Test Plan

Dominion Voting Systems
D-Suite 5.11-CO
Certification Testing

Approved by: _____

Michael Walker, VSTL Project Manager

Approved by: _____

Wendy Owens, VSTL Program Manager

May 20, 2019

1 Introduction

The purpose of this Test Plan is to document the procedures that Pro V&V, Inc. will follow to evaluate the Dominion Democracy Suite (D-Suite) 5.11-CO 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 and the voting systems requirements set forth by the State of Colorado. This modification is to the previously approved D-Suite 5.2-CO System. At test conclusion, the results of all testing performed as part of this test campaign will be presented in a final report.

1.1 Scope

The scope of this testing event will incorporate a sufficient spectrum of physical and functional tests to verify that certain D-Suite 5.11-CO features and applications, which have been modified from the previously certified 5.2-CO baseline, conform to the applicable EAC 2005 VVSG 1.0 requirements.

Specifically, the testing event has the following goals:

- Verify that the D-Suite 5.11-CO System meets both the applicable requirements of the EAC 2005 VVSG 1.0 and the additional Colorado-specific requirements
- Ensure that the D-Suite 5.11-CO provides support for all Colorado election management requirements (i.e. ballot design, results reporting, recounts, etc.)
- Source Code Review, Compliance Builds, and Build Documentation Review
- Physical Configuration Audit (PCA), including System Loads and Hardening
- Functional Configuration Audit (FCA)
- Security Testing
- System Integration Testing, including Accuracy Testing and Regression Testing
- Usability/Accessibility Testing

Dominion Voting Systems has identified the following modifications from the previously certified system:

<u>Election Management System</u>

1. Supported by Windows Server 2016
2. Added performance improvements for generating large projects

3. Improved reporting module:
    - 1% Precinct manual recount export
    - CVR results per precinct export with undervotes and overvotes
    - Batch filter on election summary report
    - Persist "Skip Adjudication" setting value when loading results
4. Blank ballot ignored when unvoted RCV contest outstack condition is met in Adjudication
5. Adjudication activity report in CSV format added
6. Leading batch cards support in EED and ICC
7. Voter card status lookup functionality in ICVA
8. Ability to inactivate a voter card in ICVA
9. General report formatting improvements in RTR
10. New reporting module (reporting module, canvas report, summary report) in RTR

ImageCast Central

1. Added InterScan HiPro 821dd high-speed scanner
2. Added Canon DR-M260 scanner

ImageCast X BMD

1. Upgraded AValue tablets to Android 8.1
2. Security enhancements
3. MCF option for poll worker screen to default to manual activation
4. Ability to test printer duplexer to be able to confirm printing on both sides of the paper
5. Ability to split contest across multiple columns, with an optional message
6. Ability to return to ICX application from Android settings (Samsung)
7. Allow only certified USB sticks to be used
8. Ability to choose if the selected text size is used for printing of the ballot or not

9. Do not bring up the default file manager upon inserting a USB stick (Samsung)

10. Removed hardcoded poll worker PIN

11. Source code obfuscation

12. Previous VoteSim File remains on machine after election data has been cleared

1.2 Background

The D-Suite 5.0 System (the predecessor of the D-Suite 5.2-CO System) was granted certification to the 2005 Voluntary Voting System Guidelines (VVSG) by the Election Assistance Commission (EAC) on February 8, 2017. The D-Suite 5.2-CO System is a modification of the D-Suite 5.0 System. The D-Suite 5.2-CO System was previously tested to the State of Colorado requirements, the results of which are documented in Pro V&V report v. TR-01-02-DVS-2017.02. The current D-Suite 5.11-CO test campaign expands upon the previously approved system.

1.3 References

The documents listed below were utilized in the development of this Test Plan:

- D-Suite 5.11-CO Colorado Testing Campaign Scope of Testing Document
- State of Colorado Requirements Matrix
- Colorado Secretary of State Election Rules [8 CCR 1505-1] Rule 21
- Election Assistance Commission (EAC) 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, Version 7.0
- EAC Requests for Interpretation (RFI) (listed on www.eac.gov)
- EAC Notices of Clarification (NOC) (listed on www.eac.gov)
- Dominion Voting Systems Democracy Suite 5.11-CO Technical Data Package

1.4 Terms and Abbreviations

The terms and abbreviations applicable to the development of this Test Plan are listed below:

"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

"ICC" – ImageCast Central

"ICX" – ImageCast X

"ISO" – International Organization for Standardization

"NOC" – Notice of Clarification

"PCA" – Physical Configuration Audit

"PCOS" – Precinct Count Optical Scan

"QA" – Quality Assurance

"RFI" – Request for Interpretation

"RTR" – Results Tally & Reporting

"TDP" – Technical Data Package

"UPS" – Uninterruptible Power Supply

"VSTL" – Voting System Test Laboratory

"VVSG" – Voluntary Voting System Guidelines

1.5 Testing Responsibilities

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

1.5.1 Project Schedule

The schedule for this project is presented in Attachment A. The dates on the schedule are not firm dates but are estimates to completion based on multiple variables.

1.5.2 Test Case Development

To verify that the system meets the applicable requirements, Pro V&V will utilize baseline test cases augmented with supplemental test cases designed specifically for the system being evaluated in this test campaign.

2 Test Candidate

The 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 and/or the System Overview.

The Democracy Suite 5.11-CO Voting System is a paper-based optical scan voting system consisting of the following major components: The Election Management System (EMS), the ImageCast Central (ICC), and the ImageCast X (ICX). Below is the description of the previously Colorado certified Democracy Suite 5.2-CO baseline system

Election Management System (EMS)

The Democracy Suite 5.2-CO EMS consists of various components running as either a front-end/client application or as a back-end/server application. A listing of the applications and a brief description of each is presented below.

Front-end/Client applications:

- EMS Adjudication: Represents the client component responsible for adjudication, including reporting and generation of adjudicated result files from ImageCast Central tabulators and adjudication of write-in selections from ImageCast Precinct and ImageCast Central tabulators. This client component is installed on both the server and the client machines.
- EMS Audio Studio: A client application that represents an end-user helper application used to record audio files for a given election project. As such, it is utilized during the pre-voting phase of the election cycle.
- EMS Election Data Translator: End-user application used to export election data from election project and import election data into election project.
- EMS Election Event Designer: A client application that integrates election definition functionality together with ballot styling capabilities and represents a main pre-voting phase end-user application.

- ImageCast Voter Activation: An application, installed on a workstation or laptop at the polling place, which allows the poll workers to program smart cards for voters. The smart cards are used to activate voting sessions on ImageCast X.

- EMS Results Tally and Reporting: A client application that integrates election results acquisition, validation, tabulation, reporting, and publishing capabilities and represents the main post-voting phase end-user application.

Back-end/Server applications:

- EMS Adjudication Service: Represents a server side application which provides ballot information such as contests, candidates and their coordinates from EMS to the Adjudication application.
- EMS Application Server: Represents a server side application responsible for executing long running processes, such as rendering ballots, generating audio files and election files, etc.

- EMS Database Server: Represents a server side RDBMS repository of the election project database which holds all the election project data, including pre-voting and post-voting data.

- EMS Data Center Manager: A server application that represents a system level configuration application used in EMS back-end data center configuration.

- EMS Election Device Manager: Application used for production and programming of election files, and other accompanying files, for ImageCast X terminals.

- EMS File System Service: A back-end application that acts as a stand-alone service that runs on client machines, enabling access to low level operating system API for partitioning CF cards, reading raw partition on ICP CF card, etc.

- EMS NAS Server: Represents a server side file repository of the election project file based artifacts, such as ballots, audio files, reports, log files, election files, etc.

- Smart Card Helper Service: A service that is installed on a workstation or laptop at the polling place, and provides required data format for programming smart cards for ImageCast devices, or, for jurisdiction's voting registration system in case of integration.

ImageCast Central (ICC) Count Scanner

The ICC is a high-speed, central ballot scan tabulator based on Commercial off the Shelf (COTS) hardware, coupled with the custom-made ballot processing application software. It is used for high speed scanning and counting of paper ballots.

ImageCast X (ICX) Ballot Marking Device (BMD)

The Democracy Suite ImageCast X ballot marking platform is a solution that is used for creation of paper cast vote records. These ballots can be scanned, reviewed, cast and tabulated at the polling location on an ImageCast Precinct device or later scanned and tabulated by the ImageCast Central optical ballot scanner. The ImageCast X also supports enhanced accessibility voting through optional accessories connected to the ImageCast X unit. The ICX is a proprietary application which runs on COTS tablets.

2.1 Test Candidate System Overview

The testing event will utilize one setup of the D-Suite 5.11-CO System and its components as configured for normal use by the State of Colorado. A diagram depicting the D-Suite 5.11-CO is provided in Figure 2-1, below.

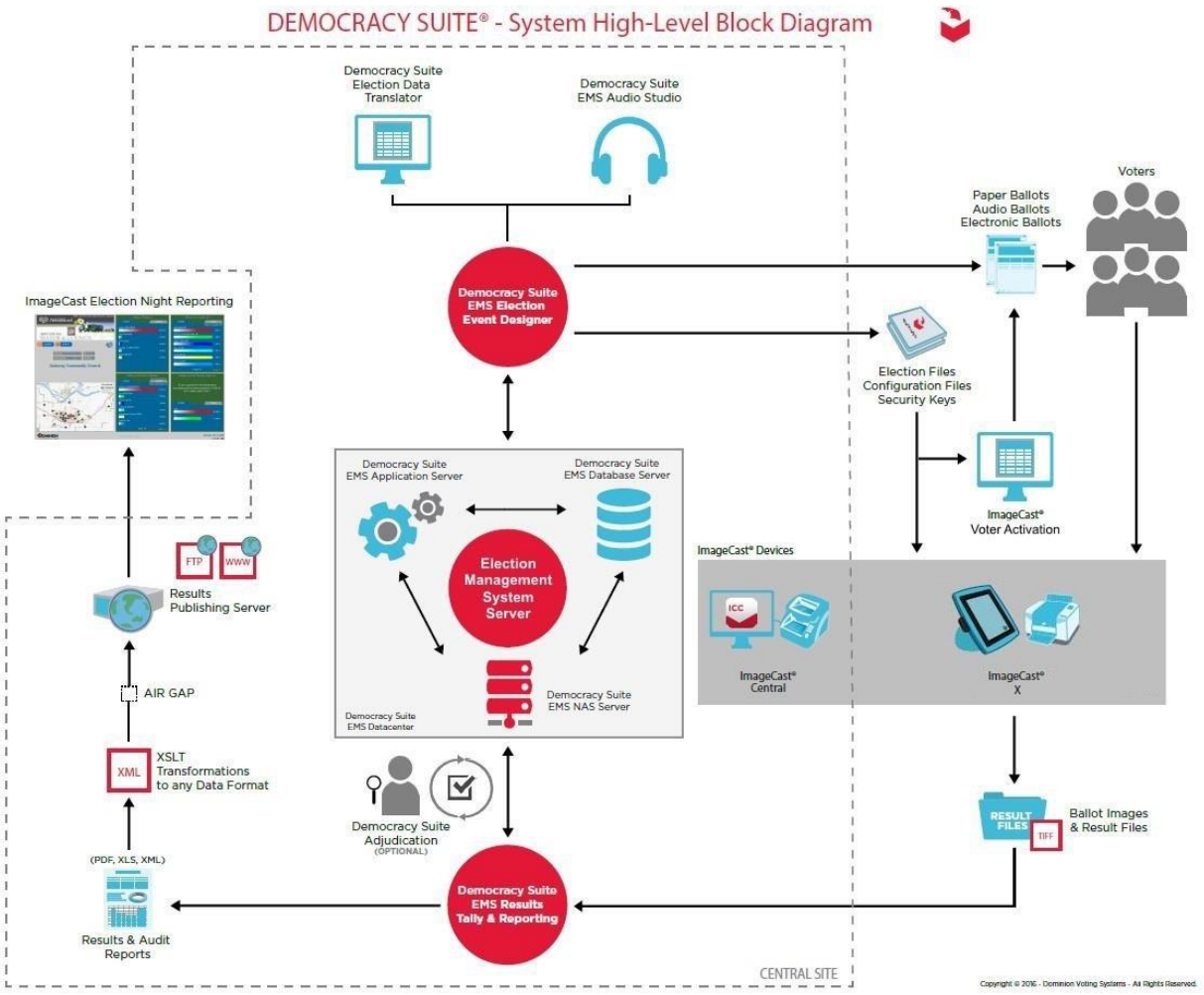

Figure 2-1 System Diagram

2.3 System Limits

No modifications have been made to the system limits from the previously certified D-Suite 5.2-CO System.

2.4 Supported Languages

The following languages have been stated to be supported by the D-Suite 5.11-CO System:

- Alaskan Native
- Aleut
- Athabascan
- Chinese
- English
- Eskimo
- Filipino
- French
- Hindi
- Japanese
- Khmer
- Korean
- Spanish
- Thai
- Bengali
- Vietnamese
- Native American
    - Apache, Jicarilla, Keres, Navajo, Seminole, Towa, Ute, Yuman

Due to the limited scope of the testing, only English and Spanish ballots will be cast during functional testing. The accuracy of the translations between languages will not be verified.

2.5 Supported Functionality

The Democracy Suite 5.11-CO 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
- Split Precincts
- Vote for N of M
- Ballot Rotation
- Provisional or Challenged Ballots

2.6 Technical Data Package

A listing of all documents contained in the D-Suite 5.11-CO TDP will be included in the Final Report.

3 Test Process

The following procedure outlines the steps that the test team will execute to evaluate the D-Suite 5.11-CO System under the scope defined in Section 1.1.

3.1 General Information

All testing will be conducted under the guidance of Pro V&V by personnel verified by Pro V&V to be qualified to perform the testing. The examination shall be performed at the Pro V&V, Inc. test facility located in Huntsville, AL.

3.2 Hardware and Software Required for Testing

Dominion Voting Systems will provide all required software and hardware to perform testing.

Election Administration

Democracy Suite Election Management System (EMS)

- Dominion Voting Systems Democracy Suite EMS 5.11, containing:
    - Election Event Designer
    - Results Tally and Reporting
    - Audio Studio

- Application Server
- Data Center Manager
- File System Service
- Adjudication Service
- Election Data Translator
- Adjudication

COTS Hardware and Software

- EMS Standard Server Configuration
  - Microsoft Windows Server 2016
  - Microsoft SQL Server 2016 Standard
  - Server computer system per 2.02 Democracy Suite System Configuration Overview
- EMS Express Server Configuration
  - Microsoft Windows 10 Professional
  - Microsoft SQL Server 2016
  - Desktop computer system per *2.02 Democracy Suite System Configuration Overview*
- Client Workstation Configuration
  - Microsoft Windows 10 Professional
  - Desktop computer system per 2.02 Democracy Suite System Configuration Overview
- EMS COTS Software common to Standard and Express configurations
  - Microsoft.Net Framework 4.6.1
  - Microsoft IIS (part of the Windows installation, not a separate item)
  - Microsoft Visual C++ 2013 Redistributable
  - Microsoft Visual C++ 2015 Redistributable
  - Dallas 1-Wire Device Driver version 4.0.5 or newer
  - RAID utility

- Adobe Reader DC or later

- Optional COTS Software for Standard and Express configurations
  - Microsoft Windows Defender (Express Server)
  - Avast! anti-virus software (Standard Server)
  - Cepstral Voices (English, Spanish, etc.) 6.2.3
  - Microsoft Excel 2010 or later
  - Additional Fonts (Arial narrow fonts, 2.37a)
  - UPS drivers
  - Printer drivers
- Auxiliary Equipment
  - iButton (SHA-1) with USB Reader/Writer: Maxim DS9490R#
  - Compact Flash Reader: Lexar Professional USB 3.0 Dual-Slot Card Reader or equivalent
  - LCD monitor, keyboard, mouse, headset with microphone, audio adapter, networking switch – COTS computing accessories
- Election media
  - iButton: Maxim DS1963S-F5+
  - DVS Compact Flash Memory Cards: 4GB, 8GB, 16GB, or 32GB
  - USB Memory Device: 4GB, 8GB, or 16GB (Only USB sticks certified for use with the ICX software can be used, otherwise the USB sticks won't be read)
  - Smart Cards: ACOS-6-64

Central Count

- ICC software application: version 5.11

  COTS Software:

  - ICC COTS computer operating system: Windows 10 (64-bit) Professional edition
  - Microsoft Windows Defender
  - Microsoft Visual C++ 2015 Redistributable
  - Dallas Maxim: 1-wire driver - version 4.0.5, 64 bit (32 bit as needed)
  - Canon: DR-X10C driver – 1.15 SP3

- Canon: DR-G1130 driver – Isis Twain 1.2 SP6 Canon: DR-M160-II driver - M160II_DRIT_V12SP6
- Canon: DR-M260 driver - 1.1.11803.19001_SP2
- InterScan HiPro 821dd - 1.1.2.0

COTS Hardware:

- ICC Scanner: Canon DR-X10C
- ICC Scanner: Canon DR-G1130
- ICC Scanner: Canon DR-M160II
- ICC Scanner: Canon DR-M260
- ICC Scanner: InterScan HiPro 821dd
- Desktop or All-in-One computer system per *2.02 Democracy Suite System Configuration Overview*

Precinct Vote Capture

ImageCast X with BMD (ICX BMD)

- Firmware version: 5.11
- Hardware version:
  - Samsung Galaxy Note Pro (12.2 in. screen)
  - Samsung Galaxy Tab Pro (12.2 in. screen)
  - Avalue SID-21V-Z37 (21.5 in. screen)
  - Accessible-Tactile Interface (ATI) box, version 1.1.0

COTS Hardware

- UPS: APC SMT-1500
- Printer: HP M402dne Laser
- Hub: LavaLink STS-2UE (for Samsung tablets only)
- Smart Cards: ACOS-6-64

COTS Software

- Android 8.1 (updated from Android 4.4 using included software and installation instructions) (Avalue)
- Android 4.4.2 (Samsung Galaxy Tab Pro tablets)
- Android 5.0.2 (Samsung Galaxy Note Pro tablets)

Optional COTS Software

- None

Optional COTS products

- Headphone: Cyber Acoustics ACM-70 or equivalent
- Accessible Interface Box: Tecla Accessible Interface box
- Sip & puff: Enabling Device #972
- Sip & puff straws: #970K (Pkg of 10)
- Paddle switches: Enabling Device #971
- Paddle switches: AbleNet 10033400 (2x)

ImageCast X Voter Activation (ICVA)

- Software version: 5.11

COTS Hardware and Software

- Client Workstation Configuration
  - Microsoft Windows 7, Windows 8.1, and Windows 10
  - Laptop computer system per *2.02 Democracy Suite System Configuration Overview*
- Smart Cards: ACOS-6-64

3.2.1 Test Support Equipment/Materials

Dominion Voting Systems will provide all supporting materials necessary to facilitate testing.

3.3 Strategy of Evaluations

To evaluate the Democracy Suite 5.11-CO 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 will be tested during the FCA and System Integration Test. This evaluation will utilize baseline test cases as well as specifically designed test cases and included predefined election definitions for the input data.

Section 3: Usability and Accessibility Requirements

The requirements in this section will be tested during the Usability/Accessibility Testing.

Section 4: Hardware Requirements

The InterScan HiPro and the Canon DR-M260 scanners are new to this configuration. To satisfy the hardware requirements for this state certification effort, results from a parallel test campaign (D-Suite 5.5-B EAC-certification) will be utilized.

Section 5: Software Requirements

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

Section 6: Telecommunications Requirements

The requirements in this section will not be tested during this test campaign.

Section 7: Security Requirements

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

Section 8: Quality Assurance Requirements

The requirements in this section will not be tested during this state certification effort as results shall be re-used from previous test campaigns.

Section 9: Configuration Management Requirements

The requirements in this section will not be tested during this state certification effort as results shall be re-used from previous test campaigns.

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

3.4 Test Procedures

Pro V&V will develop test procedures designed to evaluate the system being tested against the stated requirements. The test procedures can be executed independently. The procedures that will be utilized for this test engagement are summarized below:

- 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 Source Code Review includes a Compliance Build and a Trusted Build of the submitted source code.

- Functional Configuration Audit (FCA) – This area of testing 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 audit ability, 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.

- Accuracy – The accuracy test ensures that the voting system components can process ballot positions within the allowable target error rate. This test is designed to test the ability of the system to "capture, record, store, consolidate, and report" specific voter selections and absences of a selection.

- System Integration – The system level certification tests address 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.

- Regression Testing – Regression testing will be performed an all system components to verify that and all functional and/or firmware modifications made during the test campaign did not adversely affect the system and its operation.

- Physical Configuration Audit (PCA) – The PCA compares the voting system components submitted for testing to the manufacturer's technical documentation. The PCA includes 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

  - Review drawings, specifications, technical data, and test data associated with system hardware (if non-COTS) to establish system hardware baseline associated with software baseline.

  - Review manufacturer 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.

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

- Usability/Accessibility – During Usability Testing was conducted to verify the ICX AValue BMD met the usability requirements set forth in the EAC 2005 VVSG 1.0

4 Test Data

The output test data will be collected and stored in an appropriate manner as to allow for data analysis. Actual results from executed tests will be recorded in real-time in Test Execution Logs.

5 Conditions of Satisfaction

The voting system will be evaluated against the Colorado Requirements Gap Analysis Matrix, which incorporates the 2002 VSS requirements, and the Colorado-specific requirements in the Colorado Secretary of State Election Rules [8 CCR 1505-1] Rule 21. Throughout this test campaign, Pro V&V will execute tests, inspect resultant data and perform technical documentation reviews to ensure that each applicable requirement is met.

6 Test Findings

At test conclusion, a Test Report, completed Requirements Matrix, and associated test cases will be generated documenting all findings. Pro V&V will follow standard requirements for the format of the Test Report. The Recommendation section of the Test Report will follow the requirements of the NIST 150 Handbook for opinions and interpretations.

ATTACHMENT A

PROJECT SCHEDULE

Task Name	Start Date	End Date
Test Plan	**04/12/19**	**05/16/19**
Test Plan Creation	04/12/19	05/16/19
System Level Testing	**05/13/19**	**05/31/19**
FCA	05/13/19	05/21/19
Accuracy (M260)	05/20/19	05/21/19
Accuracy (HiPro)	05/20/19	05/20/19
Regression Testing	05/22/19	05/22/19
Final Build	05/23/19	05/28/19
System Integration	05/29/19	05/31/19
Test Report	**05/29/19**	**06/07/19**
Test Report Creation	05/29/19	06/04/19
Vendor Review & Comments	06/05/19	06/06/19
Final Report	06/07/19	06/07/19