






Test Report

**Dominion Voting Systems
Democracy Suite (D-Suite) System
Version 5.2
VVSG 1.0 Gap Analysis Testing**

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1 Introduction

The purpose of this Test Report is to document the procedures that Pro V&V, Inc. followed to evaluate the Dominion Democracy Suite (D-Suite) 5.2 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. The objective of this test campaign was to generate a VSTL Test Report on the D-Suite 5.2 System against the VVSG 1.0 requirements. This was accomplished by re-using testing from a previous 5.2 state level campaign and the D-Suite 5.0 EAC certification test campaign, where applicable, and then performing a gap analysis and additional testing as needed.

1.1 References

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

- Pro V&V Test Report No. TR-01-02-DVS-2017.02, “Test Report Dominion Voting Systems Democracy Suite (D-Suite) System Version 5.2-CO Certification Testing”
- Pro V&V Test Report No. TR-01-01-DVS-2016-01.01 Rev. D, “Test Report for EAC 2005 VVSG 1.0 Certification Testing Dominion Voting Systems Democracy Suite (D-Suite) Version 5.0 Voting System”
- 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 150-2016, “NVLAP Procedures and General Requirements (NIST Handbook 150-2016)”, dated July 2016
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, “Voting System Testing (NIST Handbook 150-22)”, dated May 2008
- United States 107th Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Pro V&V, Inc. Quality Assurance Manual, 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 5.2 Technical Data Package (*A listing of the D-Suite 5.2 documents submitted for this test campaign is listed in Section 2.4 of this Test Plan*)

1.2 Terms and Abbreviations

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

“ADA” – Americans with Disabilities Act 1990

“ATI” – Audio Tactile Interface

“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

“ICC” – ImageCast Central

“ICE” – ImageCast Evolution

“ICP” – ImageCast Precinct

“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

1.3 Background

The Democracy Suite 5.2 Voting System is a paper-based optical scan voting system consisting of the following major components: the Election Management System (EMS) software platform, the ImageCast Central (ICC) optical ballot counter, the ImageCast X (ICX) ballot marking platform, the ImageCast Precinct (ICP) optical ballot counter, the ImageCast Evolution (ICE) optical ballot counter, and Adjudication. *Note: As identified in the Democracy Suite 5.2 System Overview, the ICE is a component of the D-Suite 5.2 Voting System; however, it was not part of this test configuration and is excluded from the test campaign.*

The D-Suite 5.2 System is a modification of the EAC certified D-Suite 5.0 System. The D-Suite 5.0 System (the predecessor of the D-Suite 5.2 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 System includes the following changes to the baselined D-Suite 5.0 system configuration. Some of the changes listed were tested in the previous state effort, as noted below:

Election Management System

1. Corrected overvoted ranking results in RCV (RTR).
2. Corrected text overlap when editing keywords in ballot header templates.
3. Corrected error message to refer to MCF files and not DCF files.
4. Corrected error when importing a template keyword.
5. Corrected ballot creation failure when a ballot has an error (e.g., missing font).

6. Changed EMS components to utilize Windows Authentication instead of SQL Server Authentication. *(tested in state effort)*
7. Added ability for system to utilize self-encrypting drives as an additional security feature. *(tested in state effort)*
8. All components now running on combination of Windows 10, Windows Server 2012R2, with SQL Server 2016. Also included are scripts for security hardening procedures. *(tested in state effort)*
9. Added ability to configure how common cards are consolidated and to track precinct information for consolidated cards. *(tested in state effort)*
10. Added ability to create a convention for the ballot ID, artwork file name and description. *(tested in state effort)*
11. Added ability to generate one or more ballots without generating all ballots in the election project. *(tested in state effort)*
12. Added the ability to produce election definition in final form for the ImageCast X voting application. *(tested in state effort)*
13. Added ability to produce and modify a configuration file for ImageCast X. *(tested in state effort)*
14. Allowed the application to program the USB Flash Device with necessary resources used for setting up an ImageCast X voting device. *(tested in state effort)*
15. Extended the styling capabilities for Ballot Type, Translations, Contest and Contest Heading sections and dialogs to allow the EED User to style content for voting screens and printed artifacts. This also includes a new set of template keywords. *(tested in state effort)*
16. Added a new section for listing and modifying settings for Screen Ballots for display on the ImageCast X voting application. *(tested in state effort)*
17. Renamed existing "Ballots" Section to "Ballot Cards", serving to separate settings from "Screen Ballots". *(tested in state effort)*
18. Added ability to preview a screen ballot when an ICX device is connected via USB. *(tested in state effort)*

19. Modified the specification of available area for Write-in detection, which is passed through the election files to the optical scan tabulators. *(tested in state effort)*
20. Improved reporting ability to break-down results per precinct for consolidated ballots. *(tested in state effort)*
21. Added new report export providing information on cast vote records. *(tested in state effort)*
22. Added new report export providing information on what precincts each batch of results contains. *(tested in state effort)*
23. Added ability to select multiple precincts for the Summary Report. *(tested in state effort)*
24. Added ability to indicate in a project whether disabled contests and candidates should appear in the Election Summary and Statement of Votes Cast reports. *(tested in state effort)*
25. Added ability to bypass adjudication for early voting results. *(tested in state effort)*
26. Added ability to import subsets of data using the application: New languages and translations, template assignment, and tabulators. *(tested in state effort)*
27. Modified Contest and Contest Heading tables to allow enhance styling capabilities for ImageCast X. *(tested in state effort)*
28. Improved Adjudication Stop/Resume function to be more robust. *(tested in state effort)*

ImageCast Central

1. Corrected application behavior when scan button is pressed after scanner is disconnected.
2. Corrected ballot countback quantity on M160 scanners.
3. Changed ballot count type for QR ballots to be in sync with ICP and ICE.
4. Corrected imprinting on countback ballots for G1130 scanner.
5. Replaced the Kofax module with a TWAIN interface. *(tested in state effort)*
6. Added an option to force ICC to overrun a preset number of ballots every time scanning stops mid-batch. *(tested in state effort)*
7. Simplified the switching between election projects in ICC. *(tested in state effort)*

8. Application now runs on Windows 10 operating system. *(tested in state effort)*

ImageCast X

1. Improved ballot printing activation message.
2. Corrected ballot header that was not visible for certain activation codes.
3. Improved file integrity check performance.
4. Added a vote simulator for use during Logic & Accuracy Testing. *(tested in state effort)*
5. Added ability to display more than one contest on a screen. *(tested in state effort)*
6. Added ability to display a heading for a single or a group of contests on the screen. *(tested in state effort)*
7. Added ability to align the contest cell left, right or center, along with support for font size, bold, italic and underline text. *(tested in state effort)*
8. Added ability to playback audio for screen contents for languages that do not have Text-to-Speech support. *(tested in state effort)*
9. Modified the printing of the QR Ballot so it now has the human readable part printed in an OCR-friendly font. *(tested in state effort)*
10. Improved ability to print voter's selection on the BMD printer in non-Latin languages (e.g., Chinese). *(tested in state effort)*
11. Added support for using Legal-sized paper size on the BMD printer. *(tested in state effort)*

Adjudication

1. Corrected application launch from desktop shortcut.

ImageCast Precinct

1. Added LCD support for Bengali.
2. Added warning to user when requesting >128 log entries to view that the maximum number that will be displayed is 128.
3. Corrected behavior when moving to a previous contest from a fully voted contest.

4. Modified 'move to next contest' messaging when only one contest is on the ballot.
5. Corrected behavior in Straight Party Exclusives which prompts that making an Explicit choice will override Implicits even if there are none in the contest.
6. Corrected behavior to not allow user to overvote Straight Party Exclusive contest.
7. Corrected AuditMark to show a pixel count when casting an audio ballot.
8. Corrected behavior in Straight Party Exclusives which prompts that removing an Explicit choice will restore Implicits even if there are none in the contest.
9. Corrected behavior in Straight Party Exclusives to allow user to make an Explicit write-in selection.
10. Corrected behavior for a fully voted contest to re-enable the Blue Up/Down arrows.
11. Corrected behavior for an audio ballot when ICP returns to "SYSTEM READY" when no digits were entered in the AVS ballot ID.
12. Added new 'Resource' file to indicate the order of presentation.languages on the LCD.
13. Improved write-in area searches to include the entire choice for writing.
14. Removed unused DCF option (LCD Ballot Review).
15. Corrected behavior when ICP doesn't have soft fonts (or new LCD firmware) and shuts down with the message 'Essential font chars not present'.
16. Added warning to user if UTF8 characters are not supported but are present in message files.
17. Corrected messages for Transmission-Log Console and ICP screen to be in sync.
18. Added error message for a modem transmission failure.
19. Improved transmission performance.
20. Corrected behavior to allow transmission after cancelling report tape.
21. Added the modem field to the modem configuration file.
22. Corrected Report by Precinct to not show "No Candidate" choices.

23. Corrected behavior when pressing Clear/Cancel button multiple times.
24. Corrected entire multi-card QR ballot from being flagged as blank when one of the QR cards is blank.

2 Testing Overview

The evaluation of the D-Suite 5.2 System was designed to evaluate the voting system to the requirements set forth for voting systems in the EAC 2005 VVSG. The goals were constructed to verify that certain D-Suite 5.2 features and applications, which have been modified from the EAC certified 5.0 baseline, conform to the applicable EAC 2005 VVSG 1.0 requirements. This was accomplished by re-using testing from a previous 5.2 state level campaign and the D-Suite 5.0 EAC certification test campaign, where applicable, and then performing a gap analysis and additional testing as needed. The gap analysis revealed that the following tests would need to be performed:

- Technical Documentation Package (TDP) Review - A limited TDP Review was performed to ensure that all submitted modifications were accurately documented and that the documents met the requirements of the EAC 2005 VVSG
- Source Code Review/Trusted Build/Build Documentation Review - The source code review performed was based on the source code changes made since the previous system was certified.
- System Setup, Loads & Hardening – The system setup, loads, and hardening was performed to compare the voting system submitted for certification testing to the manufacturer’s technical documentation.
- Usability Testing – Usability testing was performed on the voting system.
- Regression Testing – Regression testing was performed to verify that the modifications made to the 5.0 system did not negatively impact the voting system.
- Functional Configuration Audit (FCA) including System Integration - The FCA for this test campaign included an assessment of the submitted modifications and included inputs of both normal and abnormal data during test performance. The system integration tests were performed to insure the D-Suite 5.2 functioned as a complete system.

The evaluation addressed each of the following test items in the following manner:

Table 2-1: Testing Overview

Test Goal	Testing Response
Perform Source Code Review, Generate Compliance Builds of the D-Suite application components, and perform a Build Documentation Review.	Trusted Builds were generated during the test campaign. The source code submitted by Dominion was reviewed by PRO V&V and was successfully built using the submitted COTS and third party software products. Additionally, build documentation was reviewed.
Verify that the D-Suite 5.2 System meets the applicable requirements of the EAC 2005 VVSG 1.0.	This was tested by evaluating the D-Suite 5.2 System to specific election scenarios using a combination of different ballot programming approaches, ballot designs, ballot sizes, languages, and tabulators.
Perform System Setup, Loads & Hardening	The system setup, loads, and hardening was tested by comparing the voting system submitted for certification testing to the manufacturer's technical documentation.
Simulate pre-election, Election Day, absentee, recounts, and post-election activities on the D-Suite 5.2 System during Functional Configuration Audit (FCA).	The components of the D-Suite System were tested in pre-election, Election Day, post-election and recount situations and evaluated against documented behavior and expected results for all scenarios.
Perform Usability Testing	Usability Testing was performed per the applicable requirements of the EAC 2005 VVSG 1.0.
Complete Functional Configuration Audit (FCA) System Integration Testing	Limited FCA testing was performed as well as System Integration Testing. The components of the D-Suite System were tested to address the integration of hardware and software. This testing focused on the compatibility of the voting system software components and subsystems with one another and with other voting system components.

Table 2-1: Testing Overview *(continued)*

Test Goal	Testing Response
Limited TDP Review	This review focused on TDP documents that had been modified since the certification of the baseline system. Any revised documents during the TDP review process were compared with the previous document revision to determine changes made, and the document was re-reviewed to determine whether subject requirements had been met.

2.1 Test Candidate

The D-Suite 5.2 Voting System is a paper-based optical scan voting system with a hybrid paper/DRE option consisting of the following major components: the Election Management System (EMS) software platform, the ImageCast Central (ICC) optical ballot counter, the ImageCast X (ICX) ballot marking platform, the ImageCast Precinct (ICP) optical ballot counter, the ImageCast Evolution (ICE) optical ballot counter, and Adjudication. *Note: As identified in the Democracy Suite 5.2 System Overview, the ICE is a component of the D-Suite 5.2 Voting System; however, it was not part of this test configuration and is excluded from the test campaign.*

The components of the D-Suite 5.2 Voting System are described below:

Election Management System (EMS)

The Democracy Suite 5.2 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. *(Note: The EMS Adjudication feature is optional)*

- 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 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.

ImageCast Precinct (ICP)

The ICP device is a hybrid precinct optical scan paper/DRE ballot counter designed to provide six major functionalities: ballot scanning, second chance voting, accessible voting, ballot review, tabulation, and poll worker functions.

For ballot scanning functionality the ICP scans marked paper ballots, interprets voter marks on the paper ballots and stores the ballots for tabulation when the polls are closed.

Second Chance voting refers to scenarios in which an error has been detected on the voter's paper ballot (e.g., blank ballot, undervoted ballot, overvoted ballot, misread ballot, cross-over voted ballot), and the ICP notifies the voter by displaying a message or providing an audio visual cue, that one of these situations has been detected, and offers the voter an opportunity to reject and fix their ballot, or to cast the ballot as-is.

Accessible voting allows voters with disabilities to listen to an audio representation of a ballot and use a hand held controller called an Audio Tactile Interface (ATI) to make vote selections, which are then saved directly to the ICP when the voter casts their Accessible Voting ballot.

The Ballot Review feature allows a voter to review their vote selections using an audio or visual representation, which displays or presents the voter with a complete listing of all contests contained on the ballot and an indication of the results which will be recorded for each contest once the voter's ballot is cast.

The Tabulation of paper ballots and Accessible Voting ballots cast by voters is performed when the polls are closed on the ICP unit and the unit tabulates the results, generates results files for aggregation into RTR, and prints a results report containing the results of the ballots cast.

For poll worker functions the ICP contains a small touch-screen LCD to allow the poll worker to initiate polling place activities, diagnostics and reports.

2.1.1 Configuration Components

The specifications for the components for the D-Suite 5.2 system configuration are listed below:

Election Administration

Democracy Suite Election Management System (EMS)

- Dominion Voting Systems Democracy Suite EMS 5.2.17.1, containing:
 - Election Event Designer
 - Results Tally and Reporting
 - Audio Studio
 - Application Server
 - Election Device Management Server
 - Data Center Manager
 - File System Service
 - Adjudication Service
 - Election Data Translator
 - Election Data Manager (for ICX electronic file generation)
- DCF version 5.2.04
- Optional Adjudication 5.2.1

COTS Hardware and Software

- EMS Standard Server Configuration o Microsoft Windows Server 2012 R2
 - 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 Express with Advanced Services
 - 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 4.5
 - Microsoft.Net Framework 3.5
 - Microsoft IIS (part of the Windows installation, not a separate item)
 - Microsoft Visual J# 2.0
 - Microsoft Visual C++ 2015 Redistributable
 - Java SE Runtime Environment 6.0 Update 20 or later
 - Dallas 1-Wire Device Driver version 4.03 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
 - Smart Cards: ACOS-6-64

Central Count

ImageCast Central Count (ICC)

- ICC software application: version 5.2.0.707

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 4.03 or newer, 64 bit (32 bit as needed)
- Canon: DR-G1130 driver - version 1.0.0.1
- Canon: DR-M160-II driver - version 1.2.5582

COTS Hardware:

- ICC Scanner: Canon DR-G1130
- ICC Scanner: Canon DR-M160-II
- Desktop or All-in-One computer system per 2.02 *Democracy Suite System Configuration Overview*

Precinct Vote Capture

ImageCast Precinct (ICP)

- Firmware version: 5.2.0-0705
- Hardware version: PCOS-320A and PCOS-320C

COTS Software

- Boot Loader (COLILO) 20040221

Optional COTS Software

- None

Optional COTS products

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

ImageCast X with BMD (ICX BMD)

- Firmware version: 5.2.6383.20934
- Hardware version:
 - Avalue SID-15V-Z37 (15.6 in. screen)
 - Avalue SID-21V-Z37 (21.5 in. screen)

Optional Hardware

- Accessible-Tactile Interface (ATI-USB) box

COTS Hardware

- UPS: APC SMT-1500
- Printer: HP M402dn Laser
- Printer: HP M402dne
- Printer: HP M203dw
- Smart Cards: ACOS-6-64

COTS Software

- Android 4.4 (Avalue)

Optional COTS Software

- None

Optional COTS products

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

ImageCast X Card Activator (ICX CA)

- Software version: 5.2.17.1

COTS Hardware and Software

- Client Workstation Configuration
 - Microsoft Windows 10 Professional
 - Desktop computer system per 2.02 Democracy Suite System Configuration Overview
- Smart Cards: ACOS-6-64

2.1.2 Supported Languages

The following languages have been stated by D-Suite 5.2 System:

- Alaskan Native
- Aleut
- Athabaskan
- Bengali
- Chinese
- English

- Eskimo
- Filipino
- French
- Hindi
- Japanese
- Khmer
- Korean
- Spanish
- Thai
- Vietnamese
- Native American
 - Apache, Jicarilla, Keres, Navajo, Seminole, Towa, Ute, Yuman

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

2.1.3 Supported Functionality

The Democracy Suite 5.2 is designed to support the following voting variations:

- General Election
- Closed Primary
- Open Primary
- Straight Party
- Ranked Choice Voting
- 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

2.2 Testing Configuration

The testing event utilized one setup of the D-Suite 5.2 System and its components as configured for normal use. The following is a breakdown of the D-Suite 5.2 System components and configurations for the test setup:

Standard Testing Platform:

Individual ICX systems were set up at various Voting Service and Polling Centers (VSPCs) for both early and election day voting. Each VSPC was supplied with a laptop computer containing the ImageCast Voter Activation (ICVA) application, multiple COTS tablet devices loaded with the ICX client application, printers connected to the ICX tablets, and accessibility devices.

The central count location utilized multiple Canon DR-G1130 or DR-M160II scanners connected to ICC workstations and ImageCast Adjudication clients. Additionally, the central count location housed an EMS server containing all of the D-Suite Server components listed above. ImageCast Adjudication, Election Event Designer (EED), and Results Tally and Reporting (RTR) clients required Ethernet connectivity with the EMS server.

2.3 Test Support Equipment/Materials

All test support equipment and materials required to facilitate testing were supplied by Dominion.

2.4 Technical Data Package

This subsection lists all manufacturer provided documentation that is relevant to the system being tested.

Table 2-2. TDP Documents

Document Number	Description	Version
<i>Adjudication Documents</i>		
2.05	Democracy Suite Adjudication Software Design and Specification	5.2::91
2.08	Democracy Suite Adjudication System Operation Procedures	5.2::139
2.09	Democracy Suite Adjudication System Maintenance Manual	5.2::73
<i>Democracy Suite Documents</i>		
2.02	Democracy Suite System Overview	5.2::106

Table 2-2. TDP Documents *(continued)*

Document Number	Description	Version
2.06	Democracy Suite System Security Specification	5.2::502
2.07	Democracy Suite System Test and Verification	5.2::159
2.10	Democracy Suite Personnel Deployment and Training Requirements	5.2::101
2.11	Democracy Suite Configuration Management Process	5.2::329
2.12	Democracy Suite Quality Assurance Program	5.2::128
2.13	Democracy Suite System Change Notes	5.2::78
<i>EMS Documents</i>		
2.03	Democracy Suite EMS Functional Description	5.2::335
2.05	Democracy Suite EMS Software Design and Specification	5.2::285
2.08	Democracy Suite EMS System Operations Procedures	5.2::692
2.09	Democracy Suite EMS System Maintenance Manual	5.2::118
---	Democracy Suite EMS System Installation and Configuration Procedure	5.2::218
<i>ImageCast Central Documents</i>		
2.03	Democracy Suite ImageCast Central Functionality Description	5.2::150
2.05	Democracy Suite ImageCast Central Software Design and Specification	5.2::94
2.08	Democracy Suite ImageCast Central System Operation Procedures	5.2::182
---	Democracy Suite ImageCast Central Installation and Configuration Procedure	5.2::118
<i>ImageCast X Documents</i>		
2.03	Democracy Suite ImageCast X Functionality Description	5.2.7
2.05	Democracy Suite ImageCast X Software Design and Specification	5.2.5
2.08	Democracy Suite ImageCast X System Operation Procedures	5.2.7
2.09	Democracy Suite ImageCast X System Maintenance Manual	5.2.6
---	Democracy Suite ImageCast X Installation and Configuration Procedure	5.2.10
<i>ImageCast Precinct Documents</i>		
2.03	Democracy Suite ImageCast Precinct Functionality Description	5.2::162
2.04	Democracy Suite ImageCast Precinct System Hardware Specification	5.2::129
2.04.1	Democracy Suite ImageCast Precinct System Hardware Characteristics	5.2::80

Table 2-2. TDP Documents *(continued)*

Document Number	Description	Version
2.05	Democracy Suite ImageCast Precinct Software Design and Specification	5.2::137
2.08	Democracy Suite ImageCast Precinct System Operation Procedures	5.2::256
2.09	Democracy Suite ImageCast Precinct System Maintenance Manual	5.2::110
<i>User Guides</i>		
---	Democracy Suite ImageCast Adjudication User Guide	5.2::118
---	Democracy Suite EMS Audio Studio User Guide	5.2::30
---	Democracy Suite EMS Election Data Translator User Guide	5.2::75
---	Democracy Suite EMS Election Event Designer User Guide	5.2::189
---	Democracy Suite EMS Mobile Ballot Production User Guide	5.2::52
---	Democracy Suite EMS Results Tally and Reporting User Guide	5.2::98
---	Democracy Suite ImageCast Central User Guide	5.2::103
---	Democracy Suite ImageCast Precinct Ballot Marking Device Audio User Guide	5.2::59
---	Democracy Suite ImageCast Precinct User Guide	5.2::50
---	Democracy Suite ImageCast Voter Activation User Guide	5.2::46
---	ImageCast X Ballot Marking Device User Guide	5.2.7
<i>Supplementary Documents</i>		
---	Cyber Acoustics ACM-70B Stereo Headphones Product Sheet	---
---	Democracy Suite ImageCast C++ Coding Standard	5.2::35
---	ImageCast Precinct Technical Guide	5.2::35
---	ImageCast Precinct Level One (L1) Maintenance Manual	5.2::51
---	Democracy Suite ImageCast Precinct Firmware Update Procedure	5.2::39
---	Democracy Suite ImageCast Precinct Extracting Firmware Contents	5.2::26
---	Democracy Suite C# Automated Code Review Process	5.2::30
---	Dell Latitude E7470 Owner's Manual	Rev. A02
---	Dell P2417H Monitor User's Guide	Rev. A01
---	Dell OptiPlex 7440 AIO Owner's Manual	Rev. A01
---	Dell Networking X-Series Specification Sheet	Ver. 1.9
---	Canon DR-G1130 User Manual	---
---	Canon DR-M160II User Manual	---

Table 2-2. TDP Documents *(continued)*

Document Number	Description	Version
---	Dominion Voting Systems Java Coding Standards	1.0
---	Dominion Voting Systems JavaScript Coding Standards	1.0
---	Democracy Suite ImageCast Device Configuration Files	5.2::78
---	Democracy Suite ImageCast Printing and Finishing Specification	5.2::68
---	Democracy Suite ImageCast Total Results File Format	5.2::38
---	Dell Latitude E7450/Latitude 7450 Regulatory Compliance Sheet	---
---	Democracy Suite ImageCast Election Definition Files	5.2::49
---	HP LaserJet Pro M203 User Guide	---
---	HP LaserJet Pro M402dn Datasheet	Rev. 2
---	HP LaserJet Pro M402dne Datasheet	---
---	Dell Precision Tower 3420 Owner's Manual	Rev. A00
---	Google Java Style Dominion XML	---
---	Dell PowerEdge R620 Owners's Manual	Rev. A05
---	Dell PowerEdge R630 Regulatory Compliance Sheet	Rev. A10
---	Dell PowerEdge R630 Owners's Manual	Rev. A03
---	APC Back-UPS BE600M1 User Manual	---
---	APC Back-UPS Pro BR1000G User Manual	---
---	APC Back-UPS SMT1500 User Manual	---
---	Tripp Lite SmartPro SM1500RMXL2UTAA Datasheet	---
---	Tripp Lite SmartPro SM3000RMXL2UTAA Datasheet	---
---	Dell OptiPlex 9020 AIO Regulatory Compliance Sheet	---
---	Dell OptiPlex 9030 AIO Regulatory Compliance Sheet	---
---	Dell OptiPlex 9020 All-in-One Technical Specification Sheet	---
---	Dell OptiPlex 9030 All-in-One Technical Specification Sheet	---
---	YEDU.E95462 Uninterruptible Power-supply Equipment Sheet	---
---	Dell Latitude E7440 Regulatory Compliance Sheet	A09
---	Dell Latitude E7450 Regulatory Compliance Sheet	A09
---	Dell Precision T1700 MT Regulatory Compliance Sheet	---
---	Dell PowerConnect 2808 Product Safety, EMC, and Environmental DataSheet	---

Table 2-2. TDP Documents *(continued)*

Document Number	Description	Version
---	Dell PowerConnect 2816 Product Safety, EMC, and Environmental DataSheet	---
---	APC Smart-UPS 230V Product Information Sheet	---
---	HP M203dw Datasheet	---
---	Avalue SID-15V_1769152252 Product Sheet	---
---	Avalue SID-21V_176915242 Product Sheet	---
---	Smart Pro SM1500 Datasheet	---
---	Dell Latitude E7450 Owner's Manual	---
---	Dell Latitude 3470 Owner's Manual	---
---	Avalue SID-15V-Z37-A1R User Manual	1
---	Avalue SID-21V-Z37-A1R User Manual	1
<i>Build Documents</i>		
---	Democracy Suite EMS Software Build Document	5.2::7
---	ImageCast X Build	5.2.5
---	Democracy suite ImageCast Precinct Firmware Build and Install	5.2::64

3 Test Process and Results

The following sections outline the test process that was followed to evaluate the D-Suite 5.2 System under the scope defined in Section 1.4.

3.1 General Information

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

3.2 Test Cases/Procedures

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

Prior to execution of the required test cases/procedures, the system under test was subjected to testing initialization to establish the baseline for testing and ensure that the testing candidate matched the expected testing candidate and that all equipment and supplies were present.

The following tasks were completed during the testing initialization:

- Ensured proper system of equipment. Checked network connections, power cords, keys, etc.
- Checked version numbers of (system) software and firmware on all components.
- Verified the presence of only the documented COTS.
- Ensured removable media is clean.
- Ensured batteries are fully charged.
- Inspected supplies and test decks.
- Recorded protective counter on all tabulators.
- Reviewed physical security measures of all equipment.
- Recorded basic observations of the testing setup and review.
- Recorded serial numbers of equipment.
- Retained proof of version numbers.

3.3 Test Results

The procedures that were utilized during the test engagement and the results obtained are summarized in the following paragraphs. During the evaluation, the test team made observations of general system behavior.

Source Code Review/Trusted Build/Build Documentation Review – A source code review was performed in order to review the submitted source code to the specific requirements. Both manual and automated review techniques were used per EAC approved procedures. The Source Code Review included a Compliance Build and a Trusted Build of the submitted source code. To perform the trusted build, Dominion-submitted source code, COTS, and Third Party software products were inspected and combined to create the executable code. Additionally, during the performance of the trusted build, the build documentation was reviewed.

Summary Findings:

At the conclusion of the Source Code Review, compliant source code was available for performance of the Trusted Build process. During execution of the Trusted Build, the source

code submitted by Dominion and reviewed by Pro V&V was successfully built using the submitted COTS and third party software products, and the reviewed build documentation.

Functional Configuration Audit (FCA) including System Integration – During this area of testing, the specific functionality of the system under evaluation that is claimed by the manufacturer was targeted to ensure the product functions as documented. This testing used both positive and negative test data to test the robustness of the system. This testing included all proprietary components and COTS components (software, hardware, and peripherals).

System level certification tests were performed to address the integration of the hardware and software. This testing focused 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 was configured as would be for normal field use.

Summary Findings:

The FCA was completed successfully with no anomalies or deficiencies noted. The evaluation utilized baseline test cases as well as specifically designed test cases and included predefined election definitions for the input data. The FCA testing included Straight Party Voting and Ranked Choice Voting and verification of the submitted modifications detailed in the change notes.

System Integration was performed on the entire Democracy Suite 5.0 system. To perform the System Integration test, three General Elections and three Primary Elections were designed in the EED application. The elections were then loaded onto ICX ballot marking devices. Ballots were marked using the ICX units and were read by the ICC. The results were sent to RTR for results reporting.

The following elections were ran from end-to-end:

- Three general elections with the following breakdowns:
 - General Election held in four precincts (one of which was a split precinct)
 - General Election held in three precincts. This election contained fifteen contests compiled into three ballot styles.
 - General Election designed to functionally test the handling of multiple ballot styles, support for at least three languages including a character-based language, support for common voting variations, and audio support for at least three languages and an ADA binary input device.

- Three primary elections with the following breakdowns:
 - Open Primary Election in two precincts. This election contained thirty contests compiled into five ballot styles.
 - Primary Election held in two precincts. This election contained thirteen contests compiled into three ballot styles. One contest is in all three ballot styles; all other contests are independent.
 - Primary Election designed to functionally test the handling of multiple ballot styles, support for at least three languages including an Ideographic based language, support for common voting variations, and audio support for at least three languages and an ADA binary input device.

All system integration tests were successfully executed. During execution of the test procedure, it was verified that the D-Suite 5.2 System successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results.

Regression Testing – Regression testing was performed to verify that the modifications made to the 5.0 system did not negatively impact the voting system. This testing was performed during FCA testing.

Summary Findings:

The D-Suite 5.2 System successfully completed the functional regression test with all actual results obtained during test execution matching the expected results.

Usability Testing – Usability Testing was performed per the applicable requirements of the EAC 2005 VVSG 1.0. For this portion of the test campaign, results from the previous state effort and the EAC certification effort were reused as applicable. The system was then subjected to testing as needed.

Summary Findings:

The D-Suite 5.2 System successfully completed the Usability Testing with all actual results obtained during test execution matching the expected results.

System Setup, Loads & Hardening – The system setup, loads, and hardening was performed to compare the voting system submitted for certification testing to the manufacturer’s technical documentation.

Summary Findings:

During execution of the test procedure, the components of the D-Suite 5.2 System were documented by component name, model, serial number, major component, and any other relevant information needed to identify the component. For COTS equipment, every effort was made to verify that the COTS equipment had not been modified for use. Additionally, each technical document submitted in the TDP was recorded by document name, description, document number, revision number, and date of release. At the conclusion of the test campaign, test personnel verified that any changes made to the software, hardware, or documentation during the test process were fully and properly documented.

4 Conclusions

Based on the results obtained during the test campaign and the re-use of testing from the previous 5.2 state level campaign and the D-Suite 5.0 EAC certification test campaign, where applicable, Pro V&V determines the D-Suite 5.2 System, as presented for evaluation, meets the requirements set forth for voting systems in the U.S. Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (VVSG), Version 1.0. Throughout the test campaign, as tests were executed, resultant data was inspected and technical documentation reviews were performed to ensure that each applicable requirement was met; therefore, fulfilling the test goals.