
NetGear 8-Port Switch	FVS318G	40F266BA00280
TP-LINK 4-Port Switch	TL-R600VPN	2157090000334
Cisco 26-Port Switch	SG250-26	DNI203400A6 & DNI203400AW
TRENDNet 8-Port Switch	TEG-S80G	C217Z28001195
Corsair Flash Padlock 3 32 GB	Secure USB 3.0 Flash Drive	CMFPLA3B-32GB
Corsair Flash Voyager GTX	3.1 USB Drive	CMFVYGTX3C-128GB
Kingston Data Traveler Elite G2	3.0 USB Drive	DTEG2/64GB
APC Smart-UPS	SMT-1500C	3S1831X12280
ClearCast Components		
ClearCast	Model D Revision 4	CCD041903778, CCD041904024
ClearCast Go	Model E Revision 5	CCER0401004, CCER0401006
Corsair Flash Padlock 3 32 GB	Secure USB 3.0 Flash Drive	CMFPLA3B-32GB
Corsair Flash Voyager GTX	3.1 USB Drive	CMFVYGTX3C-128GB
Kingston Data Traveler Elite G2	3.0 USB Drive	DTEG2/64GB
SanDisk Extreme Go 64 GB USB	3.0 USB Drive	SDCZ800-064G-G46

Table 1-2. ClearVote 2.2 Voting System Equipment *(continued)*

Component	Model	Serial Number
SanDisk Extreme Pro 64 GB USB	3.0 USB Drive	SDCZ880-128G-G46
SanDisk Ultra Flair 32 GB USB	3.0 USB Drive	SDCZ73-032G-A46, SDCZ73-032G-G46
Ballot Bag	CV-1032-1.5, CV-1032-2.0	bag001, bag002
Ballot Box	CV-1033-1.5, CV-1033-2.0	box001, box002

1.1.2 Description of Modification

ClearVote 2.3 is a modified voting system configuration that includes upgrades to the ClearAccess, ClearCount, and ClearDesign components of the ClearVote 2.2 system. Detailed information on how the modifications will be addressed is included in Section 1.1.5.

The submitted modifications include the following changes from version 2.2 to 2.3, as taken from the *ClearVote 2.3 Change Notes*:

ClearDesign

- SW-2689: Implemented three new contest rotation methods, Grouped Precinct Rotation, Voter Count Precinct Rotation, and Balance Precinct Rotation.
- SW-9451: Added new macros for 'pageNum' and 'numPages'.
- SW-9983: Fixed the issue that where the cbg_profile.sh script was not being run on logging in to the system. Also removed the 'readonly' status from TMOOUT environment variable since it caused errors.
- SW-10161: Added support for more card footer placement options. For more details, refer to the ClearDesign User Guide.
- SW-10690: Updated the ADF to account for the new page number macros introduced in this release.
- SW-10932: Enabled the DesignServer to be accessed by name on the local network by allowing updating the Samba configuration.
- Added Dell Latitude 5521 computer as a DesignStation

ClearAccess

- SW-11059: Updated Zebra CoreScanner driver to version 3.07.0011.
- Added Lexmark MS-521dn printer added to eloPos box configuration
- Added APC SRT1500RT2U uninterruptible power supply added to eloPos box configuration

ClearCount

- SW-8116: Changed the Apache configuration to set the maximum number of processes to start based on the number of CPU's installed on the server.
- SW-9151: In ClearCount when looking at Statement of Votes Cast reports, the user is now able to select the Choice Order column, to order the rows by the order of the choices how they would be on the ballot.
- SW-9437: A file ending in extension .co.csv that implements a variation on the Cast Vote Record format designed for Colorado has been added to the Cast Vote Record zip file package.
- SW-9439: In previous versions when getting the list of card images (thumbs) filtering by more than one contest the set only contained cards that had both contests on them. Now the set contains the cards that have either of the contests on them.
- SW-9553: Partitioned the results tables in the database to provide better performance on large elections (> 500,000 ballots).
- SW-9558: Updated the database index to improve speed of getting ovals to list on the oval visualization page. Performance improvement on large (>500,000 ballots) database is approximately 10x.
- SW-9604: Optimized the query used to generate the list of card images to display.
- SW-9641: Performance enhancements for the saving of ballots on the CountServer while scanning.
- SW-9648: Explicitly updated the votes and contest voted tables rather than using database triggers.

- SW-9712: The default log filter was setting an end date/time value that was preventing log messages from within the last minute from showing up. This has been fixed.
- SW-9713: The oval visualization page has been rewritten for performance reasons to support lazy loading of oval images. Oval images will be loaded as they are scrolled into view.
- SW-9795: Hourly cron job open/close log entries have been omitted to avoid filling the logs with expected messages.
- SW-9804: Table data for web statement reports is now passed as JSON to DataTables. This drastically improves client-side rendering for tables with a large amount of data (rows).
- SW-9816: The end date for logs now is unset by default, meaning that all log entries after the start date will be returned. In order for an end date/time to be persisted, it must be selected, and the "Change" button pressed.
- SW-9861: Fixed the issue in the resolver when a card's precinct or style is changed and then saved without selecting the 'vote' button.
- SW-9877: Fixed potential dead lock when error occurs during uploading of ClearCast results.
- SW-9910: Table data for the Card Resolutions page is now passed as JSON to DataTables. This drastically improves client-side rendering for tables with a large amount of data (rows).
- SW-9911: Fixed a bug in the "Show All" option under "Show / hide columns" on web reports. Previously a column that was intended to always be hidden would be displayed.
- SW-10178: Corrected the syntax for increasing the system log rate limit burst to the new configuration syntax.
- SW-10288: Fixed an issue that caused target cards to be erroneously categorized as unreadable ballots.
- SW-10517: Improved the performance for the Vote Visualization page when using large elections.

- SW-10718: Increased the number of allowable open files for MySQL to accommodate the partitioned tables.
- SW-10867: Enabled the CountServer to be accessed by name on the local network by allowing updating the Samba configuration.
- Added Dell Latitude 5521 computer as a CountStation and a ScanStation

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
- Physical Configuration Audit (PCA)
- System Level Testing
 - System Integration
 - Accuracy
- Technical Documentation Package (TDP) Review
- Functional Configuration Audit (FCA), including Regression Testing
- Hardware Testing

1.1.4 Regression Test

ClearVote 2.3 is a modified voting system configuration that includes functional upgrades and modifications to the baseline system. Modified system testing is an abbreviated testing campaign built upon a regression review of the modifications against the baseline system and requirements. Modifications, alone and collectively, are reviewed (tested) to see if they fall under any requirement(s), or functionally impact the ability of the modified system to continue to meet requirements. Regression reviews consist of targeted investigations to determine if further testing is necessary based on the nature and scope of the communicated modifications (whether activated or deactivated), and any other submitted information. The objective of regression testing is to establish assurance that the modifications have no adverse impact on the compliance, integrity, or performance of the system.

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 2.2 System consist of both software and hardware changes. Software changes and updates were implemented to accommodate defect resolutions, enhancements, and improved security and user interface features. Hardware modifications include the addition of a Dell Latitude 5521 computer to Clear Design as a DesignStation and to ClearCount as a CountStation and a ScanStation, the addition of a Lexmark MS-521dn printer to Clear Access, and the addition of the APC SRT1500RT2U UPS to Clear Access. 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
- Pro V&V Test Report No. TR-01-01-CBG-005-01.02, “Test Report for EAC 2005 VVSG Certification Testing Clear Ballot Group ClearVote 2.2 Voting System”, dated 12/03/2021
- 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 2.3 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

“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 Attachment 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 2.2. To determine the ClearVote 2.3 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 4: Hardware Requirements
 - Environmental Requirements
 - Electrical Tests (ClearAccess)
 - Environmental Tests (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)

Note: Section 6 (Telecommunications Requirements) of the VVSG 1.0 is not applicable to ClearVote 2.3 and was therefore not included in testing. Additionally, Section 3 (Usability & Accessibility), Section 7 (Security Requirements), Section 8 (Quality Assurance Requirements), and Section 9 (Configuration Management Requirements) were reviewed in previous test campaigns and were not impacted by the submitted modifications

1.5.1 Block Diagram

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

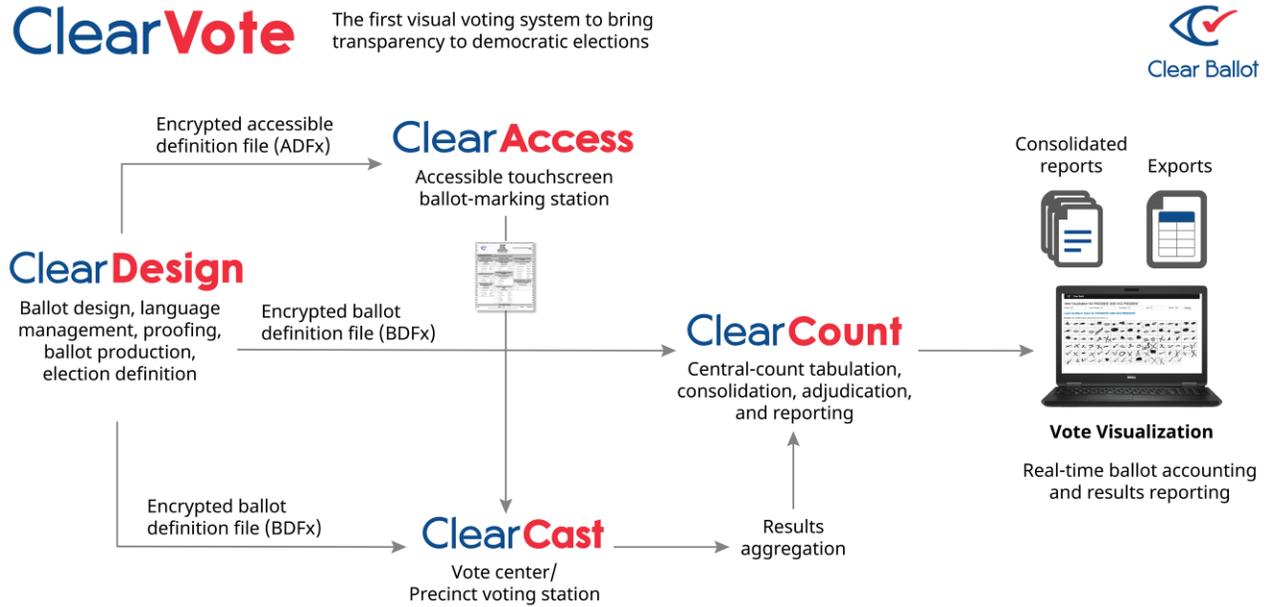


Figure 1-1. ClearVote 2.3 Product Relationship

1.5.2 System Limits

The system limits that CBG has stated to be supported by the ClearVote 2.3 Voting System are listed in the tables below.

Table 1-3 ClearVote System Limits

Characteristic	Limit
<i>Election Parameters</i>	
Precincts per election	3200
Splits per election	3200
District categories per election	100
Districts per single category	3200
Districts per election	3200
Contests per election	3200
Choices per election	3200
Choices per contest	300
Vote positions per side	420

Table 1-3 ClearVote System Limits (*continued*)

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

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.

For the character based language, the ballot will be created by Pro V&V and voted utilizing both paper ballots and ADA voting devices along with all applicable peripherals. The Chinese Language for the ballot will be created using a readily available online translation tool. The translated language text will be entered into the ClearDesign Application. A ballot preview will be generated in the ClearDesign application. The Chinese characters displayed in the ballot preview will be compared to the characters generated by the online translation tool, to ensure that the characters match. The ballots will then be generated and printed, and the election loaded onto the tabulators and the BMD units. The Chinese characters displayed on both the printed ballots and displayed on the BMD units will be compared to the original Chinese Characters generated by the online translation tool to verify that the characters match.

1.5.4 Supported Functionality

The ClearVote 2.3 is designed 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

1.5.5 VVSG

The ClearVote 2.3 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.

Hardware Testing

As of the release of this Test Plan, hardware testing has been completed for state-level efforts. The results of this testing will be evaluated for re-use to satisfy this test effort.

2.1 Evaluation of Prior VSTL Testing

Pro V&V evaluated to the published Final Test Report for the ClearVote 2.2 in order to baseline the current system under test.

2.3 Evaluation of Prior Non-VSTL Testing

No prior non-VSTL testing of the ClearVote 2.3 modifications were considered for this test campaign

2.3 Known Field Issues

The ClearVote 2.3 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 2.3 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.

All software required for testing is identified in Section 1.1 Table 1-1 of this test plan, with the exception of the ClearAccess, ClearCount, and ClearDesign software which will have the version numbering format 2.3.X once the Trusted Builds have been completed. Pro V&V will perform a comparison on the submitted source code against the previously certified versions. Pro V&V will review the submitted modified source code to the EAC VVSG 1.0 and the manufacturer-submitted coding standards.

3.2 Equipment

This subsection lists the proprietary and COTS equipment 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 3-1. ClearVote 2.3 Voting System Equipment

Component	Model	Serial Number
<i>ClearDesign Components</i>		
Dell Latitude Laptop (client)	5580, 5590, 5500, 5511, 5521	2F3L3G2, 9W5DIN2, JV3WXY2, 13KWY33, JM3WSG3
Dell OptiPlex (client)	7440	JXDFHH2, 93VDB03
Dell Precision Tower (client)	T3620	GSKRMV2
Dell PowerEdge Server (server)	T130, T140, T440, R440, T630	5G0YLN2, 8BFH3W2, H6JZLN2, 55BGB03, GCHLHL2
Cisco 8-Port Switch	SG250-08	PSZ21451MLJ
Cisco Catalyst 8-Port Switch	C1000-8T-2G-L	PSZ240319T3
NetGear 8-Port Switch	FVS318G	40F266BA00280
TP-LINK 4-Port Switch	TL-R600VPN	2157090000334
TRENDNet 8-Port Switch	TEG-S80G	C217Z28001195

Table 3-1. ClearVote 2.3 Voting System Equipment (continued)

Component	Model	Serial Number
Corsair Flash Padlock 3 32 GB	Secure USB 3.0 Flash Drive	CMFPLA3B-32GB
Corsair Flash Voyager GTX	3.1 USB Drive	CMFVYGTX3C-128GB
Kingston Data Traveler Elite G2	3.0 USB Drive	DTEG2/64GB
SanDisk Extreme Go 64 GB USB	3.0 USB Drive	SDCZ800-064G-G46
SanDisk Extreme Pro 64 GB USB	3.0 USB Drive	SDCZ880-128G-G46
SanDisk Ultra Flair 32 GB USB	3.0 USB Drive	SDCZ73-032G-A46, SDCZ73-032G-G46
<i>ClearAccess Components</i>		
ELO 15 inch EloPOS	EPS15E3	J193011873, K193008678
ELO 15 inch AIO	E-Series (ESY15E2)	K17C012858
Oki Data Laser Printer	B432dn	AK8C17022C0 & BW0107753CD
Lexmark Laser Printer	MS521dn	4600952318T35
CyberPower Smart App UPS	PR1500RT2U	PY3JT2000004
APC Smart UPS	SRT1500RMXLA	AS2155292757
Storm EZ Access Keypad	EZ08-22201	15000005, 15000007, 15020478
Storm EZ Access Keypad	EZ08-22000	20010073
Origin Instruments Sip/Puff Breeze with Headset	AC-0313-MUV	CBG-SP-001, 002, 003
Samson Over-Ear Stereo Headphones	SASR350	SR350J8G390 & SR350J8G396
Corsair Flash Padlock 3 32 GB	Secure USB 3.0 Flash Drive	CMFPLA3B-32GB
Corsair Flash Voyager GTX	3.1 USB Drive	CMFVYGTX3C-128GB
Kingston Data Traveler Elite G2	3.0 USB Drive	DTEG2/64GB
SanDisk Extreme Go 64 GB USB	3.0 USB Drive	SDCZ800-064G-G46
SanDisk Extreme Pro 64 GB USB	3.0 USB Drive	SDCZ880-128G-G46
SanDisk Ultra Flair 32 GB USB	3.0 USB Drive	SDCZ73-032G-A46, SDCZ73-032G-G46
<i>ClearCount Components</i>		
Dell PowerEdge Server (CountServer)	T130, T140, T330, T440, R440	5G0ZLN2, 8BFJ3W2, FHV9RD2, H6J5MN2, 55FDB03
Lenovo ThinkServer (CountServer)	TS140	MJ0472UV

Table 3-1. ClearVote 2.3 Voting System Equipment (continued)

Component	Model	Serial Number
Dell Precision Tower (CountStation)	T3620	GSKQMN2
Dell OptiPlex (CountStation)	7440, XE3 SFF	JXDFHH2, 93YDB03
Dell Latitude Laptop (CountStation)	5521	8LB8HG3
Dell Latitude Laptop (ScanStation)	5580, 5590, 5500, 5511, 5521	2F3L3G2, 5M5DIN2, DP5D1N2 9S3WXY2, 13KWY33, 8LB8HG3
Fujitsu Scanner	fi-7180	A20DC10302 & A20D000798
Fujitsu Scanner	fi-6800	A9HCA00737 & A9HCC00543
Fujitsu Scanner	fi-6400	AKHCC00362 & AKHCC00609
Fujitsu Scanner	fi-7800	C39C000034
Fujitsu Scanner	fi-7900	C30C000270
Cisco 8-Port Switch	SG250-08	PSZ21451MYX
Cisco Catalyst 8-Port Switch	C1000-8T-2G-L	PSZ240319T3
Cisco 24-Port Switch	C1000-24T-4X-L	FCW2417A0E6
NetGear 8-Port Switch	FVS318G	40F266BA00280
TP-LINK 4-Port Switch	TL-R600VPN	2157090000334
Cisco 26-Port Switch	SG250-26	DNI203400A6 & DNI203400AW
TRENDNet 8-Port Switch	TEG-S80G	C217Z28001195
Corsair Flash Padlock 3 32 GB	Secure USB 3.0 Flash Drive	CMFPLA3B-32GB
Corsair Flash Voyager GTX	3.1 USB Drive	CMFVYGTX3C-128GB
Kingston Data Traveler Elite G2	3.0 USB Drive	DTEG2/64GB
SanDisk Extreme Go 64 GB USB	3.0 USB Drive	SDCZ800-064G-G46
SanDisk Extreme Pro 64 GB USB	3.0 USB Drive	SDCZ880-128G-G46
SanDisk Ultra Flair 32 GB USB	3.0 USB Drive	SDCZ73-032G-A46, SDCZ73-032G-G46
APC Smart-UPS	SMT-1500C	3S1831X12280
ClearCast Components		
ClearCast	Model D Revision 4	CCD041904024
ClearCast Go	Model E Revision 5	CCER0401006
Corsair Flash Padlock 3 32 GB	Secure USB 3.0 Flash Drive	CMFPLA3B-32GB
Corsair Flash Voyager GTX	3.1 USB Drive	CMFVYGTX3C-128GB
Kingston Data Traveler Elite G2	3.0 USB Drive	DTEG2/64GB

Table 3-1. ClearVote 2.3 Voting System Equipment *(continued)*

Component	Model	Serial Number
SanDisk Extreme Go 64 GB USB	3.0 USB Drive	SDCZ800-064G-G46
SanDisk Extreme Pro 64 GB USB	3.0 USB Drive	SDCZ880-128G-G46
SanDisk Ultra Flair 32 GB USB	3.0 USB Drive	SDCZ73-032G-A46, SDCZ73-032G-G46
Ballot Bag	CV-1032-1.5, CV-1032-2.0	bag001, bag002
Ballot Box	CV-1033-1.5, CV-1033-2.0	box001, box002

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
- 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 3-2. Voting System Deliverables

Material	Version	Description
ClearDesign	2.3	EMS Software
ClearAccess	2.3	BMD software
ClearCount	2.3	Central Count and Tabulation Software
ClearCast	2.2.9	Precinct Count Software
ClearCast Go	2.2.a	Precinct Count Software
ClearVote 2.3 TDP*	2.3	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 2.3 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 2.3 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.

Note: Due to the modifications to the Clear Access components (the introduction of the Lexmark MS-521dn printer and the APC SRT1500RT2U UPS), it was determined that hardware testing would be required. The full suite of hardware electrical testing and operational environmental testing were successfully performed to meet state level test campaign requirements. The Pro V&V test report and associated hardware test reports of this testing will be submitted to the EAC for evaluation and consideration for reuse in this test campaign.

System Integration Test

The system integration tests will be performed to ensure the ClearVote 2.3 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 2.3 correctly captures, stores, consolidates, and reports the specific ballot selections, and absence of selections, for each ballot position.

4.1.1 Rationale for ‘Not Applicable’ Requirements

All requirements that were excluded from the previous test campaign (ClearVote 2.2) 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 2.3 Voting System is a paper-based voting system that consists of the following major components: ClearDesign, ClearAccess, ClearCast, and ClearCount. ClearVote is comprised of two proprietary hardware components (ClearCast and ClearCast Go) 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 and ClearCast Go components were previously subjected to hardware testing. Both components will be subjected to 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 baseline test campaign, the results of which are contained in the final certification test report for the baselined system.

ClearDesign – The ClearDesign component is unmodified COTS equipment and is exempt from non-operational hardware testing.

4.3 Software System Functions

The ClearVote 2.3 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 2.3 EMS applications are ClearDesign and 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 confirmation 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 setup 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 2.2). The Clear Access updates to the modified system (ClearVote 2.3) require the following hardware testing to be performed.

Electrical Tests:

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

Environmental Tests:

- Temperature Power Variation – ClearAccess

4.4.2 Hardware Environmental Test Case Design

Previous hardware examinations were performed on certified versions of the baseline system (ClearVote 2.2). The updates to the modified system (ClearVote 2.3) require the tests specified in Section 4.4.1 to be performed. The full suite of hardware electrical testing and operational environmental testing were successfully performed to meet state level test campaign requirements. The Pro V&V test report and associated hardware test reports of this testing will be submitted to the EAC for evaluation and consideration for reuse in this test campaign.

Testing was performed by personnel verified by Pro V&V to be qualified to perform the test. Pro V&V utilized NTS Longmont for the performance of the electrical and environmental tests. All pre/post-tests were 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 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 2.3 TDP is provided in Table 4-1.

Table 4-1. TDP Documents

Document Number	Description	Version
<i>ClearVote Documents</i>		
100101	ClearVote 2.3 Approved Parts List	2.0.3
100067	ClearVote 2.3 Ballot Stock and Printing Specification	1.0.15
100057	ClearVote 2.3 Configuration Management Plan	1.0.20
100069	ClearVote 2.3 Glossary	1.0.13
100058	ClearVote 2.3 Personnel Deployment and Training Plan	1.0.15
100059	ClearVote 2.3 Quality Assurance Program	1.0.18
100086	ClearVote 2.3 Security Policy	1.0.18
100071	ClearVote 2.3 System Overview	1.1.4
100073	ClearVote 2.3 Test and Verification Specification	1.0.17
100128	ClearVote 2.3 Change Notes	1.0.3
<i>ClearDesign Documents</i>		
100011	ClearDesign 2.3 Acceptance Test Checklist	1.0.10
100062	ClearDesign 2.3 Administration Guide	1.0.16
100083	ClearDesign 2.3 Build Procedures	1.0.11
100103	ClearDesign 2.3 Database Specification	1.0.11
100046	ClearDesign 2.3 Functionality Description	1.0.16
100098	ClearDesign 2.3 Hardware Specification	1.0.14
100063	ClearDesign 2.3 Installation Guide	2.0.6
100082	ClearDesign 2.3 Maintenance Guide	1.0.15
100045	ClearDesign 2.3 Security Specification	1.0.16
100043	ClearDesign 2.3 System Overview	1.0.18
100133	ClearDesign 2.3 Accessible Definition File Guide	1.0.5

Table 4-1. TDP Documents (continued)

Document Number	Description	Version
100131	ClearDesign 2.3 Ballot Definition File Guide	1.0.6
100074	ClearDesign 2.3 System Identification Guide	1.4
100041	ClearDesign 2.3 User Guide	3.0.3
<i>ClearCount Documents</i>		
100102	ClearCount 2.3 Acceptance Test Checklist	1.0.14
100009	ClearCount 2.3 Build Procedures	1.6.8
100005	ClearCount 2.3 Database Specification	1.1.6
100004	ClearCount 2.3 Election Administration Guide	2.0.6
100006	ClearCount 2.3 Installation Guide	2.0.2
100021	ClearCount 2.3 Functionality Description	1.0.17
100022	ClearCount 2.3 Hardware Specification	1.0.17
100023	ClearCount 2.3 Maintenance Guide	1.0.17
100070	ClearCount 2.3 Reporting Guide	1.1.5
100013	ClearCount 2.3 Scanner Operator Guide	1.2.2
100026	ClearCount 2.3 Security Specification	1.0.17
100019	ClearCount 2.3 Software Design and Specification	1.0.18
100024	ClearCount 2.3 System Operations Procedures	2.0.1
100025	ClearCount 2.3 System Overview	1.0.16
---	ClearCount 2.3 Quick Guide XML Report Conversion Tool	---
100047	ClearCount 2.3 System Identification Guide	1.4
<i>ClearCast Documents</i>		
100134	ClearCast 2.3 Hardware Acceptance Test Checklist	1.3
100135	ClearCast 2.3 Software Acceptance Test Checklist	1.1.1
100097	ClearCast 2.3 System Identification Guide	1.4
100094	ClearCast 2.3 Build Procedures	1.2.10
100079	ClearCast 2.3 Functionality Description	1.5.6
100080	ClearCast 2.3 Installation Guide	1.4.4
100081	ClearCast 2.3 Hardware Specification	1.5.4
100089	ClearCast 2.3 Maintenance Guide	2.0.3
100090	ClearCast 2.3 Poll Worker Guide	1.2

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

Document Number	Description	Version
100084	ClearCast 2.3 Security Specification	1.4.6
100093	ClearCast 2.3 Software Design and Specification	1.4.6
100100	ClearCast 2.3 Supervisor Guide	1.8.5
100078	ClearCast 2.3 System Overview	1.4.7
100148	ClearVote 2.3 ClearCast Go System Identification Guide	1.1
100142	ClearVote 2.3 ClearCast Go Maintenance Guide	1.0.3
100143	ClearVote 2.3 ClearCast Go Poll Worker Guide	1.2
100144	ClearVote 2.3 ClearCast Go Supervisor Guide	1.0.3
100147	ClearCast Go 2.3 Hardware Acceptance Test Checklist	1.0.1
100146	ClearVote 2.3 ClearCast Go Installation Guide	1.0.2
100145	ClearVote 2.3 ClearCast Go Build Procedures	1.0.2
<i>ClearAccess Documents</i>		
100109	ClearAccess 2.3 Acceptance Test Checklist	1.1.5
100051	ClearAccess 2.3 Build Procedures	1.1.6
100049	ClearAccess 2.3 Functionality Description	1.5.7
100085	ClearAccess 2.3 Hardware Specification	1.5.5
100053	ClearAccess 2.3 Installation Guide	1.8.6
100052	ClearAccess 2.3 Maintenance Guide	1.8.4
100054	ClearAccess 2.3 Poll Worker Guide	1.8.9
100050	ClearAccess 2.3 Security Specification	1.5.2
100099	ClearAccess 2.3 Software Design and Specification	1.5.7
100055	ClearAccess 2.3 Supervisor Guide	1.8.9
100044	ClearAccess 2.3 System Overview	1.6.8
100056	ClearAccess 2.3 Voter Guide	1.1.8
100038	ClearAccess 2.3 System Identification Guide	1.5

4.6 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.

The submitted source code will be compared to the previously certified ClearVote 2.2 voting system versions to determine the changes, if any. A combination of Automated Source Code Review and Manual Source Code Review methods will then be used to review the changes in the source code. A compliance review of all modified source code will be performed. Once the compliance review is performed and the source is deemed stable enough to proceed with testing, the source code and all additional packages will be compiled into a Compliance Build. Following successful completion of the FCA, a Trusted Build will be performed. The trusted build consists of inspecting the submitted source code, COTS, and third-party software products and combining them to create the executable code following 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 Automated Source Code Review will be performed during the Compliance and Trusted Builds. In addition, 10% of the source code comments will be manually reviewed.

4.7 Physical Configuration Audit (PCA)

The Physical Configuration Audit (PCA) compares the voting system components submitted for qualification to the manufacturer’s technical documentation, and shall include the following activities:

- Establish a configuration baseline of software and hardware to be tested; confirm whether manufacturer’s documentation is sufficient for the user to install, validate, operate, and maintain the voting system.
- Verify software conforms to the manufacturer’s specifications; inspect all records of manufacturer’s release control system; if changes have been made to the baseline version, verify manufacturer’s engineering and test data are for the software version submitted for certification.
- If the hardware is non-COTS, Pro V&V shall review drawings, specifications, technical data, and test data associated with system hardware to establish system hardware baseline associated with software baseline.
- Review manufacturer’s documents of user acceptance test procedures and data against system’s functional specifications; resolve any discrepancy or inadequacy in manufacturer’s plan or data prior to beginning system integration functional and performance tests.
- Subsequent changes to baseline software configuration made during testing, as well as system hardware changes that may produce a change in software operation are subject to re-examination.

4.8 System Level Testing

System Level Testing will be implemented to evaluate the complete system. This testing will include all proprietary components and COTS components (software, hardware, and peripherals) in a configuration of the system’s intended use. System Level Testing for this campaign includes the evaluations of the following test areas: FCA, Accuracy Testing, and System Integration Testing.

For software system tests, the tests will be designed according to the stated design objective without consideration of its functional specification. The system level hardware and software test cases will be prepared independently to assess the response of the hardware and software to a range of conditions. Pro V&V will review the manufacturer’s program analysis, documentation,

and module test case design and evaluate the test cases for each module with respect to flow control parameters and entry/exit data.

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

4.8.1 Functional Configuration Audit (FCA)

The Functional Configuration Audit (FCA) targets the specific functionality claimed by the manufacturer to ensure the product functions as documented. This testing uses both positive and negative test data to test the robustness of the system. The FCA encompasses an examination of manufacturer tests, and the conduct of additional tests, to verify that the system hardware and software perform all the functions described in the manufacturer's documentation submitted in the TDP (such as system operations, voter manual, maintenance, and diagnostic testing manuals). It includes a test of system operations in the sequence in which they would normally be performed. These system operations and functional capabilities are categorized as follows by the phase of election activity in which they are required:

- Overall System Capabilities: These functional capabilities apply throughout the election process. They include security, accuracy, integrity, system auditability, election management system, vote tabulation, ballot counters, telecommunications, and data retention.
- Pre-voting Capabilities: These functional capabilities are used to prepare the voting system for voting. They include ballot preparation, the preparation of election-specific software (including firmware), the production of ballots, the installation of ballots and ballot counting software (including firmware), and system and equipment tests.
- Voting System Capabilities: These functional capabilities include all operations conducted at the polling place by voters and officials including the generation of status messages.
- Post-voting Capabilities: These functional capabilities apply after all votes have been cast. They include closing the polling place; obtaining reports by voting machine, polling place, and precinct; obtaining consolidated reports; and obtaining reports of audit trails.
- Maintenance, Transportation and Storage Capabilities: These capabilities are necessary to maintain, transport, and store voting system equipment.

In addition to functioning according to the manufacturer's documentation, tests will be conducted to insure all applicable EAC 2005 VVSG requirements are met.

4.8.2 Accuracy

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

The accuracy requirements for ClearCount will be met by the execution of the standard accuracy test utilizing pre-marked and hand-marked **paper** ballots of each ballot length supported by the system, and **BMD** ballots produced by the ClearAccess. ClearCount will be tested by utilizing a combination of hand marked (70%) and pre-marked (30%) ballots. The ClearCast Accuracy test will be reused from the ClearVote 2.2 EAC Campaign.

4.8.3 System Integration

The System Integration area of testing is a system level test that evaluates the integrated operation of both hardware and software. Compatibility of the voting system software components or subsystems with one another, and with other components of the voting system environment, shall be determined through functional tests integrating the voting system software with the remainder of the system. Additionally, the system shall be configured exactly as it would for normal field use per the procedures detailed in the ClearVote 2.3 voting system technical documentation. 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.

To accomplish the test objective, two General Elections and two Primary Elections will be exercised on the voting system, as described below:

Two general elections with the following breakdowns:

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

Two primary elections with the following breakdowns:

- Primary Election PRIM-01: This election is designed to functionally test a Closed Primary Election with multiple ballots and support for common voting variations. This election contains thirty-one contests and six parties compiled into eighteen ballot styles, each ballot containing six contests.
- Primary Election PRIM-03: A Closed Primary Election held in two precincts. This election contains ten contests and is compiled into two ballot styles. Two of the contests are in both ballot styles. The other eight contests are split between the two parties' ballots. 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.

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 2.3 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 it would be for normal field use. This includes connecting all supporting equipment and peripherals.

6.3 Test Sequence

The ClearVote 2.3 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.

**ATTACHMENT A
PROJECT SCHEDULE**

Task Name	Start Date	End Date
EAC Application & TRR	01/18/22	02/02/22
Application Submitted to EAC	01/18/22	01/18/22
TRR	01/27/22	02/01/22
Application Approval from EAC	02/02/22	02/02/22
TDP	02/02/22	05/05/22
Initial Review	02/02/22	02/03/22
Compliance Review	02/04/22	05/03/22
Final review	05/04/22	05/05/22
Test Plan	02/03/22	04/08/22
Test Plan Creation	02/03/22	02/16/22
Vendor Review & Comments	02/17/22	02/18/22
EAC Submission and Review	02/21/22	03/18/22
VSTL Comment Review & Update	03/21/22	03/24/22
EAC Submission & Review of Revision	03/25/22	04/07/22
EAC Approved Test Plan	04/08/22	04/08/22
Source Code	02/03/22	02/16/22
Automated Review	02/03/22	02/03/22
Source Code Review	02/03/22	02/09/22
Source Code Re-Review	02/10/22	02/10/22
Document Review	02/11/22	02/11/22
Compliance Build	02/14/22	02/16/22
System Delivery & Setup	01/19/22	02/21/22
PCA	01/19/22	01/19/22
System Setup	01/20/22	01/21/22
System Loads & Hardening	02/17/22	02/21/22
Hardware Testing	02/22/22	02/23/22
Maintainability	02/22/22	02/22/22
Electrical Supply	02/22/22	02/23/22
System Level Testing	02/24/22	05/16/22
FCA	02/24/22	03/30/22
Security	03/31/22	04/01/22
Usability	04/04/22	04/06/22
Accessibility	04/07/22	04/08/22
Volume and Stress	04/11/22	04/15/22
Accuracy	04/18/22	04/22/22
Regression Testing	04/25/22	04/28/22
Trusted Build	04/29/22	05/03/22
System Loads & Hardening	05/04/22	05/05/22
System Integration	05/06/22	05/16/22
Test Report	05/17/22	07/14/22
Test Report Creation	05/17/22	05/23/22

Vendor Review & Comments	05/24/22	05/24/22
EAC Submission & Review	05/25/22	06/22/22
VSTL Comment Review & Update	06/23/22	06/27/22
EAC Submission & Review of Revision	06/28/22	07/13/22
EAC Approved Test Report	07/14/22	07/14/22