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Test Plan for EAC 2005 VVSG Certification Testing Clear Ballot Group ClearVote 1.4 Voting System

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TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	References.....	1
1.2	Terms and Abbreviations.....	1
1.3	Testing Responsibilities.....	2
1.3.1	Project Schedule.....	2
1.3.1.1	Owner Assignments.....	2
1.3.1.2	Test Case Development.....	2
1.3.1.3	Test Procedure Development and Validation.....	2
1.3.1.4	Third Party Tests.....	3
1.3.1.5	EAC and Manufacturer Dependencies.....	3
1.4	Target of Evaluation Description.....	3
1.4.1	System Overview.....	3
1.4.2	Block Diagram.....	5
1.4.3	System Limits.....	6
1.4.4	Supported Languages.....	6
1.4.5	Supported Functionality.....	7
1.4.5.1	Standard VVSG Functionality.....	7
1.4.5.2	Manufacturer Extensions.....	7
2.0	PRE-CERTIFICATION TESTING AND ISSUES	7
2.1	Evaluation of Prior VSTL Testing.....	8
2.2	Evaluation of Prior Non-VSTL Testing.....	8
2.3	Known Field Issues.....	8
3.0	MATERIALS REQUIRED FOR TESTING	8
3.1	Software.....	8
3.2	Equipment.....	10
3.3	Test Materials.....	12
3.4	Deliverable Materials.....	12

4.0	TEST SPECIFICATIONS	12
4.1	Requirements (Strategy of Evaluation).....	13
4.1.1	Mapping of Requirements to Equipment Type and Features.....	14
4.1.2	Rational for ‘Not Applicable’ requirements	14
4.2	Hardware Configuration and Design	14
4.3	Software System Functions.....	15
4.4	Test Case Design	15
4.4.1	Hardware Qualitative Design.....	16
4.4.1.1	Mapping of Requirements to Specific Interfaces.....	17
4.4.2	Hardware Environmental Test Case Design	17
4.4.3	Software Module Test Case Design and Data	17
4.4.4	Software Functional Test Case Design and Data.....	17
4.4.5	System-Level Test Case Design	18
4.5	Security Functions	18
4.6	TDP Evaluation.....	18
4.7	Source Code Review.....	21
4.8	QA & CM System Review	21
5.0	TEST DATA	22
5.1	Test Data Recording	22
5.2	Test Data Criteria.....	22
5.3	Test Data Reduction.....	22
6.0	TEST PROCEDURES AND CONDITIONS	22
6.1	Facility Requirements	22
6.2	Test Set-Up	23
6.3	Test Sequence	23
7.0	TEST OPERATIONS PROCEDURES	23
7.1	Proprietary Data.....	23
	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 full certification testing during a new system campaign for the Clear Ballot Group (CBG) ClearVote 1.4 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 1.4 Voting System. The application was accepted by the EAC and the project was assigned the unique Project Number of CBG1601.

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 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, 2006 Edition, “NVLAP Procedures and General Requirements (NIST Handbook 150)”, dated February 2006
- 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 May 04, 2016
- 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 1.4 documents submitted for this test campaign is listed in Section 4.6 of this Test Plan*)

1.2 Terms and Abbreviations

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

“ADA” – Americans with Disabilities Act 1990

“CM” – Configuration Management

“COTS” – Commercial Off-The-Shelf

“DRE” – Direct Record Electronic

“EAC” – United States Election Assistance Commission
“EMS” – Election Management System
“FCA” – Functional Configuration Audit
“HAVA” – Help America Vote Act
“ISO” – International Organization for Standardization
“NOC” – Notice of Clarification
“PCA” – Physical Configuration Audit
“QA” – Quality Assurance
“RFI” – Request for Interpretation
“TDP” – Technical Data Package
“UPS” – Uninterruptible Power Supply
“VSTL” – Voting System Test Laboratory
“VVSG” – Voluntary Voting System Guidelines

1.3 Testing Responsibilities

All testing will be conducted under the guidance of personnel verified by Pro V&V, Inc. to be qualified to perform the testing.

1.3.1 Project Schedule

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

1.3.1.1 Owner Assignments

This information is contained in the Project Schedule presented in Appendix A.

1.3.1.2 Test Case Development

Pro V&V will utilize baseline test cases for the Functional Configuration Audit (FCA), Usability, and System Integration Tests. These test cases will be augmented with specially designed test cases tailored to the specific design of the ClearVote 1.4 System. Additionally, specific election definitions will be designed for the Operational Status Check and the Logic & Accuracy Tests.

1.3.1.3 Test Procedure Development and Validation

Pro V&V will utilize VSTL Test Procedures during the duration of the test campaign. These procedures are developed to the EAC 2005 VVSG standards. The validation of the VSTL Test Procedures is accomplished by Technical Review and Approval. If necessary and where practical, a validation might include execution to attempt to achieve the expected results using the selected tool of the testing methodology. Test Plans, Test Suites, Test Specifications, and Test Cases will be validated prior to execution. This validation will include the following:

- Confirmation of adequate test coverage of all requirements.
- Confirmation that test case results are not ambiguous and have objective pass/fail criteria.
- Confirmation that any automated test suites will produce valid results.

1.3.1.4 Third Party Tests

Pro V&V will be utilizing third party testing during the performance of hardware testing. All testing will be witnessed by Pro V&V personnel at the third party test site with the exception of Temperature Power Variation in which Pro V&V qualified staff will execute all testing at the third party facility.

1.3.1.5 EAC and Manufacturer Dependencies

This information is contained in the Project Schedule presented in Appendix A.

1.4 Target of Evaluation Description

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

1.4.1 System Overview

The ClearVote 1.4 Voting System is a paper-based optical scan voting system consisting of the following major components: ClearDesign (ballot design), ClearCount (central count and tabulation), ClearCast (precinct count), and ClearAccess (accessible voting and ballot marking).

ClearDesign

ClearDesign is an Election Management System consisting of an interactive set of applications which are responsible for all pre-voting groups of activities in the process of defining and managing elections. This includes ballot design, proofing, layout, and production. The ClearDesign system consists of the following physical components (all of which are unmodified COTS hardware and are connected via closed, wired Ethernet connections):

- DesignServer: A laptop or desktop computer running the ClearDesign software and hosting its election database and the web server that serves its election reports.
- DesignStation(s): One or more laptop/scanner pairs used to scan and tabulate ballots.
- Router: Used to connect the DesignStations to the DesignServer using a wired, closed Ethernet.

ClearCount

ClearCount is a central, high-speed, optical scan ballot tabulator coupled with ballot processing applications. The ClearCount software runs on unmodified COTS laptop computers running the Windows operating system and supports specific models of Fujitsu scanners. The ClearCount central-count system consists of the following physical components (all of which are unmodified COTS hardware and are connected via closed, wired Ethernet connections):

- ScanServer: A laptop or desktop computer running the ClearCount software and hosting its election database and the web server that serves its election reports.
- ScanStations: One or more laptop or desktop/scanner pairs used to scan and tabulate ballots.
- Router: Used to connect the ScanStations to the ScanServer using a wired, closed Ethernet.
- Election Administration Stations: One or more Windows laptop or desktop computers installed with browser software, linked by a wired Ethernet connection to the ScanServer using the router.

All files that make up the ClearCount software reside on a single ScanServer that is shared by all client ScanStations. The Tabulator software on each ScanStation is read 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 to handle the ballots it is scanning. Tabulator analyzes the incoming image and transfers them to the local output folder named CBGBallotImages, from where the ScanServer retrieves them.
- Election Database: A centralized election database that resides on the ScanServer and collects the output of each Tabulator.
- Election Reports: A browser-based suite of reports that provides election results and analysis and allows election officials to review individual card images. A web server on the ScanServer serves the reports.
- Card Resolutions tool: A web application that allows election officials to review and appropriately resolve unreadable cards.
- User and Election Database Management through web applications: On the User Administration dashboard, the administrator can add, rename, or delete users, assign permissions, and change user passwords. On the Election Administration dashboard, the administrator can create or delete an election, set an election as active, and backup or restore an election.

ClearCast

The ClearCast tabulator is a precinct count ballot scanning solution suitable for polling, early, or any other type of in-person voting, including processing ballots printed by the ClearAccess accessible ballot marking device. The ClearCast application runs on the P1000 precinct count-based tabulator, and is used to scan, count and tally marked ballots. Its functionality is divided into three essential modes, Election Mode, which is used to process ballots in live election mode, Pre-Election Mode, which occurs prior to Election Mode, and is used to test all system functionality prior to election begin, and Post-Election Mode, which is used to perform administrative functions following election close.

ClearAccess

ClearAccess is an accessible touchscreen ballot marking device (BMD) used for the creation of paper ballots that can be scanned and tabulated by ClearCount.

1.4.2 Block Diagram

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

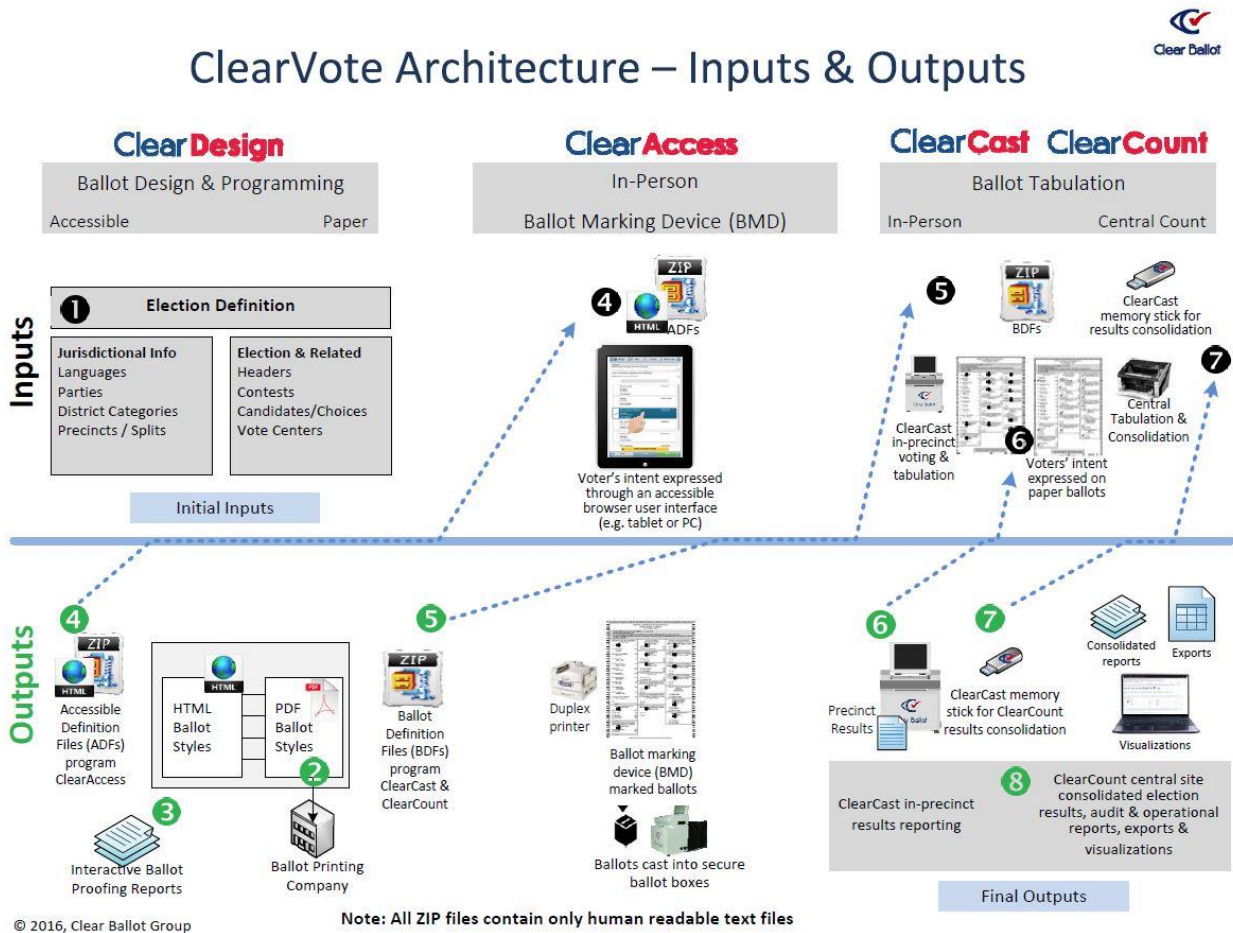


Figure 1-1. ClearVote 1.4 System Overview

1.4.3 System Limits

The system limits that CBG has stated to be supported by the ClearVote 1.4 Voting System are listed in the tables below.

Table 1-1. System Limits for ClearDesign

Characteristic	Limit
Ballot positions, per side 22”	380
Precincts in an election	5000
Contests in an election	6000
Candidates/Counters in an election	15000
Ballot Styles in an election	8192
Contests in a ballot style	125
Candidates in a contest	200
Ballot styles in a precinct	12
Number of political parties	20
“vote for” in a contest	10
Supported languages in an election	5
Number of write-ins	10

Table 1-2. 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	8.5x18	8.5x19	8.5x22	
fi-6800	7822	5508	4155	3352	3348	3000 (est)	2640	Large (>100k voters)
fi-6670 fi-6400	5592	3624	2928	2448	2400	2350 (est)	2136	Medium (25k-100k voters)
fi-7180	3396	2040	1692	1400	1356	1300 (est)	1164	Small (<25k voters)
ClearCount can have a maximum of 20 ScanStation/Scanner pairs plus 3 Administration/Adjudication Stations								

1.4.4 Supported Languages

The submitted voting system supports:

- English
- Spanish
- Chinese
- Korean
- Vietnamese

Support for all stated languages will be verified; however, 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.

1.4.5 Supported Functionality

The ClearVote 1.4 is designed to support the following voting variations:

- General Election
- Closed Primary
- Open Primary
- 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
- Cumulative Voting
- Provisional or Challenged Ballots

1.4.5.1 Standard VVSG Functionality

The ClearVote 1.4 Voting System shall be evaluated against the relevant requirements contained in the EAC 2005 VVSG, Volumes I and II.

1.4.5.2 Manufacturer Extensions

There are no manufacturer extensions on testing for this test campaign

2.0 PRE-CERTIFICATION TESTING AND ISSUES

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. It was determined that various documents were lacking some information. Additionally, inconsistencies were noted throughout the TDP package. The results of the review were reported to Clear Ballot Group for resolution. Clear Ballot Group has subsequently revised and resubmitted the TDP and Pro V&V is currently reviewing these submissions. Specific documents have been reviewed multiple times in order to facilitate performance of the FCA. The findings of each review performed are tracked in the TDP review spreadsheet.

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

The ClearVote 1.4 is a new voting system that has not previously been tested to applicable federal standards in the EAC Program.

2.2 Evaluation of Prior Non-VSTL Testing

The ClearVote 1.4 is a new voting system that has not previously been tested to applicable federal standards in the EAC Program. However, Pro V&V will review the results of any Summative Usability Testing performed on the system to verify that the submitted test results are in Common Industry Format.

2.3 Known Field Issues

There are no known field issues for the ClearVote 1.4 Voting System.

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 1.4 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.

Table 3-1. Voting System Software

Firmware/Software	Version
<i>ClearDesign Components, Version 1.4</i>	
Ubuntu 14.04	14.04
MySQL Linux	5.5.32 The database engine
Apache2	2.22-6ubuntu5.1
libapache2-mod-fcgid	1:2.3.7-0.ubuntu2
PhantomJS	1.9.01-1
Python 2	2.7.6
Python web.py	1:0.37+20120626-1
Python MySQL dB library	1.2.3-2ubuntu1
Python SQLAlchemy	0.8.4-1build1
Python Pillow library	2.3.0-1ubuntu3
Python dbutils library	1.1
Python xlrd library	0.9.4

Python rtf library	0.2.1
Python FontTools library	3
Python PyCrypto library	2.6.1
JavaScript jQuery	1.10.2
JavaScript DataTables	1.10.5
JavaScript Bootstrap	3.0.0
JavaScript jQuery-Imromptu	5.2.3
JavaScript jQuery-qrcode	1.0
JavaScript jQuery-splitter	0.14.0
JavaScript jQuery-ui	1.10.4
JavaScript jscolor	1.4.2
JavaScript tinymce	4.1.9
JavaScript fastclick	1.0.4
JavaScript libmp3lame	na
JavaScript jszip	na
JavaScript papaparse	4.1.2
<i>ClearAccess Components, Version 1.4</i>	
Windows 10	10
Python	2.7.10
Python web.py	0.38
Python pywin32 library	2.2.0
Python pyCrypto library	2.6.1
JavaScript DataTables	1.10.5
JavaScript jQuery	1.10.2
<i>ClearCast Components, Version 1.4</i>	
Ubuntu 14.04 LTS	14.04
python	2.7.6
Pillow, python-imaging	2.3.0
python-zmq	14.0.1
mysql	5.5.44
python-webpy	1:0.37+20120626-1
pmount	0.9.23-2
zeromq-4.0.5	4.0.5
libbsd-dev	0.6.0-2ubuntu1
google-chrome-stable_current_amd64.deb	53.0.2785.89-1
python-pbkdf2	1.3+20110613.git2a0fb15~ds0-3
javascript modules:	
DataTables-1.10.5	1.10.5
JTSage DateBox	4.0.0
jQuery.NumPad	1.4
jquery	1.10.2
jquery.ui-1.11.3	1.11.3
<i>ClearCount Components, Version 1.4</i>	
webCBG.fcgi	na
sql\cbgweb.sql	na
Debconf	1.5.49ubuntu1
python	2.7.4
python-mysqldb	1.2.3-1ubuntu1
PIL-python-imaging	1..7+2.0.-1ubuntu0.1

PyInstaller	2.0
python-webpy	1:0.37+20120626-1
Ubuntu Server	13.04-serveramd64
mysqserver	5.5.32
apache2	2.2.22-6ubuntu5.1
libapache2-mod-fcgid	1:2.3.7-0.ubuntu2
samba	2:3.6.9-1ubuntu1.1
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
JavaScript FixedHeader library	2.0.6
JavaScript hotkeys library	no version, dated May 25, 2013
JavaScript pep library	no version, dated Oct 4, 2013
JavaScript tooltip library	1.3
JavaScript LESS library	1.3.3
JavaScript TableTools library	2.1.5
ZeroClipboard.js	na

3.2 Equipment

This subsection lists the proprietary and COTS equipment to be 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. Voting System Equipment

Component	Model/Serial Number
<i>ClearDesign Components</i>	
Dell Latitude Laptop	Model: E5570 S/N's: 927QQC2 & J2ZQQC2
TRENDnet Switch	Model: TEG-S80g S/N: CA11238032857
Lenovo USB Portable DVD Burner	Model: GP60NB50 S/N's: 411HV005130 & 411HR027583
<i>ClearAccess Components</i>	
Dell OptiPlex	Model: 3240AIO

	S/N: F0B6B02
Dell 15" Laptop 2 in 1	Model: Inspiron 5000 series S/N: 29FX1CA
Brother Laser Printer	Model: HL-L2340DW S/N's: U63879M4N628612, U63879M4N628617 & U63879M4N628535
Oki Data Laser Printer	Model: B432dn S/N: SAK5B007647A0
HP OfficeJet Printer	Model: 7612 S/N: CN6343R0D6
HP OfficeJet Mobile printer	Model: 100 S/N: MY648F10JG
Storm EZ Access Keypad	Model: EZ08-22201 S/N: 1500005
Origin Instruments Sip/Puff Breeze with Headset	Model: BZ2 P/N: AC-0313-H2
Over-Ear Stereo Headphones	Model: Hamilton Buhl M/N: HA-7
ElectionSource Table Top Voting Booth (Privacy Screen)	Model: VB-60B
APC Smart-UPS	Model: SMT1500 S/N: 3S1525X07491
APC Smart-UPS	Model: SMT2200 S/N: AS1603160039
Stand for Dell OptiPlex 3240 AIO (portrait mode)	Model: Neo Flex S/N: 1274839-0061
Bezel for Optiplex 3240	N/A
Bezel for Inspiron 15" 2 in 1	N/A
<i>ClearCount Components</i>	
Dell Latitude Laptop (multiple units)	Model: E5570 S/N's: 5537MC2 & FXDQQC2
Dell PowerEdge Server	Model: T330 S/N: FHV9RD2
Fujitsu Scanner	Model: fi-7180 S/N: A2OD000798
Fujitsu Scanner	Model: fi-6800 S/N: A9HCA00737
Fujitsu Scanner	Model: fi-6400 S/N: AKHCC00362
Fujitsu Scanner	Model: fi-6670 S/N: AAADC00936
Lenovo USB Portable DVD Burner	Model: GP60NB50 S/N's: 411HV005130 & 411HR027583
Dell 22 inch Monitor	Model: S2240M S/N: CN-0CFGKT-64180-58B-0X3T
NetGear ProSafe VPN Firewall	Model: FVS318G S/N: 40F266BA00280
TrendNet Router	Model: TEW-733GR/A S/N: C1408RN800574

TP-LINK VPN Router	Model: TL-R600VPN S/N: 2149342000209
EZ Scanning Shelf (fi-6400 or fi-6800)	Model: WorkeZ
ClearCast Components	
ClearCast	Model: P1000 version A S/N: Cast003

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, 8 and 32 GB capacity
- Test Decks
- Power Cords
- Ballot Paper, 4inch thermal paper, 24 lb. bond or similar paper for results reports
- Labels
- 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	1.4	EMS Software
ClearAccess	1.4	BMD software
ClearCount	1.4	Central Count and Tabulation Software
ClearCast	1.4	Precinct Count Software
ClearVote TDP	1.0	TDP Documents

4.0 TEST SPECIFICATIONS

Certification testing of the Clear Ballot Group ClearVote 1.4 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 1.4 test requirements, each section of the EAC 2005 VVSG will be analyzed to determine the applicable tests. The EAC 2005 VVSG Volume I Sections, along with the strategy of evaluation, are described below:

Section 2: Functional Requirements

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

Section 3: Usability and Accessibility Requirements

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. Pro V&V will review the results of Summative Usability Testing performed on the system to verify that the submitted test results are in Common Industry Format.

Section 4: Hardware Requirements

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.

Section 5: Software Requirements

The requirements in this section shall be tested utilizing a combination of review and functional testing during the Source Code Review, TDP Review, and FCA.

Section 6: Telecommunications Requirements

The requirements in this section shall be tested utilizing baseline test cases as well as specifically designed test cases.

Section 7: Security Requirements

The requirements in this section shall be tested during the Source Code Review, Security Tests, and FCA.

Section 8: Quality Assurance Requirements

The requirements in this section shall be tested throughout the test campaign. This testing will utilize a TDP Review in conjunction with the Source Code Review and PCA to determine compliance to the EAC 2005 VVSG requirements and the requirements stated in the Clear Ballot Group technical documentation. The review of the Quality Assurance documentation will focus on Clear Ballot Group's adherence to its stated QA processes.

Section 8: Configuration Management Requirements

The requirements in this section shall be tested throughout the test campaign. This testing will utilize a TDP Review in conjunction with the Source Code Review and PCA to determine compliance to the EAC 2005 VVSG requirements and the requirements stated in the Clear Ballot Group technical documentation. The review of the Configuration Management documentation will focus on Clear Ballot Group's adherence to its stated CM processes.

Throughout the test campaign, Pro V&V personnel shall maintain a test log identifying the system and equipment under test and any records of deviations to the test plan along with the rationale for performing the deviations. Pro V&V shall also utilize an internal bug tracking system to record and track all issues and/or discrepancies noted during the test campaign.

4.1.1 Mapping of Requirements to Equipment Type and Features

This information shall be included in the EAC online matrix tool (VRT).

4.1.2 Rationale for ‘Not Applicable’ Requirements

The ClearVote 1.4 is a paper-based system that supports a closed network. Therefore, all EAC 2005 VVSG requirements, with the exceptions listed below, will be evaluated as part of this test campaign.

- Volume I, Section 6.2.6 (Telecommunications Requirements)
- Volume I, Section 7.52-7.54 (Telecommunications and Data Transmission)
- Volume I, Section 7.6 (Use of Public Networks)
- Volume I, Section 7.7 (Wireless Communications)
- Volume I, Section 7.9 (Voter Verifiable Paper Audit Trail Requirements)

The rationale for not evaluating the ClearVote 1.4 to the indicated sections is described in following table. Specific requirements that are excluded from this test campaign are identified in the EAC online matrix tool.

Table 4-1. Not Applicable Requirements

EAC 2005 VVSG Version 1 Volume I, Section	Rationale for ‘Not Applicable’
6.2.6	These requirements are written for use of public networks. The ClearVote 1.4 does not utilize public networks.
7.5.2-7.5.4	These requirements are written for use of public networks. The ClearVote 1.4 does not utilize public networks.
7.6	This system does not support transmission over public networks.
7.7	No wireless technology is utilized in this system.
7.9	This system does not contain a Voter Verifiable Paper Audit Trail (VVPAT).

4.2 Hardware Configuration and Design

The ClearVote 1.4 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), one COTS hardware component (ClearCount), and one integrated COTS component (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, Safety, and Accuracy Testing.

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

4.3 Software System Functions

The ClearVote 1.4 Election Management System (EMS) consists of a set of applications responsible for all pre-voting and post-voting activities used in election definition and management process. The ClearVote 1.4 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 testing candidate 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 clean.
- Ensure batteries are fully charged.
- Inspect supplies and test decks.
- Record protective counter on all tabulators.
- Review physical security measures of all equipment.
- Record basic observations of the testing setup and review.
- Record serial numbers of equipment.
- Retain proof of version numbers.

4.4.1 Hardware Qualitative Examination Design

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

Electrical Tests:

- Electrical Power Disturbance – ClearCast, ClearAccess
- Electromagnetic Radiation – ClearCast, ClearAccess
- Electrostatic Disruption – ClearCast, ClearAccess
- Electromagnetic Susceptibility – ClearCast, ClearAccess
- Electrical Fast Transient – ClearCast, ClearAccess
- Lightning Surge – ClearCast, ClearAccess
- Conducted RF Immunity – ClearCast, ClearAccess
- Magnetic Fields Immunity – ClearCast, ClearAccess
- Electrical Supply – ClearCast, ClearCount (fi-6400, fi-6800, fi-6670, fi-7180), ClearAccess

Environmental Tests:

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

- Temperature Power Variation - ClearCast, ClearCount (fi-6400, fi-6800, fi-6670, fi-7180), ClearAccess
- Acoustic – ClearAccess

4.4.1.1 Mapping of Requirements to Specific Interfaces

This information shall be contained in the EAC online matrix tool.

4.4.2 Hardware Environmental Test Case Design

No previous examinations have been performed on the ClearVote 1.4 Voting System. The voting system hardware 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 a third-party test facility for 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, Compliance Builds, and Security Testing, 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. 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. 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 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. A threat matrix shall be created to determine the risks and vulnerabilities. An evaluation of the system shall be accomplished by utilizing a combination of functional testing, source code review, and Fortify SCA. All findings will be reported to the EAC and Clear Ballot Group.

4.6 TDP Evaluation

In order to determine full compliance with the EAC 2005 VVSG, three phases of TDP review shall be conducted:

- **Initial TDP Review:** The first review is performed to determine whether the TDP submitted is complete enough to perform TDP review. This is an abbreviated review. Each document is read to determine whether it provides enough description of the submitted voting system components and whether it at least generically addresses VVSG requirements. The results of the review are used in determining contractual requirements for the test campaign.
- **Compliance Review:** This review is conducted on a document-by-document basis to determine if every regulatory, state, or manufacturer-stated requirement has been met based on the context of each requirement. This review does not address consistency or completeness of documents. The review is more complex than the initial TDP review. Results of the review of each document are entered on the TDP Review Checklist and are reported to the manufacturer for disposition of any anomalies. This process is ongoing until all anomalies are resolved. Any revised documents during the TDP review process are compared with the previous document revision to determine changes made, and the document is re-reviewed to determine whether subject requirements have been met.

- Consistency/Completeness Review: The third TDP review is completed after the review for compliance has been performed (the Consistency/Completeness TDP Review may overlap the Compliance Review in part). This review is to ensure the information included in the TDP documents is consistent across documents, especially in component naming, software and firmware versioning, and the hardware, software, and firmware included with the voting system submitted for testing. Any revisions to a document during the TDP review process which affect other documents must also be revised. As with the other TDP reviews, the TDP Review Checklist is utilized to report any anomalies to the manufacturer for resolution, if required. The TDP review continues until all anomalies have been satisfactorily resolved.

A listing of all documents contained in the ClearVote 1.4 TDP is provided in Table 4-2.

Table 4-2. TDP Documents

Document Number	Description	Version
<i>ClearVote Documents</i>		
100101	ClearVote Approved Parts List	1.0
100067	ClearVote Ballot Stock Specification	1.0
100057	ClearVote Configuration Management Plan	1.0
100060	ClearVote Hardware Specification	1.0
100061	ClearVote Maintenance Manual	1.0
100058	ClearVote Personnel Deployment and Training Plan	1.0
100059	ClearVote Quality Assurance Program	1.0
100086	ClearVote Security Policy	1.0
100073	ClearVote Test and Verification Specification	1.0
100016	ClearVote Virtual Coordinate System Specification	1.0
<i>ClearDesign Documents</i>		
100011	ClearDesign Acceptance Test Checklist	1.0
100062	ClearDesign Administration Guide	1.0
100083	ClearDesign Build Procedures	1.0
100103	ClearDesign Database Definitions	1.0
100046	ClearDesign Functionality Description	1.0
100063	ClearDesign Installation Guide	1.0
100045	ClearDesign Security Specification	1.0
100072	ClearDesign Software Design and Specification	1.0
100074	ClearDesign System Identification Guide	1.0
100043	ClearDesign System Overview	1.0
100041	ClearDesign User Guide	1.0

<i>ClearCount Documents</i>		
100102	ClearCount Acceptance Test Checklist	1.0
100048	ClearCount Ballot Definition File Guide	1.0
100009	ClearCount Build Procedures	1.0
100005	ClearCount Database Specification	1.0
100004	ClearCount Election Administration Guide	1.0
100006	ClearCount Election Preparation and Installation Guide	1.0
100021	ClearCount Functionality Description	1.0
100008	ClearCount Glossary and Acronyms	1.0
100010	ClearCount Module and Function Interfaces	1.0
100070	ClearCount Reporting Guide	1.0
100013	ClearCount Scanner Operator Guide	1.0
100026	ClearCount Security Specification	1.0
100019	ClearCount Software Design and Specification	1.0
100047	ClearCount System Identification Guide	1.0
100024	ClearCount System Operations Procedures	1.0
100025	ClearCount System Overview	1.0
<i>ClearCast Documents</i>		
100095	ClearCast Acceptance Test	1.0
100096	ClearCast Approved Parts List	1.0
100094	ClearCast Build Procedures	1.0
100079	ClearCast Functionality Description	1.0
100081	ClearCast Hardware Specification	1.0
100089	ClearCast Maintenance Guide	1.0
100090	ClearCast Poll Worker Guide	1.0
100036	ClearCast Poll Worker Instructions	1.0
100084	ClearCast Security Specification	1.0
100027	ClearCast Simplified Voter Instructions	1.0
100093	ClearCast Software Design and Specification	1.0
100100	ClearCast Supervisor Guide	1.0
100097	ClearCast System Identification Guide	1.0
100078	ClearCast System Overview	1.0
100068	ClearCast Troubleshooting Instructions	1.0

100092	ClearCast Voter Guide	1.0
<i>ClearAccess Documents</i>		
100109	ClearAccess Acceptance Test	1.0
100051	ClearAccess Build Procedures	1.0
100049	ClearAccess Functionality Description	1.0
100085	ClearAccess Hardware Specification	1.0
100053	ClearAccess Installation Guide	1.0
100052	ClearAccess Maintenance Guide	1.0
100054	ClearAccess Poll Worker Guide	1.0
100035	ClearAccess Poll Worker Instructions	1.0
100050	ClearAccess Security Specification	1.0
100020	ClearAccess Simplified Voter Instructions	1.0
100099	ClearAccess Software Design and Specification	1.0
100055	ClearAccess Supervisor Guide	1.0
100038	ClearAccess System Identification Guide	1.0
100044	ClearAccess System Overview	1.0
100033	ClearAccess Troubleshooting Instructions	1.0
100056	ClearAccess Voter Guide	1.0
<i>Supplemental Documents</i>		
100017	Write-ins Tool Adjudication Guide	1.0
100087	Write-ins Tool Technical Data Package	1.0
100029	Write-ins Tool Build Procedures	1.0
100031	Write-ins Tool System Identification Guide	1.0

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.

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 1.4 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 ($\pm 3.6^\circ\text{F}$)
- Relative Humidity: Local Site Humidity
- Atmospheric Pressure: Local Site Pressure
- Time Allowable Tolerance: $\pm 5\%$

Testing performed at third-party laboratories will be subjected to the test parameters and tolerances defined by the test facility and 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 1.4 Voting System will be evaluated against all applicable requirements in the EAC 2005 VVSG. There is no required sequence for test performance.

7.0 TEST OPERATIONS PROCEDURES

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.

7.1 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.

**APPENDIX A
PROJECT SCHEDULE**

Task Name	Start Date	End Date	Duration
Readiness for Testing (TRR)	04/22/16	05/04/16	9d
EAC Application Submitted	04/22/16	04/22/16	1d
Preliminary Source Code Delivered	04/26/16	04/26/16	1d
TDP Delivered	04/25/16	04/25/16	1d
Source Code Delivered (Remaining)	04/26/16	04/26/16	0
Equipment Delivered	04/27/16	04/27/16	0
TDP Verification	04/28/16	04/28/16	1d
Source Code Verification	04/28/16	04/28/16	1d
Equipment Verification	04/28/16	04/28/16	1d
System Setup	04/29/16	04/29/16	1d
Mark Reading Test	04/29/16	04/29/16	1d
VRT Status Update	05/02/16	05/02/16	0
Application Approved by EAC	05/03/16	05/04/16	2d
TDP	12/07/16	02/27/17	57d
Initial Review	12/07/16	12/13/16	5d
Compliance Review	12/14/16	02/14/17	42d
Final review	02/15/16	02/28/16	10d
Test Plan	09/19/16	01/31/17	92d
Test Plan Creation	09/19/16	11/18/16	45d
Vendor Review & Comments	11/21/16	11/29/16	5d
EAC Submission & Review	11/30/16	12/30/16	20d
EAC Comment Review & Update	01/03/17	01/13/17	9d
EAC Submission & Review of Revision	01/16/17	01/27/17	10d
EAC Approved Test Plan	01/30/17	01/31/17	2d
Source Code	12/07/16	12/22/16	12d
Automated Review	12/07/16	12/08/16	2d
Source Code Review	12/09/16	12/15/16	5d
Source Code Re-Review	12/16/16	12/19/16	2d
Document Review	12/20/16	12/20/16	1d
Compliance Build	12/21/16	12/22/16	2d
System Delivery & Setup	10/10/16	12/29/16	55d
PCA	10/10/16	10/14/16	5d
System Setup	10/17/16	10/20/16	2d
System Loads & Hardening	12/27/16	12/29/16	3d
Hardware Testing	01/23/17	03/24/17	45d
Electrical Testing (all required units)	01/23/17	02/13/17	16d
Environmental Testing (all required units)	01/23/17	02/07/17	12d
Temp Power (all required units)	02/20/17	02/28/17	7d
Electrical Supply	03/20/17	03/21/17	2d

Maintainability	03/22/17	03/23/17	2d
Acoustic Testing	03/24/17	03/24/17	1d
System Level Testing	03/27/17	05/31/17	41d
FCA	03/27/17	04/28/17	25d
Security (include SCAP)	05/01/17	05/03/17	3d
Usability	05/01/17	05/03/17	3d
Accessibility	05/04/17	05/08/17	3d
Volume & Stress (system limits)	05/04/17	05/10/17	5d
Accuracy	05/11/17	05/17/17	5d
Regression Testing	05/18/17	05/19/17	2d
Trusted Build	05/22/17	05/23/17	2d
System Loads & Hardening	05/24/17	05/26/17	3d
System Integration	05/29/17	05/31/17	3d
Test Report	05/22/17	07/24/17	44d
Test Report Creation	05/22/17	06/05/17	10d
Vendor Review & Comments	06/06/17	06/09/17	4d
EAC Submission & Review	06/12/17	06/23/17	20d
EAC Comment Review & Update	06/06/17	07/07/17	9d
EAC Submission & Review of Revision	07/10/17	07/21/17	10d
EAC Approved Test Report	07/24/17	07/24/17	1d