



# Test Plan

**Dominion Voting Systems**  
**D-Suite 5.13**  
**Certification Testing**

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## 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) 5.13 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. *Note: Colorado requires testing to the 2002 Voting Systems Standard (VSS) by statute; however, testing to the VVSG requirements is deemed sufficient since the requirements in the VSS and VVSG are almost identical.*

The system configuration is a modification baselined from the state approved 5.11-CO system configuration. Previous source code reviews on versions that have been examined between 5.11-CO and 5.13 will be re-used to minimize duplication of effort. 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 5.13 features and applications, which have been modified from the previously certified 5.11-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 5.13 System meets both the applicable requirements of the EAC 2005 VVSG 1.0 and the additional Colorado-specific requirements
- Ensure that the D-Suite 5.13 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
- Environmental Testing (Temperature/Power Variation)

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

### Election Management System

1. EED - Added ability to store tabulator resources in the NAS project folder
2. RTR - Removed the Byte Order Marker (BOM) from the beginning of the export file
3. ADJ - Added option to only allow adjudication of contests that meet the out-stack criteria as defined in the Adjudication project

### ImageCast Central

1. Modified ICC log entry text to be more descriptive for double feed errors
2. Corrected functionality to allow discarding of batches after 999
3. Modified ICC to not accept a batch without a Poll ID
4. Added ability to print Batch Header Cards from ICC
5. Added support for HiPro firmware 1.0.1074
6. Changed maximum Poll ID length from 6 characters to 32

### ImageCast X BMD

1. Added support for ICX BMD to produce a ballot without a barcode
2. Added support for Avison AP3061 printer
3. Added option to display only a 10-key keyboard when only numeric values are required for entry
4. Added option to print a Daily Print Report that provides statistics for auditing but no results
5. Added support for new Aegis USB memory devices
6. Corrected scroll bar display on Samsung device when first voting session after power up is an accessible voting session

## **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 currently certified D-Suite 5.11-CO test campaign expanded upon the 5.2-CO system. The results of that test campaign are documented in Pro V&V report v. TR-01-02-DVS-028-01.01. This test campaign expands on the D-Suite 5.11-CO campaign.

## **1.3 References**

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

- D-Suite 5.13 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 107<sup>th</sup> 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](http://www.eac.gov))
- EAC Notices of Clarification (NOC) (listed on [www.eac.gov](http://www.eac.gov))
- Dominion Voting Systems Democracy Suite 5.12-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 Democracy Suite 5.13 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).

*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.*

Below is the description of the previously Colorado-certified Democracy Suite 5.11-CO baseline system, which are the same components descriptions for the Democracy Suite 5.13 system.

## **Election Management System (EMS)**

The Democracy Suite 5.11-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.
- **EMS Logger:** A stand-alone application that runs on client or server machines and is used to gather diagnostics for troubleshooting.

### 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.

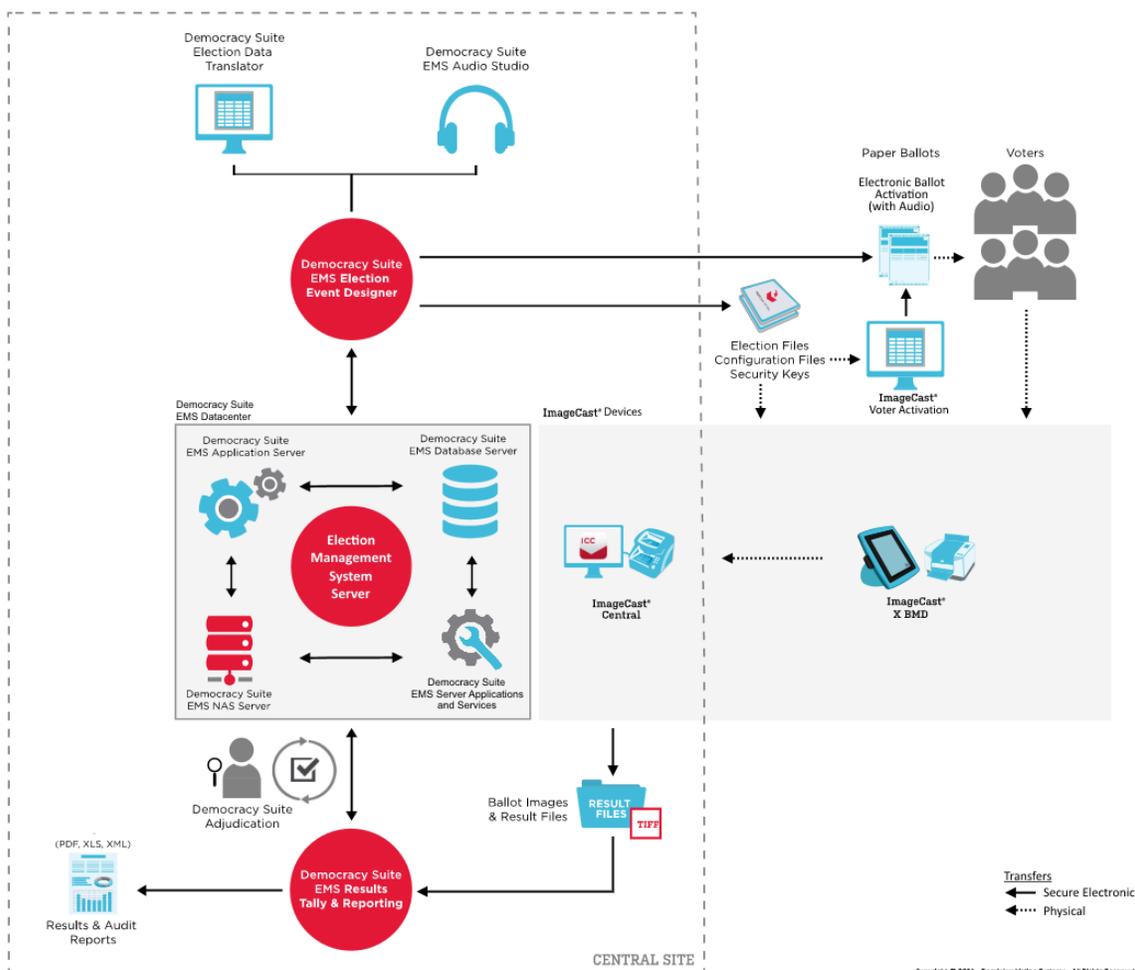
#### **2.1 Test Candidate System Overview**

The testing event will utilize one setup of the D-Suite 5.13 System and its components as configured for normal use by the State of Colorado.

#### **2.2 System Diagram**

A diagram depicting the D-Suite 5.13 is provided in Figure 2-1, below.

## DEMOCRACY SUITE® - System High-Level Block Diagram 📄



**Figure 2-1 System Diagram**

### 2.3 System Limits

**Table 2-1. D-Suite 5.13 System Limits**

Limit (Maximum Number)	Value (by configuration)		Limiting Component
	Express	Standard	
<i>Landscape Ballot Orientation</i>			
Ballot Positions	292	292	22 inch Landscape Ballot (240 candidates + 24 write-ins + 28 Yes/No choices)
Precincts in Election	250	1000	Memory
Contests in Election	250	1000	Memory

**Table 2-1. D-Suite 5.13 System Limits (continued)**

Limit (Maximum Number)	Value (by configuration)		Limiting Component
	Express	Standard	
Candidates/Counters in Election	2500	10000	Memory
Candidates/Counters in Precinct	240	240	22 inch Landscape Ballot
Candidates/Counters in Tabulator	2500	10000	Memory
Ballot Styles in Election	750	3000	Memory
Contests in a Ballot Style	38	38	22 inch Landscape Ballot (24 candidacy contests + 14 propositions)
Candidates in a Contests	240	240	22 inch Landscape Ballot
Ballot Styles in a Precinct	5	5	Memory
Number of Parties	30	30	Memory
Vote For in Contest	24	24	22 inch Landscape Ballot
Supported Languages per Election	5	5	Memory
Number of Write-ins	24	24	22 inch Landscape Ballot
<i>Portrait Orientation</i>			
Ballot Positions	462	462	22 inch Portrait Ballot
Precincts in Election	250	1000	Memory
Contests in Election	250	1000	Memory
Candidates/Counters in Election	2500	10000	Memory
Candidates/Counters in Precinct	462	462	22 inch Portrait Ballot
Candidates/Counters in Tabulator	2500	10000	Memory
Ballot Styles in Election	750	3000	Memory
Contests in a Ballot Style	156	156	22 inch Portrait Ballot
Candidates in a Contests	231	231	22 inch Portrait Ballot (Column Span 3)
Ballot Styles in a Precinct	5	5	Memory
Number of Parties	30	30	No Limitation
Vote For in Contest	30	30	No Limitation
Supported Languages per Election	5	5	Memory
Number of Write-ins	462	462	22 inch Portrait Ballot

## **2.4 Supported Languages**

The following languages have been stated to be supported by the D-Suite 5.13 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 5.13 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 5.13 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 5.13 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, as listed below:

#### Democracy Suite 5.13 EMS Software Platform Components

- Software
  - EMS Election Event Designer (EED) 5.13.11.1
  - EMS Results Tally and Reporting (RTR) 5.13.11.1
  - EMS Election Data Translator (EDT) 5.13.11.1
  - EMS File System Service (FSS) 5.13.11.1
  - EMS Audio Studio (AS) 5.13.11.1
  - EMS Data Center Manager (DCM) 5.13.11.1
  - EMS Application Server (APPS) 5.13.11.1
  - EMS Adjudication Services 5.13.11.1
  - EMS Adjudication Client 5.13.11.1
  - EMS Logger 5.13.11.1
  - Smart Card Helper Service (SCHS) 5.13.11.1

### Democracy Suite 5.13 EMS Standard Server Platform Components

- Software
  - Microsoft Windows Server 2016 (Build 1607)
  - Microsoft SQL Server 2016 Standard with SP2
  - Microsoft SQL Server 2016 Management Studio
  - Microsoft IIS (part of Windows installation, not a separate item)
  - Microsoft .NET Framework 3.5
  - Microsoft .NET Framework 4.8
  - Microsoft Visual C++ 2013 Redistributable
  - Microsoft Visual C++ 2015 Redistributable
  - Microsoft Windows Defender
  - Arial Narrow Fonts 2.37a
  - Cepstral Voices (English, Spanish, etc.) 6.2.3
- Hardware
  - Dell PowerEdge R640
  - Dell PowerEdge R630
  - Dell PowerEdge T630
  - Dell PowerEdge R710
  - Ethernet Switch: Dell x1026
  - Ethernet Switch: Dell x1018
  - Ethernet Switch: Dell N1524
  - Mini-Server Rack: StarTech RK1236BKF (for rackmount components)
  - Rack Power Distribution Unit: APC AP9562 (for rackmount components)
  - UPS: Tripp Lite SMART1500RMXL2U (for rackmount components)

### Democracy Suite 5.13 EMS Express Server Platform Components

- Software
  - Microsoft Windows 10 Professional (Build 1909)
  - Microsoft Access Database Engine
  - Microsoft SQL Server 2016 SP2 Express with Advanced Services

- Microsoft SQL Server 2016 Management Studio
- Microsoft IIS (part of Windows installation, not a separate item)
- Microsoft .NET Framework 3.5
- Microsoft .NET Framework 4.8
- Microsoft Visual C++ 2013 Redistributable
- Microsoft Visual C++ 2015 Redistributable
- Microsoft Windows Defender
- Open XML SDK 2.0 for Microsoft Office
- Dallas 1-Wire Device Driver version 4.0.5
- Adobe Reader DC
- Arial Narrow Fonts 2.37a
- Cepstral Voices (English, Spanish, etc.) 6.2.3
- (Optional) Microsoft Excel 2010 or later
- Hardware
  - Dell Precision 3440 XE
  - Dell Precision T3420
  - Dell Precision T1700
  - Ethernet Switch: Dell x1008

#### Democracy Suite 5.13 EMS Client Application Platform Components

- Software
  - Microsoft Windows 10 Professional (Build 1909)
  - Microsoft Access Database Engine
  - Microsoft .NET Framework 3.5
  - Microsoft .NET Framework 4.8
  - Microsoft Visual C++ 2013 Redistributable
  - Microsoft Visual C++ 2015 Redistributable
  - Microsoft Windows Defender
  - Open XML SDK 2.0 for Microsoft Office
  - Dallas 1-Wire Device Driver version 4.0.5

- Adobe Reader DC
- Arial Narrow Fonts 2.37a
- (Optional) Microsoft Excel 2010 or later
- Hardware
  - Dell Precision 3440 XE
  - Dell Precision T3420
  - Dell Precision T1700

#### Democracy Suite 5.13 Auxiliary Components Common to EMS Platforms

- Hardware
  - iButton to 1-Wire USB Adapter: Dallas Maxim DS1402-RP8+
  - iButton Reader/Writer: Dallas Maxim DS9490R#
  - Smart Card Reader: Advanced Card Systems ACR38U
  - Smart Card Reader: Advanced Card Systems ACR39U
  - LCD Monitor: Dell P2419H
  - LCD Monitor: Dell P2417H
  - Keyboard, Mouse, Headset with microphone, Audio Adapter – COTS computing accessories
  - UPS: APC SMT1500 Smart-UPS
  - UPS: APC SMT1500C Smart-UPS
  - UPS: CyberPower PR1500LCD
  - UPS: APC BR1000G
  - EMS Report Printer: Canon LBP6230DW laser or equivalent
  - EMS Report Printer: HP LaserJet M404dn or equivalent

#### Democracy Suite 5.13 Election Media Components

- Hardware
  - iButton (Pollworker): Dallas Maxim DS1963S-F5+ (w/Black Key Ring Mount DS9093A+)
  - USB Memory Device (128GB): ASK3-NX-128GB
  - USB Memory Device (32GB): ASK3-NX-32GB
  - USB Memory Device (120GB): Apricorn Aegis ASK3-120GB

- USB Memory Device (30GB): Apricorn Aegis ASK3-30GB
- USB Memory Device (16GB): Centon S4-CM-U3P2-16.1
- USB Memory Device (8GB): Centon S4-CM-U3P2-8.1
- USB Memory Device (16GB): Apacer EH353-M APHA016GAG0CG-3TM
- USB Memory Device (8GB): Apacer EH353-M APHA008GAG0CG-3TM
- Smart Cards: ACOS-6-64

#### Democracy Suite 5.13 ICVA Platform Components

- Software
  - Microsoft Windows 10 Professional (Build 1909)
  - ImageCast Voter Activation Application 5.13.11.1
  - Smart Card Helper Service (SCHS) 5.13.11.1
  - Microsoft .NET Framework 3.5
  - Microsoft .NET Framework 4.8
  - Microsoft Windows Defender
- Hardware
  - Dell Latitude 3410
  - Dell Latitude e3480
  - Dell Latitude e3470
  - Dell Latitude e7450
  - Dell Latitude e7470
  - Smart Card Reader: Advanced Card Systems ACR38U
  - Smart Card Reader: Advanced Card Systems ACR39U

#### Democracy Suite 5.13 ICC Platform Components

- Software
  - Microsoft Windows 10 Professional (Build 1909)
  - ImageCast Central Application 5.13.2.5
  - Microsoft .NET Framework 3.5
  - Microsoft .NET Framework 4.8
  - Microsoft Windows Defender

- Microsoft Visual C++ 2015 Redistributable
- Dallas Maxim 1-Wire driver 4.0.5
- HiPro 821dd driver 1.3.0.4
- Canon DR-X10C driver 1.15 SP3
- Canon DR-G1130 driver 1.2 SP6
- Canon DR-G2140 driver 1.1 SP2
- Canon DR-M160II driver 1.2 SP6
- Hardware - Canon
  - Dell Optiplex 3050 AIO
  - Dell Optiplex 7440 AIO
  - Dell Optiplex 9030 AIO
  - Dell Precision 3440 XE with Monitor: Planar PCT2235
  - Scanner: DR-G2140 (FW 1.23) with optional post-imprinter
  - Scanner: DR-G1130 v1 (FW 1.33) with optional post-imprinter
  - Scanner: DR-X10C (FW 2.8)
  - Scanner: DR-M160II (FW 2.02)
  - UPS: APC SMT1500 Smart-UPS
  - UPS: APC SMT1500C Smart-UPS
  - UPS: CyberPower PR1500LCD
- Hardware - HiPro
  - Dell Optiplex XE3
  - Dell Optiplex 7060
  - Monitor: Lenovo 10QXPAR1US
  - Monitor: Dell P2418HT
  - Scanner: InterScan HiPro 821dd with integrated imprinter
  - iButton to 1-Wire USB Adapter: Dallas Maxim DS1402-RP8+
  - iButton Reader/Writer: Dallas Maxim DS9490R#

#### Democracy Suite 5.13 ICX Platform Components

- Software

- ICX Application 5.13.9.1
- Android 8.1.0-1.1.10 (ICX Classic)
- Android 5.0.2 (ICX Samsung Galaxy Note Pro)
- Android 4.4.2 (ICX Samsung Galaxy Tab Pro)
- Google TTS 3.15.18
- Hardware
  - ICX Tablet: Avalue SID-21V-Z37 (ICX Classic)
  - ICX Tablet: Samsung Galaxy NotePro (12.2 in. screen) in Armodilo enclosure
  - ICX Tablet: Samsung Galaxy TabPro (12.2 in. screen) in Armodilo enclosure
  - UPS: APC SMT1500 Smart-UPS
  - UPS: APC SMT1500C Smart-UPS
  - UPS: CyberPower PR1500LCD
  - UPS: CyberPower PR1500LCD-VTVM
  - Printer: HP M402dne
  - Printer: Avision AP3061
  - Hub: LavaLink STS-2UE (for Samsung Galaxy tablets only)
  - (Optional) Headphone: Cyber Acoustics ACM-70 or equivalent
  - (Optional) Sip & Puff: Enabling Devices #972
  - (Optional) Sip & Puff Straws: Enabling Devices #970K
  - (Optional) Paddle Switches: AbleNet 10033400 (2x)
  - (Optional) Paddle Switch Cable: Hosa Technology YMM-261 (for use with AbleNet switches)
  - (Optional) Accessible Tactile Interface (ATI) box, v1.1.0
  - (Optional) Accessible Tactile Interface (ATI-USB) box
  - (Optional) ICX Classic BMD Transport Bag
  - (Optional) ICX Samsung Transport Bag
  - (Optional) ICX Voting Booth

### **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 5.13 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 in the following paragraphs. Brief descriptions of all listed test cases are provided in Table A-1 located in Appendix A.

#### 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.

The test cases specifically designed to evaluate the modifications are listed below:

- EED - Added ability to store tabulator resources in the NAS project folder
- RTR - Removed the Byte Order Marker (BOM) from the beginning of the export file
- ADJ - Added option to only allow adjudication of contests that meet the out-stack criteria as defined in the Adjudication project
- Modified ICC log entry text to be more descriptive for double feed errors
- Corrected functionality to allow discarding of batches after 999
- Modified ICC to not accept a batch without a Poll ID
- Added ability to print Batch Header Cards from ICC
- Added support for HiPro firmware 1.0.1074
- Changed maximum Poll ID length from 6 characters to 32
- Added support for ICX BMD to produce a ballot without a barcode
- Added support for Avision AP3061 printer
- Added option to display only a 10-key keyboard when only numeric values are required for entry
- Added option to print a Daily Print Report that provides statistics for auditing but no results
- Added support for new Aegis USB memory devices
- Corrected scroll bar display on Samsung device when first voting session after power up is an accessible voting session

#### Section 3: Usability and Accessibility Requirements

The requirements in this section will be tested during the Usability/Accessibility Testing. The test cases utilized during this portion of the test campaign are listed below:

- Add Alternative Language Support To Election
- Create Ballot Layout

- Audio Ballot Activation By Voter Card Insertion
- Make Vote Selection
- Cast Ballot
- Cast Overvoted Ballot
- Cast Undervoted Ballot
- Cancel Ballot Casting
- Make Vote Selection(Audio)
- Return to Previous Contest(Audio)
- Proceed to Next Contest(Audio)
- Cancel Vote Selection(Audio)
- Review Selections(Audio)
- Cast Ballot(Audio)
- Cast Overvoted Ballot(Audio)
- Cast Undervoted Ballot(Audio)
- Cancel Ballot Casting(Audio)
- Text Size and Magnifying Tool
- Fleeing Voter
- Cast Blank Ballot
- Cast Blank Ballot Audio
- Overvoted Vote Selection
- Overvoted Vote Selection(Audio)
- Manually Reset to Defaults
- Dexterity Required for Activation of Controls
- Voter Response
- Accidental Activation
- Skip Referendum Text (Audio)
- Repeat Information (Audio)
- Pause Audio Playback
- Resume Audio Playback
- Adjust Color Settings for Color Screens
- Ambient Contrast Ratio Settings for Color Screens
- Inspect Touch Sensitive Areas of Touchscreen
- Handset Audio Support Inspection
- Mobility
- Auto Reset to Defaults

- Audio Visual Sync
- Page Scrolling
- Audio Acoustic Levels
- Button, Control, and Key Inspection
- Display Refresh Rate (Flicker) Test
- Color Blindness
- Ambient Contrast Ratio
- Privacy Inspection
- Accessibility Inspection
- Audio Comprehension
- Adjust Audio Speed
- Adjust Audio Volume
- Examine Ballot Images
- Export Ballot Images

#### Section 4: Hardware Requirements

The 5.13 system introduces support for the Avison AP3061 printer for use with the ICX BMD. To satisfy the hardware requirements for this certification effort, Temperature/Power Variation Testing will be performed.

#### 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 due to Colorado Rule 20.6.19(f) prohibiting the use of modems.

#### Section 7: Security Requirements

The test cases utilized during this portion of the test campaign are listed below:

- Security Access Controls
- Safeguards
- Security Provisions
- ICX Access Privileges
- Polling Place Security
- Protection Against Malicious Software

## 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 test procedures are high-level process documents that provide an overview of the testing to be performed. Test cases are utilized within test procedures, as applicable.

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.

During the Source Code Review, Pro V&V will review the submitted source code to the EAC VVSG 1.0 and the manufacturer-submitted coding standards. Prior to initiating the software review, Pro V&V will 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 is based on the source code changes made since the previous system was certified.

A combination of Automated Source Code Review and Manual Source Code Review methods will be used to review the changes in the source code from the previously certified system. In addition, 10% of the source code comments will be manually reviewed. The automated source code review tools utilized are CheckStyle and StyleCop. These tools are used to review 10% of changed source code modules, sampled at random. ExamDiff Pro is the tool utilized to perform a manual comparison

of the previously certified code against the modified code submitted for this test campaign.

- 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. The maximum acceptable error rate in the test process is one in 500,000 ballot positions.
- 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 on all system components to verify that 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 measures 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 – Usability/Accessibility Testing will be conducted to verify the ICX BMD with Avison printer meets 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.

**APPENDIX A**  
**TEST CASE DESCRIPTIONS**

**Table A-1. Test Case Descriptions**

Test Case	Description
<i>Functional Requirements</i>	
EED - Added ability to store tabulator resources in the NAS project folder	Specifically designed test case created to evaluate the modification.
RTR - Removed the Byte Order Marker (BOM) from the beginning of the export file	Specifically designed test case created to evaluate the modification.
ADJ - Added option to only allow adjudication of contests that meet the out-stack criteria as defined in the Adjudication project	Specifically designed test case created to evaluate the modification.
Modified ICC log entry text to be more descriptive for double feed errors	Specifically designed test case created to evaluate the modification.
Corrected functionality to allow discarding of batches after 999	Specifically designed test case created to evaluate the modification.
Modified ICC to not accept a batch without a Poll ID	Specifically designed test case created to evaluate the modification.
Added ability to print Batch Header Cards from ICC	Specifically designed test case created to evaluate the modification.
Added support for HiPro firmware 1.0.1074	Specifically designed test case created to evaluate the modification.
Changed maximum Poll ID length from 6 characters to 32	Specifically designed test case created to evaluate the modification.
Added support for ICX BMD to produce a ballot without a barcode	Specifically designed test case created to evaluate the modification.
Added support for Avison AP3061 printer	Specifically designed test case created to evaluate the modification.
Added option to display only a 10-key keyboard when only numeric values are required for entry	Specifically designed test case created to evaluate the modification.
Added option to print a Daily Print Report that provides statistics for auditing but no results	Specifically designed test case created to evaluate the modification.
Added support for new Aegis USB memory devices	Specifically designed test case created to evaluate the modification.
Corrected scroll bar display on Samsung device when first voting session after power up is an accessible voting session	Specifically designed test case created to evaluate the modification.

**Table A-1. Test Case Descriptions** *(continued)*

Test Case	Description
<i>Usability and Accessibility</i>	
Add Alternative Language Support to Election	Testing EMS support for alternative languages during election definition creation.
Create Ballot Layout	Testing EMS support for creating a ballot layout.
Audio Ballot Activation by Voter Card Insertion	Testing the capability of a voting machine to activate an audio ballot by means of inserting a voter card.
Make Vote Selection	Testing the ability to select a candidate on a ballot.
Cast Ballot	Testing the ability to cast a ballot that has been voted.
Cast Overvoted Ballot	Testing the ability to cast a ballot which has more than the allowable number of selections made.
Cast Undervoted Ballot	Testing the ability to cast a ballot which has less than the allowable number of selections made for a contest
Cancel Ballot Casting	Testing the ability to cancel the casting of a ballot.
Make Vote Selection (Audio)	Testing the ability to select a candidate on an audio ballot.
Return to Previous Contest (Audio)	Testing the ability to return to a previous contest in the current election on an audio ballot.
Proceed to Next Contest (Audio)	Testing the ability to move to the next contest in the current election on an audio ballot.
Cancel Vote Selection (Audio)	Testing the ability to cancel vote selection on an audio ballot.
Review Selections (Audio)	Testing the ability to review selections made prior to casting an audio ballot
Cast Ballot (Audio)	Testing the ability to cast an audio ballot that has been voted.
Cast Overvoted Ballot (Audio)	Testing the ability to cast an audio ballot which has more than the allowable number of selections made.
Cast Undervoted Ballot (Audio)	Testing the ability to cast an audio ballot which has less than the allowable number of selections made.
Cancel Ballot Casting (Audio)	Testing the ability to cancel the casting of an audio ballot.
Text Size and Magnifying Tool	Testing the ability to use a magnifying tool to view a ballot and verifying the font size used on ballots
Fleeing Voter	Testing support for fleeing voters.

**Table A-1. Test Case Descriptions** *(continued)*

Test Case	Description
Cast Blank Ballot	Testing the ability to cast an un-voted ballot.
Cast Blank Ballot Audio	Testing the ability to cast an un-voted audio ballot.
Overvoted Vote Selection	Testing the ability to select more than the allowable number of choices in a contest.
Overvoted Vote Selection (Audio)	Testing the ability to select more than the allowable number of choices in a contest (audio).
Manually Reset to Defaults	Testing the ability to manually reset a voting machine to its default settings.
Dexterity Required for Activation of Controls	Testing the required dexterity and force required to operate the controls on an accessible voting station.
Voter Response	Testing the ability of voting system that requires a response from the voter within a specific time frame, to alert the voter twenty seconds in advance of the time expiring.
Accidental Activation	Testing the voting machine's controls to ensure that accidental activation does not occur.
Skip Referendum Text (Audio)	Testing the ability to skip the over the reading of the text in a referendum on an audio ballot to facilitate the voter being able to vote immediately.
Repeat Information (Audio)	Testing the ability to repeat information provided to the voter when voting an audio ballot.
Pause Audio Playback	Testing the ability to pause audio playback when voting an audio ballot.
Resume Audio Playback	Testing the ability to resume audio playback after it has been paused, when voting an audio ballot.
Adjust Color Settings for Color Screens	Testing the ability to adjust the color settings for voting machines with color displays.
Ambient Contrast Ratio Settings for Color Screens	Testing the ability to adjust the figure-to-ground ambient contrast ratio on voting machines with color displays.
Inspect Touch Sensitive Areas of Touchscreens	Measuring the touch sensitive areas of a touch screen to ensure that steps have been taken to minimize accidental activation of vote response fields.
ATI Handset Audio Support Inspection	Inspection of Audio Tactile Interface (ATI) to verify that it supports voters personal assisted listening devices.

**Table A-1. Test Case Descriptions** *(continued)*

<b>Test Case</b>	<b>Description</b>
Mobility	Inspecting the voting machine to verify that it is accessible to voters who use mobility aids, including wheelchairs.
Auto Reset to Defaults	Testing the ability of a voting machine to reset adjustable settings to their default values after a voter's session is completed.
Audio Visual Sync	Testing the ability of a voting machine to present a ballot in audio/visual mode with correct synchronization.
Page Scrolling	Verifying that page scrolling is not required for voting a ballot on an accessible voting station which uses an electronic display
Audio Acoustic Levels	Measuring the acoustic output of a voting machine's audio output, and verifying that the audio is audible only by the voter.
Button, Control, and Key Inspection	Inspecting buttons, controls, and other user actuated aspects of an accessible voting station to ensure ease of use by individuals with vision or hearing impairment.
Display Refresh Rate (Flicker) Test	Verifying that a voting system's display screen does not flicker with a frequency between 2 Hz and 55 Hz.
Color Blindness	Inspecting the voting system interface to verify that steps have been taken to accommodate voters with color blindness via color usage and design decisions.
Ambient Contrast Ratio	Verifying that a voting system's display utilizes an ambient contrast ratio sufficient to accommodate voter's with perception issues, and is accessible to voters with partial vision.
Privacy Inspection	Testing the voting machine's ability to protect the privacy of a voter.
Alternative Language	Testing the accessibility features provided by a voting machine to assist voters who lack English proficiency or have an unwritten language, in the voting process.

**Table A-1. Test Case Descriptions** *(continued)*

Test Case	Description
Accessibility Inspection	Inspecting an accessible voting station to verify that support provided for voters with disabilities is intrinsic to the voting station and that means for voter identification or authentication do not render the accessible voting station inaccessible to voters with certain disabilities.
Audio Comprehension	Inspect audio to verify that verbal information is easily comprehensible to accommodate voters with partial vision.
Adjust Audio Speed	Testing the ability to change the rate of speech output by the voting machine, which shall support a range of speeds between 75% and 200% of the nominal rate of speech.
Adjust Audio Volume	Testing the ability to adjust volume settings while voting and audio ballot.
<i>Security Requirements</i>	
Security Access Controls	Testing the ability to verify that the Voting System implements security access controls.
Safeguards	Testing the ability to verify that the Voting System provides safeguards against tampering.
Security Provisions	Testing the ability of the system to provide security provisions compatible with procedures and administrative tasks involved in operation of the voting system
ICX Access Privileges	Testing the ability of the ICX to ensure that the user can only perform the permissions that were granted to the voter activation card (Tech Advisor, Poll worker, Voter
Polling Place Security	Verifying that the manufacturer has included measures pertaining to effective Polling Place Security, in their documentation
Protection Against Malicious Software	Verifying that the manufacturer's documentation has provided procedures for ensuring that protection against malicious software is maintained in a current status