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# TEST REPORT

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## NATIONAL CERTIFICATION TEST REPORT

### CERTIFICATION TESTING OF THE DOMINION DEMOCRACY SUITE VERSION 4.14-A.1 VOTING SYSTEM

EAC CERTIFICATION NUMBER – DVS-DemSuite4.14-A.1

for

Dominion Voting Systems, Inc.  
1201 18th Street, Suite 210  
Denver, Colorado 80202

STATE OF ALABAMA  
COUNTY OF MADISON }

Robert D. Hardy, Department Manager, being duly sworn, deposes, and says: The information contained in this report is the result of complete and carefully conducted testing and is to the best of his knowledge true and correct in all respects

NTS Huntsville shall have no liability for damages of any kind to person or property, including special or consequential damages, resulting from NTS Huntsville providing the services covered by this report.

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U.S. Election Assistance Commission  
**VSTL**

EAC Lab Code 0704

**SEAL**  
SUBSCRIBED and sworn to before me this 21 day of May 2014  
Sandra A. Kanel  
Notary Public in and for the State of Alabama at Large

My Commission expires June 2, 2015



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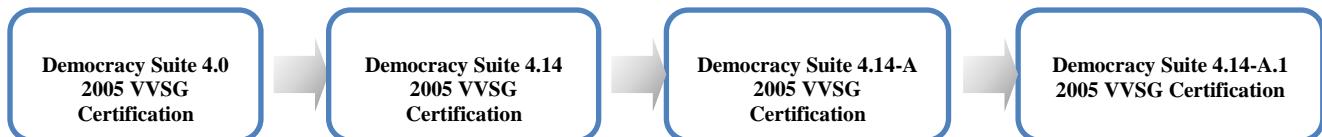
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A	05-16-14	1.2	Updated Objective
A	05-16-14	2.1	Removed duplicate word “this”
A	05-16-14	3.2	Updated Certification Testing Scope for “Section 9: Configuration Management (CM) Requirements”
A	05-16-14	4.1	Updated Test Procedures and Results for “Source Code Review”
A	05-16-14	4.2	Updated Test Procedures and Results for “Trusted Builds”
A	05-16-14	4.4.1	Updated Test Procedures and Results for “Physical Configuration Audit” Summary Findings
B	05-21-14	Title Page	Certification number added and highlights removed

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## **1.0 INTRODUCTION**

The Democracy Suite 4.14-A.1 was submitted for 2005 Voluntary Voting System Guidelines Standards (2005 VVSG) certification. The modifications submitted were tested to the latest voting system standards, the 2005 Voluntary Voting System Guidelines (2005 VVSG), based on the requirements set forth in section 4.4.2.3 of the EAC Testing and Certification Program Manual.



### **1.1 Scope**

This report presents the test results for testing of the Dominion Voting Systems Democracy Suite 4.14-A.1 Voting System. Dominion Voting Systems submitted the voting system to NTS Huntsville for compliance testing to the Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (VVSG). The Democracy Suite 4.14-A.1 Voting System is a modification to the previously certified Democracy Suite 4.14 (Certification number: DemSuite-4-14) and Democracy Suite 4.14-A (Certification number: DemSuite-4-14-A) voting systems. All testing completed on the submitted modifications was conducted in accordance with the EAC 2005 VVSG.

The focus of this test campaign was to test the submitted modifications to the system since the last certification. NTS Huntsville performed functional testing and Engineering Change Order (ECO) Analysis to verify all changes submitted for this upgrade.

This report is valid only for the system modifications identified below. Any changes, revisions, or corrections made to the system after this evaluation shall be submitted to the EAC to determine if the system modification requires a new application, or can be re-submitted as a newly-modified system. The scope of testing required was determined based upon the degree of modification.

The upgraded features submitted as part of the Democracy Suite 4.14-A.1 Voting System modification are listed below:

1. Introduction of source code obfuscation of the EMS software suite to conceal its purpose in order to prevent tampering and reverse engineering
2. Addition of a new tamper-proof bracket for the ICE service switch (ECO 100216) in order to prevent tampering
3. Additional language support for the ICE tabulator to improve product marketability
4. Introduction of a new hardware RAID controller for the EMS Standard Server computer to improve performance

This modification also includes additional system capabilities that were included as a response to the requirements of individual states. The scope of testing for these additional capabilities, along with the test results, are included in Appendix C of this report.

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## **1.0 INTRODUCTION (Continued)**

### **1.2 Objective**

The objective of this system modification test program was to test and determine if the system was compliant or not compliant with the EAC 2005 VVSG requirements. The scope and detail of the requirements tested in the certification were selected to correspond to the scope of the system detailed in the application submitted by Dominion Voting Systems. An in-depth examination of the system further confirmed the applicable requirements selected for compliance testing. This included the inspection and evaluation of system documentation and the execution of functional tests to verify system functionality and performance.

### **1.3 Test Report Overview**

This test report consists of four main sections and appendices:

- 1.0 Introduction – Provides the architecture of the National Certification Test Report (hereafter referred to as Test Report); a brief overview of the testing scope of the Test Report; a list of documentation, customer information, and references applicable to the voting system hardware, software and this test report.
- 2.0 System Identification and Overview – Provides information about the system tested that includes the system's name and major subsystems, test support hardware, and specific documentation provided by the vendor used to support testing.
- 3.0 Test Background – Provides information about the certification test process and a list of terms and nomenclature pertinent to the Test Report and system tested.
- 4.0 Test Procedures and Results – Provides a summary of the procedures and results of the testing process.
- Appendices– Information supporting reviews and testing of the voting system are included as appendices to this report. These include Photographs, the as-run Certification Test Plan, and Notices of Anomaly.

### **1.4 Customer**

Dominion Voting Systems  
1201 18<sup>th</sup> Street, Suite 210  
Denver, Colorado 80202

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## **1.0 INTRODUCTION (Continued)**

### **1.5 References (Continued)**

- Election Assistance Commission 2005 Voluntary Voting System Guidelines, Volume I, Version 1.0, “Voting System Performance Guidelines,” and Volume II, Version 1.0, “National Certification Testing Guidelines,” dated December 2005
- Election Assistance Commission Testing and Certification Program Manual, Version 1.0, effective date June 1, 2011
- Election Assistance Commission Voting System Test laboratory Program Manual, Version 1.0, expires November 2014
- 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
- Quality Assurance Program Manual, Revision 5
- ANSI/NCSL Z540-1, “Calibration Laboratories and Measuring and Test Equipment, General Requirements”
- ISO 10012-1, “Quality Assurance Requirements for Measuring Equipment”
- EAC Requests for Interpretation and Notices of Clarification (listed on [www.eac.gov](http://www.eac.gov))
- EAC Quality Monitoring Program residing on:  
[http://www.eac.gov/testing\\_and\\_certification/quality\\_monitoring\\_program.aspx](http://www.eac.gov/testing_and_certification/quality_monitoring_program.aspx)
- Dominion Voting Systems’ Democracy Suite 4.0 VSTL Certification Test Report Rev. A (listed on [www.eac.gov](http://www.eac.gov))
- Dominion Voting Systems Democracy Suite 4.0 Technical Data Package
- Dominion Voting Systems’ Democracy Suite 4.14 Modification VSTL Certification Test Report Rev. C (listed on [www.eac.gov](http://www.eac.gov))
- Dominion Voting Systems’ Democracy Suite 4.14-A Modification VSTL Certification Test Report Rev. B (listed on [www.eac.gov](http://www.eac.gov))
- Dominion Voting Systems Democracy Suite 4.14 Technical Data Package
- Dominion Voting Systems Democracy Suite 4.14-A Technical Data Package

A listing of the Democracy Suite 4.14-A.1 Voting System Technical Data Package (TDP) Documents submitted for this test effort is listed in Section 2.6, “Vendor Technical Data Package.”

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## **2.0 SYSTEM IDENTIFICATION AND OVERVIEW**

### **2.1 System Overview**

Dominion Voting Systems' Democracy Suite 4.14-A.1 Voting System is a paper-based, optical scan voting system. The voting system hardware consists of four major components:

#### **1. Election Management System**

The EMS consists of eight components deployed as either front-end (client) applications or back-end (server) applications:

- Election Event Designer (client) - Integrates election definition functionality and represents a main pre-voting phase end-user application.
- Results Tally and Reporting (client) - Integrates election results acquisition, validation, tabulation, reporting and publishing capabilities and represents a main post-voting phase end-user application.
- Audio Studio (client) - 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.
- Data Center Manager (client) - Represents a system-level configuration application used in EMS back-end data center configuration.
- Election Data Translator (client) – Exports and imports data in a format suitable for rapid interaction with the Election Event Designer (EED).
- Application Server (server) - Responsible for executing long running processes, such as rendering ballots, generating audio files and election files.
- Network Attached Storage (NAS) Server application (server) - Represents a file repository for election project file based artifacts, such as ballots, audio files, reports, log files, and election files.
- Database Server application (server) - An RDBMS repository of the election project database which holds all the election project data such as districts, precincts, candidates, contests, ballot layouts, tabulators, vote totals, and status of polls.

The EMS is certified to be deployed in two separate physical hardware configurations:

- ***EMS Express hardware configuration*** – A stand-alone EMS system consisting of all software components installed on a single PC or laptop.
- ***EMS Standard hardware configuration*** – A closed-network EMS configuration consisting of EMS server components installed on a single server, Local Area Network (LAN) switch devices, and EMS client components installed on one or more PCs or laptops. In this configuration, all system components are interconnected in a client-server LAN environment.

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## 2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)

### 2.1 System Overview (Continued)

#### 2. ImageCast Evolution (ICE) Precinct Ballot Tabulator

The ImageCast Evolution employs a precinct-level optical scan ballot counter (tabulator) in conjunction with an external ballot box. This tabulator is designed to mark and/or scan paper ballots, interpret voting marks, communicate these interpretations back to the voter (either visually through the integrated LCD display or audibly via integrated headphones), and upon the voter's acceptance, deposit the ballots into the secure ballot box. The tabulator also features binary input devices which permit voters who cannot negotiate a paper ballot to generate a synchronously human and machine-readable ballot from elector-input vote selections. The supported binary input devices include a Sip and Puff device, Foot Pedals, and Audio Tactile Interface (ATI). In this sense, the ImageCast Evolution acts as a ballot marking device. These devices are interchangeable and may be shared between the ICE and ICP units. Additionally, ballots marked by the ImageCast Evolution may be subsequently scanned on the ImageCast Precinct or the ImageCast Central if a recount is required.



**Figure No. 1**  
**ImageCast Evolution**

## 2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)

### 2.1 System Overview (Continued)

#### 3. ImageCast Precinct (ICP) Precinct Ballot Tabulator

The ImageCast Precinct is a precinct-based optical scan ballot tabulator that is used in conjunction with ImageCast-compatible ballot storage boxes. The system is designed to scan marked paper ballots, interpret voter marks on the paper ballot, and safely store and tabulate each vote from the paper ballot. Like the ImageCast Evolution, the ImageCast Precinct also supports enhanced accessibility voting which is enabled by connecting the interchangeable Sip-and-Puff device, Foot Pedals, or Audio Tactile Interface (ATI).



**Figure No. 2**  
**ImageCast Precinct**

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## 2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)

### 2.1 System Overview (Continued)

#### 4. ImageCast Central Count (ICC)

The ImageCast Central Count system is a high-speed, central ballot scan tabulator based on Commercial off the Shelf (COTS) hardware, coupled with a custom-made ballot processing software application. It is used for high-speed scanning and counting of paper ballots. The ICC system hardware consists of the following two COTS devices working together to provide accurate ballot processing functionality:

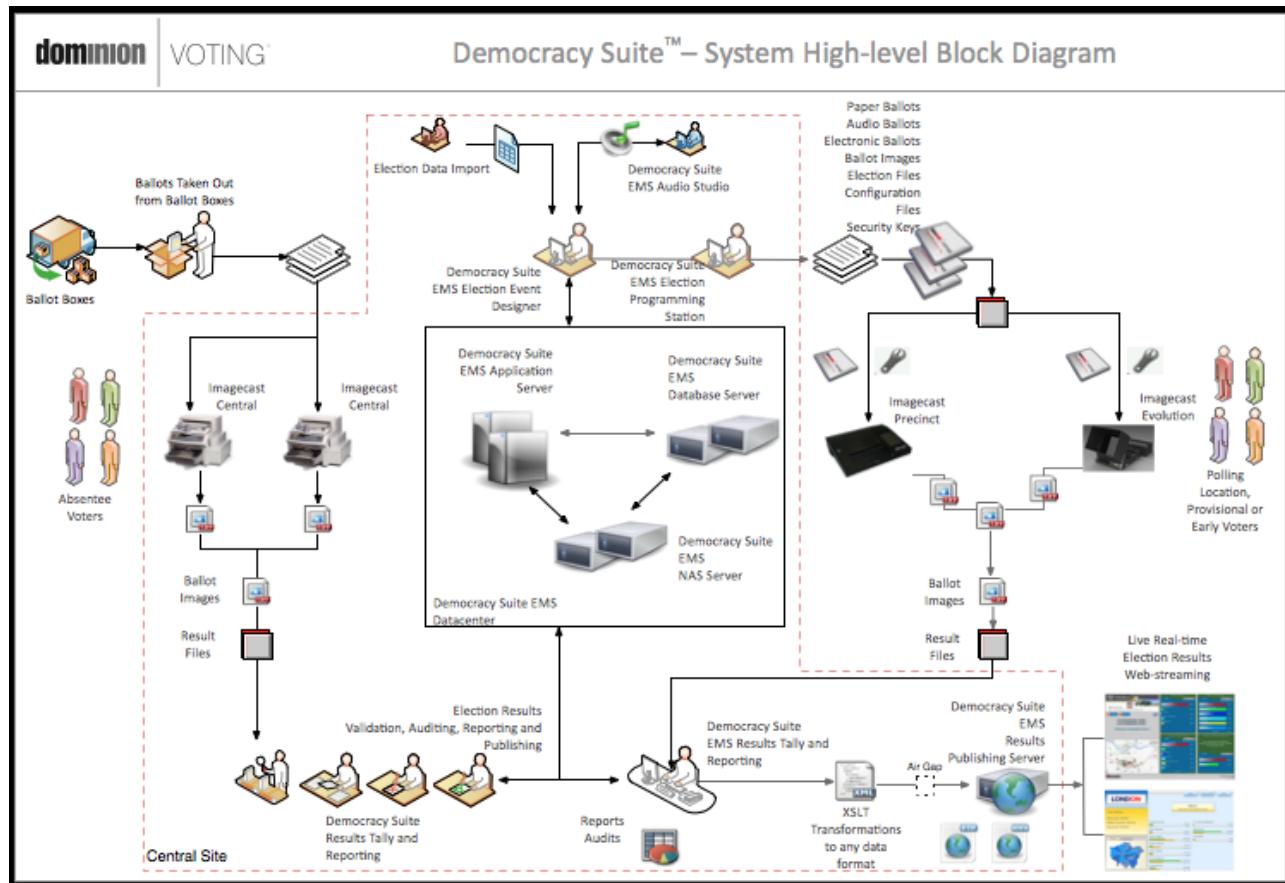
- Canon DR-X10C Scanner: Provides high-speed ballot scanning functionality, transferring the scanned images to the connected ImageCast Central Workstation.
- ImageCast Central Workstation: An all-in-one PC workstation used for ballot image and election rules processing. The workstation can be deployed in a stand-alone or networked configuration, allowing for automatic results transfers to the EMS Datacenter. The ImageCast Central workstation is COTS hardware which executes software for both image-processing and election rules application, such as “Vote for 2.”



**Figure No. 3**  
**Canon DR-X10C Scanner and ImageCast Central Workstation**

## 2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)

### 2.1 System Overview (Continued)



**Figure No. 4**  
**System Overview Diagram**

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## 2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)

### 2.2 System Limits

**Table 2-1 Democracy Suite 4.14-A.1 System Limits**

Limit (Maximum Number of)	Value (by configuration)		Limiting Component
	Express	Standard	
Ballot Positions	462	462	22 Inch Portrait Ballot
Precincts in Election	250	1000	Memory
Contests in Election	250	4000	Memory
Candidates/Counters in Election	2500	40000	Memory
Candidates/Counters in Precinct	462	462	22 Inch Portrait Ballot
Candidates/Counters in Tabulator	2500	10000	Memory
Ballot Styles in Election	750	4000	Memory
Contests in a Ballot Style	156	156	22 Inch Portrait Ballot
Candidates in a Contests	231	462	22 Inch Portrait Ballot (Column Span 3)
Ballot Styles in a Precinct	5	5	Memory
Number of Parties	30	30	22 Inch Portrait Ballot
Vote For in Contest	30	30	22 Inch Portrait Ballot
Supported Languages per Election	5	5	Memory
Number of Write-ins	462	462	22 Inch Portrait Ballot

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## **2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)**

### **2.3 Hardware**

The hardware components identified in Table 2-2 were utilized for certification testing of the Democracy Suite 4.14-A.1 System.

**Table 2-2 Democracy Suite 4.14-A.1 Voting System Equipment Description**

<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Specifications</b>	<b>Serial Number</b>
EMS Server PC	Dell	PowerEdge 1620	Intel Xeon CPU E5-2640 v2 @ 2.00GHz, 8GB RAM, 500GB HD	J8H9H02
EMS Client PC	Dell	Precision T1500	Intel Core i7-860 @ 2.8GHz, 4GB RAM, 500 GB HD	61TPNM1
Central Count All-in-One PC	Dell	Optiplex 9010	Intel Core i3-3220 @ 3.30GHz, 4GB RAM, 500GB HD	627BRW1
Build Server	SuperMicro	SuperServer 7045	Dual Intel 64-bit Xeon @ 3.6GHz, 8GB RAM, 125GB solid-state HD	BM-57381-001
High-Speed Scanner	Canon	DR-X10C	Scanning Speeds: 130 ppm and 260 ipm	ED300880

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## **2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)**

### **2.3 Hardware (Continued)**

**Table 2-3 Democracy Suite 4.14-A.1 COTS Voting System Support Equipment Description**

<b>Test Material</b>	<b>Make</b>	<b>Model</b>	<b>Quantity</b>	<b>Serial Number(s)</b>
iButton (SHA-1) with USB reader/Writer	Maxim	USB R/W: DS9490R iButton: DS1963S	1	51DFD
iButton (SHA-1)	Maxim	DS1963S	20	N/A
LCD Monitor	Soyo	18.5" wide LCD	1	DYLM19R6-KLE-10202
LCD Monitor	Samsung	23" wide LCD	1	MY23HVMS701197B
Networking Switch	D-Link	D-Link DES-1105 5-Port Switch	1	DRL728A001397
Mouse	Dell	USB w/rollerball	1	G1A00M0M
Mouse	Microsoft	USB w/rollerball	1	X800898
Headphones	Sony	MDR-G45LP-01	2	T70251-Sony-01
Sip & Puff	Origin Instruments	Air Voter	2	AV-57381-001 thru 002
Compact Flash Cards	SanDisk	8 GB	40	SDCFAA-008G; DVS 123-000189

**Table 2-4 Democracy Suite 4.14-A.1 Voting System Equipment**

<b>Equipment</b>	<b>Manufacturer</b>	<b>Serial Number(s)</b>
ImageCast Precinct (ICP)	Dominion Voting Systems	WLDAFBH0023
ImageCast Precinct (ICP)	Dominion Voting Systems	WLDAFBH0018
ImageCast Precinct (ICP)	Dominion Voting Systems	AANAGCP0265
ImageCast Evolution (ICE)	Dominion Voting Systems	CAFEBDC0015
ImageCast Evolution (ICE)	Dominion Voting Systems	AAFEBDW0117
ImageCast Evolution (ICE)	Dominion Voting Systems	ICE2P200004
ImageCast Evolution (ICE)	Dominion Voting Systems	ICE2P200002
ICE Plastic Ballot Box	Dominion Voting Systems	AAUCBDQ0074, T70251-BOX-01
ICE Metal Ballot Box	Dominion Voting Systems	BOX-57381-007, BOX-57381-15
ICP Metal Ballot Box	Dominion Voting Systems	BOX-57381-011, BOX-57381-016, BOX-57381-014

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## **2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)**

### **2.4 Software**

The software components identified in Table 2-5 were utilized for certification testing of the Democracy Suite 4.14-A.1 System.

**Table 2-5 Democracy Suite 4.14-A.1 EMS Software Platform Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
EMS Election Event Designer (EED)	4.14.2301	EED_FED_CERT.Setup_64b.msi
EMS Results Tally and Reporting (RTR)	4.14.2301	RTR_FED_CERT.Setup_x64.Setup.msi
EMS File System Service (FSS)	4.14.2301	DemocracySuiteEMS_FSS_Setup.msi
EMS Audio Studio (AS)	4.14.2301	EMSAS2010Setup.msi
EMS Data Center Manager (DCM)	4.14.2301	DemocracySuiteEMS_DCM.exe
EMS Election Data Translator (EDT)	4.14.2301	ElectionDataTranslatorSetup_x64.msi
EMS Application Server (APPS)	4.14.2301	EMSAplicationServer_FED_CERT.Setup_x64.Setup.msi

**Table 2-6 Democracy Suite 4.14-A.1 EMS Software Platform Third Party Software Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Infragistics NetAdvantage Win Forms 2011.1	2011 Vol.1	NetAdvantage_WinForms_2011.1.msi
TX Text Control Library for .NET	16.0	TX Text Control.NET for Windows Forms 16.0.exe

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## **2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)**

### **2.4 Software (Continued)**

**Table 2-7 Democracy Suite 4.14-A.1 EMS Client Application Software Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Microsoft Windows 7 x64	6.1	Microsoft DVD provided
Windows Server 2008 R2 x64	6.1	Microsoft DVD provided
Adobe Reader	10.1.1	AdbeRdr1011_en_US.exe
Microsoft .NET Framework 4.0	4.0	dotNetFx40_Full_x86_x64.exe
Microsoft SQL Server 2008 R2 x64	10.0	Microsoft DVD provided
Microsoft SQL Server 2008 Express R2 x64	10.50.4000.0	SQLEXPRAADV_x64_ENU.exe
Microsoft SQL Server 2008 R2 SP1x64	10.50.4000.0	SQLServer2008R2SP2-KB2630458-x64-ENU.exe
Microsoft Visual J# 2.0 Redistributable Package – Second Edition (x64)	2.0	vjredist64.exe
1-Wire Driver version 4.0.3b x64	4.0.3	install_1_wire_drivers_x64_v403beta.msi
Java Runtime Environment 6.0 x64	6.0.290	jre-6u29-windows-x64.exe
Microsoft Visual C++ 2010 SP1 Redistributable Package(x86)	10.0.40219	vcredist_x86.exe
Microsoft Access Database Engine 2010 Redistributable	1 (published 12/16/2010)	AccessDatabaseEngine.exe AccessDatabaseEngine_x64.exe

**Table 2-8 Democracy Suite 4.14-A.1 EMS Software Platform Unmodified COTS Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Infragistics NetAdvantage Win Forms 2011.1	2011 Vol.1	NetAdvantage_WinForms_20111.msi (for details see document Components_3rdParty_1.0.xlsx)
TX Text Control Library for .NET	16.0	TX Text Control.NET for Windows Forms 16.0.exe (for details see document Components_3rdParty_1.0.xlsx)
Microsoft.Net Framework Library	4.0	dotNetFx40_Full_x86_x64.exe (for details see document Components_3rdParty_1.0.xlsx)
Sox	14.3.1	sox.exe,libgomp-1.dll,pthreadgc2.dll,zlib1.dll (for details see document Components_3rdParty_1.0.xlsx)

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## **2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)**

### **2.4 Software (Continued)**

**Table 2-8 Democracy Suite 4.14-A.1 EMS Software Platform Unmodified COTS Components (Continued)**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Log4net	1.2.10	log4net.dll, log4net.xml (for details see document Components_3rdParty_1.0.xlsx)
NLog	1.0.0.505	NLog.dll (for details see document Components_3rdParty_1.0.xlsx)
iTextSharp	5.0.5.0	itextsharp.dll (for details see document Components_3rdParty_1.0.xlsx)
OpenSSL	1.1.2	openssl.exe, lebeay32.dll, ssleay32.dll (for details see document Components_3rdParty_1.0.xlsx)
SQLite	1.0.65.0	System.Data.SQLite.DLL 32-bit and 64-bit (for details see document Components_3rdParty_1.0.xlsx)
Lame	3.99.4	lame.exe (for details see document Components_3rdParty_1.0.xlsx)
Speex	1.0.4	speexdec.exe and speexenc.exe (for details see document Components_3rdParty_1.0.xlsx)
Ghostscript	9.04	gsdll32.dll – both 32-bit and 64-bit (for details see document Components_3rdParty_1.0.xlsx)
PdfToImage	1.2	PdfToImage.dll (for details see document Components_3rdParty_1.0.xlsx)
SharpSSh package	1.1.1.13	Tamir.SharpSSH.dll, Diffie.Hellman.dll, Org.Mentalis.Security.dll (for details see document Components_3rdParty_1.0.xlsx)
One Wire API for .NET	4.0.2.0	OneWireAPI.NET.dll (for details see document Components_3rdParty_1.0.xlsx)
Avalon-framework-cvs-20020806	20020806	avalon-framework-cvs-20020806.jar (for details see document Components_3rdParty_1.0.xlsx)
Batik	0.20-5	batik.jar (for details see document Components_3rdParty_1.0.xlsx)
Fop	0.20-5	fop.jar (for details see document Components_3rdParty_1.0.xlsx)
Microsoft Visual J# 2.0 Redistributable Package – Second Edition (x64)	2.0	vjc.dll,vjsjbc.dll,vjslibcw.dll,vjsnativ.dll,vjssupuilib.dll,vjsvwaux.dll (for details see document Components_3rdParty_1.0.xlsx)

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## **2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)**

### **2.4 Software (Continued)**

**Table 2-9 Democracy Suite 4.14-A.1 EMS Software Build Environment Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Microsoft Windows Server 2008 R2 x64	6.1	Microsoft DVD provided
7-Zip	9.20	7z920-x64.msi
Microsoft Visual Studio 2010	10.0	Microsoft DVD provided
Microsoft SDK for Windows 7	7.1	GRMSDKX_EN_DVD.iso
Microsoft.NET Framework Library	4.0	dotNetFx40_Full_x86_x64
Microsoft Visual Studio 2010 Service Pack 1	10.0 SP1	VS2010SP1dvd1.iso
Microsoft patch KB2286556	N/A	VS10-KB2286556-x86.exe
ImgBurn	2.5.7.0	SetupImgBurn_2.5.7.0.exe
Infragistics NetAdvanatage Win Forms 2011.1	2011 Vol.1	NetAdvantage_WinForms_20111.msi
TX Text Control Library for .NET	16.0	TX Text Control.NET for Windows Forms 16.0.exe
Speex	1.0.4	speex_win32_1.0.4_setup.exe
Microsoft Visual J# 2.0 Redistributable Package – Second Edition (x64)	2.0	vjredist64.exe
ActivePerl	5.14.3	ActivePerl-5.14.3.1404-MSWin32-x64-296513.msi

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## **2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)**

### **2.4 Software (Continued)**

**Table 2-10 Democracy Suite 4.14-A.1 ImageCast Evolution Software Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Voting Machine	4.14.10A1	GApplication-4.14.10.vhd.7z
Election Application	4.14.10A1	dvs
Linux Kernel	2.6.30.9-dvs-21	uImage
Linux Device File	1.3	mpc8347dvs.dtb
Root File System	1.0.14	rfs
Ram Disk	1.0.1	initrd.img
Boot Startup Logo	4.0.0	logo_platform.bmp
Linux Startup Logo	4.0.0	logo_os.bmp
Boot Loader	1.3.4.29	u-boot.bin
Motherboard FPGA	1.1.5	ice2_mc_p1.bit
Scanner Board FPGA	1.1.2	ice2_scb_p2.bit
Logger Controller	1.0.11	logger.bin
Power Controller	2.0.7	power.bin
Integrated Printer	4.1.6	integratedPrinter.hex, printerFont.hex

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## **2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)**

### **2.4 Software (Continued)**

**Table 2-11 Democracy Suite 4.14-A.1 ImageCast Evolution Unmodified COTS Software Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
busybox	1.20.2	busybox-1.20.2.tar.bz2
e2fsprogs	1.42.4	e2fsprogs-1.42.4.tar.gz
expat	2.1.0	expat-2.1.0.tar.gz
fontconfig	2.9.0	fontconfig-2.9.0.tar.gz
freetype	2.4.9	freetype-2.4.9.tar.bz2
i2c-tools	3.1.0	i2c-tools-3.1.0.tar.bz2
libjpeg	v8d	jpegsrc.v8d.tar.gz
libogg	1.3.0	libogg-1.3.0.tar.gz
libpng	1.5.10	libpng-1.5.10.tar.gz
libusb	1.0.8	libusb-1.0.8.tar.bz2
libusb-compat	0.1.3	libusb-compat-0.1.3.tar.bz2
linux	2.6.30.9	linux-2.6.30.9.tar.bz2
openssl-fips	1.2.3	openssl-fips-1.2.3.tar.gz
ppp	2.4.5	ppp-2.4.5.tar.gz
qt-everywhere	4.7.3	qt-everywhere-opensource-src-4.7.3.tar.gz
skell	1.19	skell-1.19.tar.gz
soundtouch	1.6.0	soundtouch-1.6.0.tar.gz
speex	1.2rc1	speex-1.2rc1.tar.gz
sqlite	3.7.13	sqlite-autoconf-3071300.tar.gz
sysfsutils	2.1.0	sysfsutils-2.1.0.tar.gz
libtiff	4.0.1	tiff-4.0.1.tar.gz
tzcode	2012b	tzcode2012b.tar.gz
tzdata	2012c	tzdata2012c.tar.gz
usb-modeswitch	1.2.4	usb-modeswitch-1.2.4.tar.bz2
usb-modeswitch-data	20120815	usb-modeswitch-data-20120815.tar.bz2
zlib	1.2.7	zlib-1.2.7.tar.bz2
log4cplus	1.0.4.1	log4cplus-1.0.4.1.tar.bz2
quazip	0.5	quazip-0.5.tar.gz

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**2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)**

**2.4 Software (Continued)**

**Table 2-12 Democracy Suite 4.14-A.1 ImageCast Evolution Modified COTS Software Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Kernel	2.6.30.9-dvs-21	uImage
U-BOOT	1.3.4.29	u-boot.bin

**Table 2-13 Democracy Suite 4.14-A.1 ImageCast Evolution Election Firmware Compiler**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
g++ (GNU C++ compiler)	gcc-4.5.38-eglibc-2.11.38	freescale-powerpc-linux-gnu-2011.03-38.i686.rpm

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## **2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)**

### **2.4 Software (Continued)**

**Table 2-14 Democracy Suite 4.14-A.1 ImageCast Evolution Firmware Build Environment Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Ubuntu	10.04 LTS	ubuntu-10.04.4-desktop-i386.iso
LTIB	10.1.1a	ltib-10-1-1a-sv.tar.gz
g++ (GNU C++ compiler)	gcc-4.5.38-eglibc-2.11.38	freescale-powerpc-linux-gnu-2011.03-38.i686.rpm
autoconf	2.57	autoconf-2.57.tar.bz2
bison	2.3	bison-2.3.tar.bz2
ccache	2.4	ccache-2.4.tar.gz
cksum	19990607	cksum-19990607.tar.gz
cramfs	20081121	cramfs-20081121.tar.gz
distcc	2.18.3	distcc-2.18.3.tar.bz2
dtc	1.2.0	dtc-1.2.0.tar.gz
flex	2.5.33	flex-2.5.33.tar.gz
genext2fs	1.4.1	genext2fs-1.4.1.tar.gz
gen_init_cpio	2.6.25-rc7	gen_init_cpio-2.6.25-rc7.tar.gz
genromfs	0.5.1	genromfs-0.5.1.tar.gz
git	1.5.6.5	git-1.5.6.5.tar.gz
libtool	1.5	libtool-1.5.tar.gz
lkc	1.4	lkc-1.4.tar.gz
mkspooflinks	3.4	mkspooflinks-3.4.tar.gz
mtd-utils	20060302	mtd-utils-20060302.tar.bz2
mux_server	1.0	mux_server.c
pkg-config	0.21	pkg-config-0.21.tar.gz
sparse	0.4	sparse-0.4.tar.gz
texinfo	4.8	texinfo-4.8.tar.bz2
tunctl	1.5	tunctl-1.5.tar.gz
u-boot-tools	1.1.6	u-boot-tools-1.1.6.tar.bz2
unifdef	1.0	unifdef-1.0.tar.gz
wget	1.9.1	wget-1.9.1.tar.gz
yaffs_utils	20060418	yaffs_utils-20060418.tar.gz
rpm	4.0.4	rpm-4.0.4.tar.gz

## **2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)**

### **2.4 Software (Continued)**

**Table 2-15 Democracy Suite 4.14-A.1 ImageCast Precinct Software Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Election Firmware	4.14.5-US	cf2xx.sig
Firmware Updater	4.14.5-US	firmUp.enc
Firmware Extractor	4.14.5-US	FirmwareExtract.enc
Kernel (uClinux)	4.14.5-US	Image.bin.gz
Boot Loader (COLILO)	20040221	colilo.bin

**Table 2-16 Democracy Suite 4.14-A.1 ImageCast Central Software Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
ImageCast Central Application	4.14.4	ImageCast Central.exe
Image-Analysis DLL	4.14.4	ImgProc.dll
Windows 7	Professional x64 or X86 with SP1	Operating System for COTS ICC workstation when using Canon DR-X10C scanner

**Table 2-17 Democracy Suite 4.14-A.1 - ImageCast Central Runtime Software Components (Unmodified COTS)**

<b>Software Required For Testing ICC application</b>	<b>Software Version</b>	<b>Filename</b>
Imgcomp.dll	2.11	apiman.zip
1-Wire driver 64-bit	4.03	install_1_wire_drivers_x64_v403.msi
Kofax VRS	4.50	Full CD from Kofax
VCredist	4/10/2006	vcredist_x86.exe

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## **2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)**

### **2.5 Test Support Materials**

This subsection identifies all test materials required to perform voting system testing. The scope of testing was used to determine the quantity required.

The test materials listed in Table 2-18 were required to support the Democracy Suite 4.14-A.1 certification testing:

**Table 2-18 Democracy Suite 4.14-A.1 Test Support Materials**

<b>Test Material</b>	<b>Manufacturer/Description</b>	<b>Quantity</b>
ATI Handset	Dominion	2
Memory Flash Cards	RiData	12
Standard Paper Ballots	Dominion	30
Permanent Markers	p/n SHARPIE1 BK	2
Thermal Printer Rolls	ICP/ICE Paper Rolls	10
Sanitary Headphone Cover	Dominion	2

### **2.6 Vendor Technical Data Package**

The Technical Data Package (TDP) contains information about requirements, design, configuration management, quality assurance, and system operations. The EAC 2005 VVSG requirements state, that at a minimum, the TDP shall contain the following documentation: system configuration overview; system functionality description; system hardware specifications; software design and specifications; system test and verification specifications; system security specifications; user/system operations procedures; system maintenance procedures; personnel deployment and training requirements; configuration management plan; quality assurance program; and system change notes.

The documents listed in Table 2-19 comprise the Democracy Suite 4.14-A.1 Voting System TDP. These documents are considered an addition to the Democracy Suite 4.14 voting system's TDP, certified by the EAC on July 18, 2013 (Dem-Suite-4-14).

**Table 2-19 Democracy Suite 4.14-A.1 Voting System TDP**

<b>Democracy Suite 4.14-A.1 TDP Documents</b>	<b>System</b>	<b>Version</b>	<b>Date</b>	<b>Document Number</b>
Democracy Suite System Overview	All	1.2.0::283	03/26/14	2.02
Democracy Suite Configuration Management Plan	All	1.2.0::188	03/25/14	2.11
Switch Shield Installation Instructions	ICE	Rev2	04/02/14	N/A
EMS Build Environment Procedure	EMS	2.1.0::14	03/31/14	N/A
EMS-4.14.2301-Build-Addendum-20140401	EMS	1.0.0::0	04/02/14	N/A

## **2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)**

### **2.7 Deliverable Materials**

The materials listed in Table 2-20 are identified by Dominion Voting Systems to be delivered as part of the Democracy Suite 4.14-A.1 Voting System to the end users.

**Table 2-20 Democracy Suite 4.14-A.1 Voting System Deliverables**

<b>Deliverable Material</b>	<b>Version</b>	<b>Description</b>
ImageCast Evolution Firmware	4.14.10A1	ICE Software
Election Event Designer	4.14.2301	EMS Software
Results Tally and Reporting	4.14.2301	EMS Software
File System Service	4.14.2301	EMS Software
Audio Studio	4.14.2301	EMS Software
Data Center Manager	4.14.2301	EMS Software
Application Server	4.14.2301	EMS Software
Democracy Suite System Overview	1.2.0::283, dated 03/26/14	TDP Document
Democracy Suite Configuration Management Plan	1.2.0::188, dated 03/25/14	TDP Document
D-Suite 4.14.A1 Change Notes	4.14-A.1::57, dated 04/01/14	TDP Document
Democracy Suite System Overview	1.2.0::283, dated 03/26/14	TDP Document
Switch Shield Installation Instructions	Rev2	TDP Document

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### **3.0 TEST BACKGROUND**

NTS Huntsville is an independent testing laboratory for systems and components under harsh environments, including dynamic and climatic extremes as well as the testing of electronic voting systems. NTS Huntsville holds the following accreditations:

- ISO-9001:2000
- NVLAP Accredited ISO 17025:2005
- EAC Accredited VSTL, NIST 150,150-22
- A2LA Accredited (Certification No.'s 845.01, 845.02, and 845.03)
- FCC Approved Contractor Test Site (Part 15, 18, 68)

#### **3.1 General Information**

All testing performed as part of the test effort was performed at the NTS Huntsville facility. Certification testing included: the inspection and evaluation of voting system documentation, and operational tests verifying system performance and function under normal and abnormal conditions. Qualification/Certification testing was limited to the Democracy Suite Version 4.14-A.1 Voting System which includes the items listed in Section 2.0 of this test report.

#### **3.2 Certification Testing Scope**

To evaluate the system test requirements and the scope of the test campaign, each section of the EAC 2005 VVSG was analyzed to determine the applicable tests. The EAC 2005 VVSG Volume I Sections, along with the strategy for evaluation, are described below:

- **Section 2: Functional Requirements** – The requirements in this section were tested during the FCA and System Integration test utilizing test cases specifically designed to target the modifications submitted for the Democracy Suite 4.14-A.1 System.
- **Section 3: Usability and Accessibility** – The requirements in this section were deemed not applicable, and therefore, were not tested during this test campaign.
- **Section 4: Hardware Requirements** – The requirements in this section were deemed not applicable, and therefore, were not tested during this test campaign.
- **Section 5: Software Requirements** – The requirements in this section were tested during source code review, TDP review, and FCA. A combination of review and functional testing was performed to ensure these requirements were met.
- **Section 6: Telecommunication** – The requirements in this section were deemed not applicable, and therefore, were not tested during this test campaign.

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### **3.0 TEST BACKGROUND (Continued)**

#### **3.2 Certification Testing Scope (Continued)**

- **Section 7: Security Requirements** – The requirements in this section were deemed not applicable, and therefore, were not tested during this test campaign.
- **Section 8: Quality Assurance (QA) Requirements** – The requirements in this section were deemed not applicable, and therefore, were not tested during this test campaign.
- **Section 9: Configuration Management (CM) Requirements** – The CM requirements were spot-checked within the modified TDP and Source Code. Based on no source code changes other than obfuscation, minimal TDP changes, and minor system modifications this was very limited in scope.

#### **3.3 Quality Assurance**

All work performed on this program was in accordance to the NTS Huntsville Quality Assurance Program and the NTS Huntsville Quality Program Manual, which conforms to the applicable portions of International Standard Organization (ISO) Guide 17025.

The NTS Huntsville Facility, Quality Management System is registered in compliance with the ISO-9001 International Quality Standard. Registration has been completed by Quality Management Institute (QMI), a Division of Canadian Standards Association (CSA).

#### **3.4 Test Equipment and Instrumentation**

All instrumentation, measuring, and test equipment used in the performance of this test program was calibrated in accordance with NTS Huntsville's Quality Assurance Program, which complies with the requirements of ANSI/NCSL 2540-1, ISO 10012-1, and ISO/IEC 17025. Standards used in performing all calibrations are traceable to the National Institute of Standards and Technology (NIST) by report number and date. When no national standards exist, the standards are traceable to international standards, or the basis for calibration is otherwise documented.

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### 3.0 TEST BACKGROUND (Continued)

#### 3.5 Terms and Abbreviations

Table 3-1 defines all terms and abbreviations applicable to this Test Report.

**Table 3-1 Terms and Abbreviations**

Term	Abbreviation	Definition
Americans with Disabilities Act of 1990	ADA	ADA is a wide-ranging civil rights law that prohibits, under certain circumstances, discrimination based on disability.
Audio Studio	AS	EMS application used to record audio files.
Audio Tactile Interface	ATI	Voter interface designed to not require visual reading of a ballot. The same ATI is utilized for both the ICP and ICE.
Configuration Management	CM	---
Commercial Off the Shelf	COTS	Commercial, readily available hardware devices (such as card readers, printers or personal computers) or software products (such as operating systems, programming language compilers, or database management systems)
Direct Record Electronic	DRE	An electronic voting system that utilizes electronic components for the functions of ballot presentation, vote capture, vote recording, and tabulation which are logically and physically integrated into a single unit. A DRE produces a tabulation of the voting data stored in a removable memory component and in printed hardcopy.
United States Election Assistance Commission	EAC	Commission created per the Help America Vote Act of 2002, assigned the responsibility for setting voting system standards and providing for the voluntary testing and certification of voting systems.
EMS Election Event Designer	EED	EMS application used for election definition functionality.
Election Management System	EMS	An umbrella term for the software application used to define and report election projects.
Functional Configuration Audit	FCA	Exhaustive verification of every system function and combination of functions cited in the manufacturer's documentation.
Help America Vote Act	HAVA	Act created by United States Congress in 2002.

### **3.0 TEST BACKGROUND (Continued)**

#### **3.5 Terms and Abbreviations (Continued)**

**Table 3-1 Terms and Abbreviations (Continued)**

<b>Term</b>	<b>Abbreviation</b>	<b>Definition</b>
ImageCast Precinct	ICP	Precinct-level optical scanner and tabulator with audio voting capabilities.
ImageCast Evolution	ICE	Precinct-level optical scanner, tabulator with audio voting and integrated Ballot-marking Device
ImageCast Central	ICC	COTS High-speed central ballot scan tabulator.
National Institute of Standards and Technology	NIST	Government organization created to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhances economic security and improves our quality of life.
Operating Procedure	OP	Test Method or Test Procedure.
Relational Database Management System	RDBMS	A database management system (DBMS) that is based on the relational model
Physical Configuration Audit	PCA	Review by accredited test laboratory to compare voting system components submitted for certification testing to the manufacturer's technical documentation, and confirmation the documentation meets national certification requirements.
Quality Assurance	QA	---
Results, Tally and Reporting	RTR	EMS application used to integrate election results and reporting.
Technical Data Package	TDP	Manufacturer documentation related to the voting system required to be submitted as a precondition of certification testing.
Trusted Build	---	Final build of source code performed by a trusted source and overseen by the manufacturer which is delivered to the EAC designated repository; also referred to as a "Witness Build".
Voluntary Voting System Guidelines	EAC 2005 VVSG	Published by the EAC, the third iteration of national level voting system standards.
Voting System Test Laboratory	VSTL	An independent, non-federal laboratory qualified to test voting systems to Federal standards.

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## **4.0 TEST PROCEDURES AND RESULTS**

The Dominion Voting Systems Democracy Suite 4.14-A.1 Voting System, as identified in Section 2.0 of this report, was subjected to the tests as summarized in this section.

### **4.1 Source Code Review**

As part of testing activities, the EMS and ICE source code submitted for the Democracy Suite 4.14-A.1 System were compared to the baseline versions included in the Democracy Suite 4.14 System to confirm the code was unmodified. A SHA256 hash value was created for the source code received, and these values were confirmed to match the existing hash values for the baseline source code.

#### **Summary Findings**

No deficiencies were found during the source code review.

### **4.2 Trusted Builds**

Trusted Builds of the EMS and ICE software were performed by utilizing Dominion Voting Systems' trusted build documentation. A Trusted Build review confirmed the changes included in the software build components included the addition of a COTS code obfuscation software tool for the EMS and ICE software builds, and a process added to include the additional languages to the ICE software.

The following steps were performed in the order listed by NTS Huntsville to complete the Trusted Builds:

- Clear hard drive of existing data
- Retrieve the compliant source code
- Retrieve the installation media for OS, compilers, and build software
- Construct the build environment
- Create disk image of the build environment
- Load the compliant source code into the build environment
- Create a disk image of the pre-build environment
- Create a digital signature of the pre-build environment
- Build executable code
- Create a disk image of the post-build environment
- Create a digital signature of executable code
- Create installation media
- Create a digital signature of the installation media
- Install executable code onto the system and validate the software/firmware
- Deliver source code with digital signature, disk image of pre-build environment with digital signatures, disk image of post-build environment with digital signatures, executable code with digital signatures, and installation media to the EAC Repository.

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## **4.0 TEST PROCEDURES AND RESULTS (Continued)**

### **4.2 Trusted Builds (Continued)**

The Trusted Builds for the Democracy Suite 4.14-A.1 System included source code, data, and script files in clear text form. The builds included COTS software provided to NTS Huntsville on commercially available media, COTS software downloaded and verified by the VSTL, COTS software verified by SHA256 from the software supplier, and picture and sound files in binary format provided by Dominion Voting Systems. Each component required for the Trusted Build was verified by NTS Huntsville prior to performing the Trusted Build.

Prior to performing the Trusted Builds, the PC hard drive was cleared of any existing data by writing data to every hard drive sector. The operating system identified for the Trusted Build was installed, followed by all prerequisite software, data files, and configurations identified in the build documentation. Lastly, the software was built by performing the process provided by Dominion Voting Systems.

#### **Summary Findings**

NTS Huntsville performed Trusted Builds for the EMS and ICE software components of the Democracy Suite 4.14-A.1 System on March 27<sup>th</sup> and April 1<sup>st</sup>, 2014. The Dominion Voting Systems' Technical Representatives for the Trusted Builds were Dragoljub Petrovic and Elena Spasic.

For the EMS and ICE Trusted Builds, a 3<sup>rd</sup>-party code obfuscation software tool called .NET Reactor was introduced into the build process. This application was executed during the final stages of each build process to assist Dominion Voting Systems in protecting their software assets. The software products resulting from the Trusted Builds shall be supplied to the EAC at the conclusion of the certification effort. No deficiencies were noted during the performance of the Trusted Builds.

### **4.3 Technical Data Package Review**

The Democracy Suite 4.14-A.1 Voting System Technical Data Package (TDP) was reviewed to the 2005 VVSG. This review was performed as part of the testing activities. The TDP review only included the revised and new documents submitted for this testing campaign. The documents were reviewed for accuracy, completeness, and compliance to the 2005VVSG.

#### **Summary Findings**

The TDP documents submitted and reviewed for the Democracy Suite 4.14-A.1 test campaign can be found in Section 2.5 of this report. No deficiencies were noted for the TDP Review.

### **4.4 System Level Testing**

System Level Testing was performed to evaluate the functionality of the modifications submitted for the Democracy Suite 4.14-A.1 Voting System as documented in the TDP. The suite of tests that comprised the System level Testing included a Physical Configuration Audit, Functional testing and a System Integration Test.

An overview of the tests performed during the System Level Testing is provided below, along with the summary findings for each test.

## **4.0 TEST PROCEDURES AND RESULTS (Continued)**

### **4.4 System Level Testing (Continued)**

#### **4.4.1 Physical Configuration Audit**

A Physical Configuration Audit (PCA) of the Democracy Suite 4.14-A.1 Voting System was performed in accordance with Section 6.6 of Volume II of the 2005 VVSG. The PCA compared the voting system components submitted for certification to the vendor's technical documentation, and confirmed the submitted documentation met the Guidelines. The PCA performed for the Democracy Suite 4.14-A.1 System consisted of inspecting the baseline voting system and the following:

- The Democracy Suite 4.14-A.1 ImageCast Evolution precinct ballot counter with applied ECO
- The Democracy Suite 4.14-A.1 EMS Server PC (Dell PowerEdge 1620)

#### **Summary Findings**

A limited PCA was performed to baseline the system's hardware components that were utilized during the test campaign, along with the components submitted for the system modification.

#### **4.4.2 Functional Testing**

The Functional Testing encompassed an examination of the modifications submitted for the Democracy Suite 4.14-A.1 System. The following tests were performed in accordance with the 2005 VVSG:

1. Additional languages added to the ICE tabulator – Test cases were developed for the ICE tabulator to target the activation and deactivation of the newly added languages.
2. New hardware RAID controller for EMS Standard server – The method of verifying that the hardware RAID controller had no adverse effects on the operation and functionality of the EMS server software components was accomplished by executing all functional tests throughout the certification campaign using the Standard server configuration. Additionally, the system and application logs were analyzed throughout the campaign to ensure errors did not appear related to the new hardware or EMS software.
3. EMS code obfuscation – This modification was verified by performing a full System Integration test as described in the following section. The test utilized all tabulators (ICE/ICP/ICC) certified in the baseline Democracy Suite 4.14 Voting System, and encompassed the end-to-end functionality of the EMS application suite by confirming General and Primary election types can be created and results validated.

#### **Summary Findings**

Functional Tests were performed to ensure the system operates as described in the system's technical documentation. There were no deficiencies noted during the functional testing.

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## **4.0 TEST PROCEDURES AND RESULTS (Continued)**

### **4.4 System Level Testing (Continued)**

#### **4.4.3 System Integration Test**

The System Integration test was performed as the primary means of verifying the submitted modifications did not affect the functionality of the base system. The test deck created for system integration included hand-marked ballots and ICE-generated ballots, and all tabulators certified for the Democracy Suite 4.14 System (ICE/ICP/ICC) were utilized. The voting results were verified to match the expected results via the printed tapes from each tabulator and cumulative reports from the RTR application.

The five election definitions exercised during the System Integration Testing are listed below:

- GEN-01
- GEN-02
- GEN-03
- PRIM-01
- PRIM-03

#### **Summary Findings**

No discrepancies were noted during testing, although the test was briefly halted to replace the ICE printer cartridges and re-calibrate the scanners. A representative from Dominion Voting Systems was present for this task, and the steps taken were documented and saved as raw data by NTS Huntsville personnel. Upon completion, the System Integration Test revealed the modifications submitted for the Democracy Suite 4.14-A.1 System had no adverse effect on the system's hardware or software.

## **4.5 Recommendation for Certification**

NTS Huntsville performed conformance/specification testing on the Dominion Voting Systems Democracy Suite 4.14-A.1 System to the EAC 2005 VVSG (Version 1.0). During the test campaign, all data from pre-testing and functional testing activities was combined to ensure all VVSG requirements that are supported by the Democracy Suite 4.14-A.1 had been tested. NTS Huntsville also used discretion as granted by the VVSG to design and exercise Functional Test Cases.

NTS Huntsville concludes that the Democracy Suite 4.14-A.1, submitted by Dominion Voting Systems, meets all applicable requirements for certification as set forth in the Election Assistance Commission (EAC) 2005 Voluntary Voting Systems Guidelines, Version 1.0. As such, NTS Huntsville recommends that the EAC grant the Dominion Voting Systems Democracy Suite 4.14-A.1 certification to the VVSG.

This test report is valid only for the system identified in Section 2.0 of this test report. Any changes, revisions, or corrections made to the system after this evaluation shall be submitted to the EAC to determine if the modified system requires a new application, or can be submitted as a modified system. The scope of testing required will be determined based upon the degree of modification.

**Due to the varying requirements of individual jurisdictions, it is recommended by the VVSG that local jurisdictions perform pre-election logic and accuracy tests on all systems prior to their use in an election within their jurisdiction.**

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**APPENDIX A**  
**PHOTOGRAPHS**



**Photograph 1**  
**System Integration Test: ImageCast Evolution**



**Photograph 2**  
**System Integration Test: ImageCast Precinct**



**Photograph 3**  
**System Integration Test: ImageCast Central**



**Photograph 4**  
**Functional Testing: ImageCast Evolution**

**APPENDIX B**

**NTS HUNTSVILLE'S CERTIFICATION TEST PLAN AS RUN NO. T71615.01, REV B**

## CERTIFICATION TEST PLAN

Prepared for:

<b>Manufacturer Name</b>	Dominion Voting Systems, Inc.
<b>Manufacturer System</b>	Democracy Suite Version 4.14-A.1
<b>EAC Application No.</b>	DVS1401
<b>Manufacturer Address</b>	1201 18 <sup>th</sup> Street, Suite 210 Denver, Colorado 80202

 <b>HUNTSVILLE OPERATIONS</b>			REPORT NO. Test Plan No. T71615.01 Rev B
REV	DATE	PAGE OR PARAGRAPHS AFFECTED	DESCRIPTION OF CHANGES
---	04-04-14	Entire Document	Original Release
A	04-16-14	1.2	Updated Scope
A	04-16-14	1.5	Added ending parenthesis
A	04-16-14	1.7.1	Changed the wording of System Overview section
A	04-16-14	1.7.1	Changed “D” to lowercase
A	04-16-14	3.0	Updated paragraph
A	04-16-14	3.1	Changed tense of word “update” to present tense
A	04-16-14	4.2	Removed ECO reference
A	04-16-14	4.2	Updated paragraph
A	04-16-14	4.2	Removed extra period
A	04-16-14	4.4	Updated Source Code Review section for further clarification
A	04-16-14	Appendix A	Clarified process of updating language files
B	04-19-14	Appendix B	Added Appendix B to include description of additional testing

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## **1.0 INTRODUCTION**

The purpose of this National Certification Test Plan (Test Plan) is to document the procedures that National Technical Systems (NTS) will follow to perform certification testing of the Dominion Voting Systems (DVS) Democracy Suite 4.14-A.1 voting system to the requirements set forth for voting systems in the U.S. Election Assistance Commission 2005 Voluntary Voting System Guidelines (EAC 2005 VVSG). Prior to submitting the system for certification testing, DVS submitted an application to the EAC for certification of the Democracy Suite 4.14-A.1 voting system modification to the previously certified Democracy Suite 4.14 (Certification number: DemSuite-4-14) and Democracy Suite 4.14-A (Certification number: DemSuite-4-14-A) voting systems. This test plan follows Notice of Clarification 09-005: Development and Submission of Test Plans for Modifications to EAC Certified Systems and Notice of Clarification 13-02: Detailed Description of Changes for Modifications.

At test conclusion, the results of all testing performed as part of this test campaign will be submitted to the EAC in the form of a final report.

### **1.1 Established Baseline System**

The baseline system for this modification is the Democracy Suite 4.14-A voting system. Tables 1-1, 1-2, and 1-3 describe the certified equipment and firmware versions. For full details about the Democracy Suite 4.14-A system, refer to the Dominion Voting Systems Democracy Suite 4.14-A Modification's Final Test Report (Rev B) located on the EAC's website at <http://www.eac.gov>.

**Table 1-1 Democracy Suite 4.14 Voting System Hardware Components**

Component	Hardware Version	Software/Firmware Version
ICP – Precinct ballot scanner	320A and 320C	4.14.5
ICP – Ballot box	310A (metal), 330A (plastic), 340C (coroplast) and 341C (coroplast with latch)	N/A
ICE – Precinct ballot scanner	400A and 410A	4.14.10
ICE – Ballot box	400A (metal), 410A (plastic), 420A (coroplast)	N/A
ICC – Ballot scanner	Canon DR-X10C	N/A
ICC – PC workstation configured with ICC software	Dell OptiPlex 9010	4.14.4

**Table 1-2 Democracy Suite 4.14 Voting System Software Components**

Component	Version
Election Event Designer (EED)	4.14.23
Results Tally and Reporting (RTR)	4.14.23
File System Service (FSS)	4.14.23
Audio Studio (AS)	4.14.23
Data Center Manager	4.14.23
Application Server	4.14.23

**Table 1-3 Democracy Suite 4.14 Voting System EMS Components**

Equipment	Description	Serial Number
Server PC	Dell PowerEdge T620	J8H9H02
Client PC	Dell Precision T1500	61TPNM1

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#### **1.0 INTRODUCTION (Continued)**

##### **1.2 Scope of Modification**

The scope of this modification includes four system changes to address the security and marketability of the Democracy Suite system. These changes include:

1. Introduction of source code obfuscation of the EMS software suite to conceal its purpose in order to prevent tampering and reverse engineering
2. Addition of a new tamper-proof bracket for the ICE service switch (RCCO 100216) in order to prevent tampering
3. Additional language support for the ICE tabulator to improve product marketability
4. Introduction of a new hardware RAID controller for the EMS Standard Server computer to improve performance

##### **1.3 Initial assessment**

All versions of the precinct tabulators and central count components were submitted for testing in previous EAC campaigns. NTS personnel have analyzed the results of the Democracy Suite 4.14 and Democracy Suite 4.14-A testing to determine prior testing acceptance (Wyle Test Report T70251.01-01 and T71120.01-01). Based on this analysis, NTS is applying for reuse for all prior testing within the Democracy Suite 4.14 and Democracy Suite 4.14-A EAC test campaigns unless otherwise noted within this document. In addition, to verify that the modifications to the voting system do not introduce any nonconformities or instabilities, the Democracy Suite 4.14-A.1 voting system shall be subjected to a system integration test to ensure all components interact properly.

##### **1.4 References**

The documents listed below were used in the development of the Test Plan and are utilized to perform certification testing.

- Election Assistance Commission 2005 Voluntary Voting System Guidelines, Volume I, Version 1.0, "Voting System Performance Guidelines," and Volume II, Version 1.0, "National Certification Testing Guidelines," dated December 2005
- Election Assistance Commission Testing and Certification Program Manual, Version 1.0, effective date June 1, 2011
- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 1.0, expires November 2014
- 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
- Quality Assurance Program Manual, Revision 5
- ANSI/NCSL Z540-1, "Calibration Laboratories and Measuring and Test Equipment, General Requirements"
- ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment"

**1.0 INTRODUCTION (Continued)**

**1.4 References (Continued)**

- EAC Requests for Interpretation (listed on <http://www.eac.gov>)
- EAC Notices of Clarification (listed on <http://www.cac.gov>)
- EAC Quality Monitoring Program residing at:  
[http://www.eac.gov/testing\\_and\\_certification/quality\\_monitoring\\_program.aspx](http://www.eac.gov/testing_and_certification/quality_monitoring_program.aspx)
- Dominion Voting Systems' Democracy Suite 4.14 Modification VSTL Certification Test Report Rev. C (listed on <http://www.cac.gov>)
- Dominion Voting Systems Democracy Suite 4.14 Technical Data Package
- Dominion Voting Systems' Democracy Suite 4.14-A Modification VSTL Certification Test Report Rev. B (listed on [www.cac.gov](http://www.cac.gov))
- Dominion Voting Systems Democracy Suite 4.14-A Technical Data Package

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## 1.0 INTRODUCTION (Continued)

### 1.5 Terms and Abbreviations

Table 1-4 defines all terms and abbreviations applicable to the development of this Test Plan.

**Table 1-4 Terms and Abbreviations**

Term	Abbreviation	Definition
Americans with Disabilities Act of 1990 (Amended 2008)	ADA	ADA is a wide-ranging civil rights law that prohibits, under certain circumstances, discrimination based on disability.
Audio Studio	AS	EMS application used to record audio files.
Audio Tactile Interface	ATI	Electronic voter interface that does not require visual reading of a ballot. Audio is used to convey information to the voter and sensitive tactile controls allow the voter to convey information to the system.
Configuration Management	CM	---
Commercial Off the Shelf	COTS	Commercial, readily available hardware or software.
Direct Record Electronic	DRE	An electronic voting system that utilizes electronic components for the functions of ballot presentation, vote capture, vote recording, and tabulation which are logically and physically integrated into a single unit. A DRE produces a tabulation of the voting data stored in a removable memory component and in printed hardcopy.
United States Election Assistance Commission	EAC	Commission created per the Help America Vote Act of 2002, assigned the responsibility for setting voting system standards and providing for the voluntary testing and certification of voting systems.
EMS Election Event Designer	EED	EMS application used for election definition functionality.
Election Management System	EMS	An umbrella term for the software application used to define and report election projects
Equipment Under Test	EUT	---
Functional Configuration Audit	FCA	Exhaustive verification of every system function and combination of functions cited in the manufacturer's documentation.
Federal Communications Commission	FCC	---
Help America Vote Act	HAVA	Act created by United States Congress in 2002.
ImageCast Central	ICC	High-speed central ballot scan tabulator
ImageCast Evolution	ICE	Precinct-level optical scanner, ballot marker, and tabulator with audio voting.
ImageCast Precinct	ICP	Precinct-level optical scanner and tabulator with audio voting capabilities.
National Institute of Standards and Technology	NIST	Government organization created to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhances economic security and improves our quality of life.
National Technical Systems, Inc.	NTS	---
NTS Operating Procedure	OP	NTS Test Method or Test Procedure.
System Under Test	SUT	---
Test Case Procedure Specifications	TCPS	NTS-developed document that specifies test items, input specifications, output specifications, environmental needs, special procedural requirements, inter-case dependencies, and all validated test cases that will be executed during the area under test.
Technical Data Package	TDP	Manufacturer documentation related to the voting system required to be submitted as a precondition of certification testing.
Underwriters Laboratories Inc.	UL	---
Uninterruptible Power Supply	UPS	---
Voluntary Voting System Guidelines	EAC 2005 VVSG	Published by the EAC, the third iteration of national level voting system standards.

**1.0 INTRODUCTION (Continued)**

**1.6 Testing Responsibilities**

All core and non-core software and hardware certification testing will be conducted under the guidance of NTS by personnel verified by NTS to be qualified to perform the testing.

**1.6.1 Test Case Development**

NTS will utilize the "NTS Baseline Test Cases" for the Functional and System Integration Tests. These will be augmented with specially designed test cases tailored to the Dominion 4.14-A.1 system.

**1.6.2 Test Procedure Development and Validation**

NTS will utilize the NTS Operating Procedures (OPs) during the duration of this test program.

**1.6.3 Third-Party Tests**

NTS will not utilize any 3rd party testing during performance of the Democracy Suite 4.14-A.1 test campaign.

**1.7 Target of Evaluation Description**

The following sections address the design methodology and product description of the Democracy Suite 4.14-A.1 Voting System, as taken from the Dominion Voting Systems technical documentation.

**1.7.1 System Overview**

The Dominion Voting Systems Democracy Suite 4.14-A.1 System is a paper-based optical scan voting system, and a modification to the previously-certified Democracy Suite 4.14-A System.

The certified system consists of four major components: the Election Management System (EMS), ImageCast Evolution (ICE) precinct scanner and ballot marking device, ImageCast Precinct (ICP) precinct scanner with audio ballot, and ImageCast Central (ICC) central count scanner.

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## **1.0 INTRODUCTION (Continued)**

### **1.7.1 System Overview (Continued)**

#### **Election Management System**

The EMS consists of eight components running as either a front-end/client application or as a back-end/server application. Below is an overview and brief description of each. This listing is for informational and verification purposes only and not all areas will be included in testing based on the limited modifications included in this test campaign.

- Election Event Designer (EED) client application - integrates election definition functionality and represents a main pre-voting phase end-user application.
- Results Tally and Reporting client application - integrates election results acquisition, validation, tabulation, reporting and publishing capabilities and represents a main post-voting phase end-user application.
- Audio Studio client application - 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.
- Data Center Manager client application - represents a system level configuration application used in EMS back-end data center configuration.
- Application Server application - represents a server side application responsible for executing long running processes, such as rendering ballots, generating audio files and election files, etc.
- Network Attached Storage (NAS) Server application - represents a server side file repository for election project file based artifacts, such as ballots, audio files, reports, log files, election files, etc.
- Database Server application - 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.
- Election Data Translator (EDT) – exports and imports data in a format suitable for usage in the Election Event Designer (EED) application.

#### **Precinct Ballot Tabulator: ImageCast Evolution (ICE)**

The Dominion Democracy Suite ImageCast Evolution System employs a precinct-level optical scan ballot counter (tabulator) in conjunction with ImageCast compatible ballot storage boxes. This tabulator is designed to mark and/or scan paper ballots, interpret voting marks, communicate these interpretations back to the voter (either visually through the integrated LCD display or audibly via integrated headphones), and upon the voter's acceptance, deposit the ballots into the ballot box. The unit also features an Audio Tactile Interface (ATI) which permits voters who cannot negotiate a paper ballot to generate a synchronously human and machine-readable ballot from elector-input vote selections. In this sense, the ImageCast Evolution acts as a ballot marking device.

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**1.0 INTRODUCTION (Continued)**

**1.7 Target of Evaluation Description (Continued)**

**1.7.1 System Overview (Continued)**

**Precinct Ballot Tabulator: ImageCast Evolution (ICE) (Continued)**



**Photograph 1: ImageCast Evolution (ICE) on Plastic Ballot Box**

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**1.0 INTRODUCTION (Continued)**

**1.7 Target of Evaluation Description (Continued)**

**1.7.1 System Overview (Continued)**

**Precinct Ballot Tabulator: ImageCast Precinct (ICP)**

The Dominion Democracy Suite ImageCast Precinct ballot counter is a precinct-based optical scan ballot tabulator that is used in conjunction with ImageCast compatible ballot storage boxes. The system is designed to scan marked paper ballots, interpret voter marks on the paper ballot and store and tabulate each vote from each paper ballot. The ICP contains a small touch-screen LCD to allow the poll worker to access diagnostic and configuration settings.

In addition, enhanced accessibility voting may be accomplished via optional accessories connected to the ImageCast unit. The ICP utilizes an ATI device to allow voters with disabilities to navigate and submit a voted ballot. This is accomplished by presenting the ballot to the voter in an audio format. The ATI is connected to the tabulator, and allows the voter to listen to an audio voting session consisting of contest and candidate names. The ATI also allows a voter to adjust the volume and speed of audio playback. The cast vote record is recorded electronically when the ATI is used to cast a ballot. There is no contemporaneous paper ballot or paper record produced when the ATI is utilized for voting. A ballot representing the voter's choices may be printed from EMS at a later time.

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**1.0 INTRODUCTION (Continued)**

**1.7 Target of Evaluation Description (Continued)**

**1.7.1 System Overview (Continued)**



**Photograph 2: ImageCast Precinct (ICP) on Metal Ballot Box**

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**1.0 INTRODUCTION (Continued)**

**1.7 Target of Evaluation Description (Continued)**

**1.7.1 System Overview (Continued)**

**Central Tabulator: ImageCast Central Count (ICC)**

The Dominion Democracy Suite ImageCast Central Count ballot counter system is a high-speed, central ballot scan tabulator based on COTS hardware, coupled with the custom-made ballot processing application software. It is used for high speed scanning and counting of paper ballots. Central Count scanning system hardware consists of a combination of two COTS devices used together to provide the required ballot scanning processing functionality:

- ImageCast Central Workstation: a COTS computer which hosts the ImageCast Central application used for ballot image processing, election rules processing, and results transfer to the EMS datacenter.
- Canon DR-X10C Scanner: a COTS scanner used to provide ballot scanning and image transfers to the local ImageCast Central Workstation.



**Photograph 3: Canon DR-X10C Scanner and ImageCast Central Workstation**

## **2.0 PRE-CERTIFICATION TESTING AND ISSUES**

NTS has conducted a pre-certification review, and findings indicate that all system changes are consistent with the change items documented in the EAC Application DVS-1401.

### **2.1 Evaluation of Prior VSTL Testing**

NTS will reutilize all testing from the previously-certified systems submitted by Dominion Voting Systems. The testing of these systems was conducted by Wyle Laboratories in accordance with the EAC 2005 VVSG, and the EAC Certification Numbers are DVS-40-G-10, DVS-DemSuite-4-14, and DVS-DemSuite-4-14-A.

### **2.2 Known Field Issues**

This system is a modification to previously-certified systems. There were no systemic or significant issues traceable to any of the previously certified systems.

## **3.0 MATERIALS REQUIRED FOR TESTING**

The materials required for certification testing of the Democracy Suite 4.14-A.1 Voting System include software, hardware, test materials, and deliverable materials. These items were shipped directly to NTS by Dominion Voting Systems to enable the test campaign to occur. The equipment used during this test is the same equipment used during the original certification campaign.

### **3.1 Software**

The Democracy Suite Version 4.14-A software will be utilized during the Democracy Suite 4.14-A.1 modification, although a new software build will be performed to include obfuscation of the source code. The software for the ImageCast Precinct and ImageCast Central will be utilized with no modifications since the Democracy Suite 4.14-A test campaign. The software for ImageCast Evolution precinct ballot tabulators will be updated to include new languages and fonts. The update is handled within the build process as no source code has been changed within this campaign from the certified Democracy Suite 4.14-A system.

**Table 3-1 Software Utilized for Testing**

Software Required For Testing	Software Version
Democracy Suite EMS Application Suite	4.14.2301
ImageCast Precinct (ICP)	4.14.5
ImageCast Central (ICC)	4.14.4
ImageCast Evolution (ICE)	4.14.10A1

### **3.2 Equipment**

This subsection categorizes the equipment the manufacturer submitted for testing listed in Table 3-2. Each test element is included in the list of equipment required for testing of that element, including system hardware, general purpose data processing and communications equipment, and any required test instrumentation.

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**3.0 MATERIALS REQUIRED FOR TESTING (Continued)**

**3.2 Equipment (Continued)**

**Table 3-2 Test Equipment**

<b>Equipment</b>	<b>Description</b>	<b>Serial Number</b>
ICP - Precinct Count Optical Scanner	Dominion Voting Systems	WLDAFBH0023
ICP - Precinct Count Optical Scanner	Dominion Voting Systems	WLDAFBH0018
ICP - Precinct Count Optical Scanner	Dominion Voting Systems	AA_NAGCP0265
ICE - Precinct Count Optical Scanner	Dominion Voting Systems	CAFEBCD0015
ICE - Precinct Count Optical Scanner	Dominion Voting Systems	AAFEBDW0117
ICE - Precinct Count Optical Scanner	Dominion Voting Systems	ICE2P200004
ICE - Precinct Count Optical Scanner	Dominion Voting Systems	ICE2P200002
ICE Plastic Ballot Box	Dominion Voting Systems	AAUCBDQ0074, T70251-BOX-01
ICE Metal Ballot Box	Dominion Voting Systems	BOX-57381-007, BOX-57381-15
ICP Metal Ballot Box	Dominion Voting Systems	BOX-57381-011, BOX-57381-016, BOX-57381-014
Dell PowerEdge 1620	EMS Server PC	J8H9H02
Dell Precision T1500	EMS Client PC	61TPNMI
Canon DR-X10C	Central Count Digital High Speed Scanner	ED300880
Dell Optiplex 9010	Central Count All-in-One PC	6271RW1
iButton (SHA-1) with USB Reader/Writer	Maxim	514DFD
RiData CFC-14A	Compact Flash cards	N/A
SanDisk CF Card Reader	Compact Flash Card Reader	0171630

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**3.0 MATERIALS REQUIRED FOR TESTING (Continued)**

**3.3 Test Tools/Materials**

This subsection enumerates any and all test materials needed to perform voter system testing in Table 3-3. The scope of testing determines the quantity of a specific material required.

**Table 3-3 Test Tools/Material**

<b>Test Tool/Material</b>	<b>Quantity</b>
100 lb. Stock Ballot Paper	as required
Sharpie Markers	as required
Printer Thermal Paper Rolls	as required
Ballot Box Security Seals/Iasp Locks	as required

**3.4 Deliverable Materials**

At test conclusion, NTS shall deliver a final report to Dominion Voting Systems and the EAC that includes the following:

- A description of the functional testing results
- ECO analysis results
- TDOP documentation showing changes
- A list of any anomalies discovered during testing on NTS form WH1066, Notice of Anomaly

All supplied equipment and software furnished to NTS for this modification shall be returned to the customer at the conclusion of testing unless otherwise agreed in writing.

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#### **4.0 TEST SPECIFICATIONS**

Modification testing of the DVS 4.14-A.1 will be performed on the configuration submitted in the EAC application DVS1401. NTS' qualified personnel will ensure that all certification testing performed on the manufacturer's voting system follows NTS' procedures for testing, and the specific test cases developed for this campaign meet the requirements of the EAC 2005 VVSG and EAC Testing and Certification Program Manual.

All Requests for Interpretation (RIFs) and Notices of Clarification (NOCs) applicable as of the date of this document shall apply to this test campaign unless otherwise noted.

##### **4.1 Requirements (Strategy of Evaluation)**

NTS personnel shall maintain a test log of the procedure(s) employed. This log identifies the system and equipment by model and serial number. In the event that the project engineer deems it necessary to deviate from NTS Test Cases or NTS Operating Procedures (OP) pertaining to the test environment, the equipment arrangement and method of operation, the specified test procedure, or the provision of test instrumentation and facilities shall be recorded in the test log. A discussion of the reasons for the deviation and the effect of the deviation on the validity of the test procedure shall also be completed by the Project Engineer and Program Manager.

NTS personnel utilize an internal issue tracking system in order to capture and track all issues and discrepancies found during the testing campaign. This allows for all issues and discrepancies to be monitored for reoccurrence, tracks the root cause analysis, and provides a resolution status. NTS personnel shall verify all items logged into the bug tracking system are resolved prior to the completion of testing and before any recommendation may be made for certification.

The specific NTS OPs to be used during testing include the following:

OP 1 Operations Status Checks	OP 25 Physical Configuration Audit
OP 2 Receipt Inspection	OP 26 Functional Requirements
OP 3 Technical Data Package Review	OP 30 System Integration Test
OP 4 Test Plan Preparation ( <i>This document</i> )	OP 34 Test Report
OP 7 Trusted Build	

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**4.0 TEST SPECIFICATIONS (Continued)**

**4.2 Hardware Configuration and Design**

The Dominion Voting Systems Democracy Suite is a paper-based optical scan voting system. The Democracy Suite system consists of four major components: the EMS, ICE precinct scanner and ballot marking device, ICP precinct scanner, and ICC central count scanner. The Democracy Suite is comprised of two proprietary pieces of hardware (ICE and ICP) and one piece of COTS hardware (ICC). All EMS functions are handled by proprietary software running on COTS PC/laptops/servers.

The hardware modifications submitted for this test campaign include the addition of a hardware RAID controller for the EMS computing environment, and the addition of a hardware bracket to the ICE service switch housing. NTS performed an engineering analysis of the Dominion documents, as well as a visual inspection of the changes, and determined the changes to be “Minor Modifications” with some testing required to confirm that these changes did not affect the system’s functional operation. This will be accomplished by performing a System Integration test to confirm that the RAID controller does not negatively impact the functionality of the EMS.

**4.3 Software System Functions**

The modifications shall be tested using targeted functional tests designed to verify specific changes made to the voting system. Operational status checks will be performed before and after each test to confirm system readiness.

**4.4 Source Code Review**

The strategy for evaluating Dominion Democracy Suite 4.14-A.1 will be based on the previously identified modification to the system. There are no source code changes claimed from the Democracy Suite 4.14A to the Democracy Suite 4.14-A.1. A comparison will be completed by NTS qualified personnel to verify no changes to the source code and the only changes are within the build documentation. All prior source code reviews were reviewed to the EAC 2005 VVSG coding standards and the manufacturer supplied coding standards (Dominion Voting C C++ Coding Standard).

The next step in the source code review will be to create a “Trusted Build” from the approved source code.

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**4.0 TEST SPECIFICATIONS (Continued)**

**4.4 Source Code Review (Continued)**

Trusted Build Process

- Clean the build machine of existing software
- Retrieve the compliant source code
- Construct the build environment
- Create digital signatures of the build environment
- Load the compliant source code into the build environment
- Create a digital signature of the pre build environment
- Create a disk image of the pre-build environment
- Build executable code
- Create a digital signature of executable code
- Create a disk image of the post-build environment
- Build installation media
- Create a digital signature of the installation media
- Install executable code onto the system and validate the software/firmware
- Deliver source code with digital signature, disk image of pre-build environment with digital signatures, disk image of post-build environment with digital signatures, executable code with digital signatures, and installation media with signatures to the EAC Approved Repository.

The “Trusted Build” for the Dominion Democracy Suite 4.14-A.1 includes source code, data, and script files, in clear text form. The build also includes COTS software on commercially available media, COTS software downloaded by the VSTL, COTS software verified by SUA1 from the software supplier, and picture and sound files in binary format provided by Dominion Voting Systems. The first step of the process is to clean the hard drives by writing data to every spot on the hard drive, so the drive is cleared of existing data. The appropriate operating system will then be loaded and the applications from the VSTL reviewed source along with the VSTL verified COTS software will be built. The final step is installing the applications on the hardware.

**5.0 TEST DATA**

**5.1 Test Data Recording**

All equipment utilized for test data recording shall be identified in the test data package. For hardware environmental and operational testing, the equipment shall be listed on the Instrumentation Equipment Sheet for each test. The output test data shall be recorded in an appropriate manner as to allow for data analysis. For source code and TDP reviews, results shall be compiled in output reports and submitted to Dominion Voting Systems for resolution.

Additionally, all test results, including functional test data, will be recorded on the relevant NTS Operating Procedure and Test Cases. Results will also be recorded real-time in engineering log books. Incremental reports will be submitted to Dominion Voting Systems and the EAC at the completion of major test areas to communicate progress and results as deemed necessary by the stakeholders.

**5.0 TEST DATA (Continued)**

**5.2 Test Data Reduction**

Test data shall be processed and recorded in the relevant NTS Operating Procedures and Test Cases. Results will also be recorded real-time in engineering log books.

**6.0 TEST PROCEDURE AND CONDITIONS**

The following subsections describe test procedures and a statement of the criteria by which readiness and successful completion shall be indicated and measured.

**6.1 Facility Requirements**

All testing will be conducted at NTS Huntsville, AL facility unless otherwise annotated.

Unless otherwise specified herein, all remaining tests, including system level functional testing, shall be performed at standard ambient conditions:

- |                         |   |
|-------------------------|---|
| • Temperature:          | 68 to 75 degrees Fahrenheit ( $\pm 4^{\circ}\text{F}$ ) |
| • Relative Humidity:    | 20 to 90%   |
| • Atmospheric Pressure: | Local Site Pressure                                     |

Unless otherwise specified herein, the following tolerances shall be used:

- |               |   |
|---------------|---|
| • Time        | $\pm 5\%$   |
| • Temperature | $\pm 3.6^{\circ}\text{F}$ ( $2^{\circ}\text{C}$ ) |

Deviations to the above tolerances may be submitted by the responsible test laboratory with sufficient engineering information to substantiate the deviation request, but only when best effort technique and system limitations indicate the need for a deviation.

**6.2 Test Set-Up**

All voting machine equipment (hardware and software), shall be received and documented utilizing NTS' Receiving Ticket (WL-218, Nov. '85) and proper QA procedures. When voting system hardware is received, NTS personnel will notify NTS QA personnel. With NTS QA personnel present, each test article will be unpacked and inspected for obvious signs of degradation and/or damage that may have occurred during transit. Noticeable degradation and/or damage, if present, shall be recorded, photographed, and the Dominion Voting Systems' Representative shall be notified. NTS QA personnel shall record the serial numbers and part numbers. Comparison shall be made between those numbers recorded and those listed on the shipper's manifest. Any discrepancies noted shall be brought to the attention of the Dominion Voting Systems' representative for resolution. All TDP and source code modules received will be inventoried and maintained by the NTS Project Engineer assigned to testing.

For test setup, the system will be configured as it would for normal field use. This includes connecting all supporting equipment and peripherals. NTS personnel will properly configure and initialize the system, and verify that it is ready to be tested by following the procedures detailed in the Democracy Suite 4.14-A.1 voting system technical documentation. NTS personnel will develop an Operational Status Check to be performed prior to and immediately following each hardware test. NTS personnel will develop the system performance levels to be measured during operational tests.

NTS personnel have developed six election definitions that shall be used during this test campaign:

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**6.0 TEST PROCEDURE AND CONDITIONS (CONTINUED)**

**6.2 Test Set-Up (Continued)**

**Operational Status Check**

This election definition will be used to verify that the equipment operates properly prior to and immediately following the execution of all tests.

**General Election: GEN-01**

The Gen-01 is a basic election held in four precincts, one of which is a split precinct, containing nineteen contests compiled into four ballot styles. Five of the contests are in all four ballot styles. The other fourteen contests are split between at least two of the precincts with a maximum of four different contests spread across the four precincts. This election was designed to functionally test the handling of multiple ballot styles, support for at least two languages, support for common voting variations, and audio support for at least two languages.

The parameters of this election are listed below:

- Closed Primary: No
- Open Primary: No
- Partisan offices: Yes
- Non-Partisan offices: Yes
- Write-in voting: Yes
- Primary presidential delegation nominations: No
- Ballot Rotation: Yes
- Straight Party voting: Yes
- Cross-party endorsement: No
- Split Precincts: Yes
- Vote for N of M: Yes
- Recall issues, with options: No
- Cumulative voting: No
- Ranked order voting: No
- Provisional or challenged ballots: Yes
- Early Voting: No

In addition to the parameters listed above, the following will also be tested:

- Audio input in an alternative language for basic voting pattern using an ADA device
- Audio input for write-in voting using an ADA device
- Spanish language input for a basic voting pattern
- Input for write-in voting using Spanish language

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**6.0 TEST PROCEDURES AND CONDITIONS (Continued)**

**6.2 Test Set-Up (Continued)**

**General Election: GEN-02**

The Gen-02 is a basic election held in three precincts. This election contains fifteen contests compiled into three ballot styles. Ten of the contests are in all three ballot styles with the other five split across the three precincts. This election was designed to functionally test the handling of multiple ballot styles, support for ballot rotation, support for two languages, support for complex voting variations, and audio support for multiple languages.

The parameters of this election are listed below:

- Closed Primary: No
- Open Primary: No
- Partisan offices: Yes
- Non-Partisan offices: Yes
- Write-in voting: Yes
- Primary presidential delegation nominations: No
- Ballot Rotation: Yes
- Straight Party voting: No
- Cross-party endorsement: No
- Split Precincts: No
- Vote for N of M: Yes
- Recall issues, with options: Yes
- Cumulative voting: No
- Ranked order voting: Yes
- Provisional or challenged ballots: No
- Early Voting: Yes

In addition to the parameters listed above, the following will also be tested:

- Early voting election with at least one unit in all precincts
- Voting options for over-voting
- Voting options for under-voting
- Spanish language ballots
- Audio ballots utilizing ADA capabilities

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**6.0 TEST PROCEDURES AND CONDITIONS (Continued)**

**6.2 Test Set-Up (Continued)**

**General Election: GEN-03**

The Gen-03 is a basic election held in two precincts. This election contains eight contests compiled into two ballot styles. Four of the contests are in both ballot styles. The other four contests are split between the two precincts. This election was 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.

The parameters of this election are listed below:

- Closed Primary: No
- Open Primary: No
- Partisan offices: Yes
- Non-Partisan offices: Yes
- Write-in voting: Yes
- Primary presidential delegation nominations: No
- Ballot Rotation: No
- Straight Party voting: No
- Cross-party endorsement: No
- Split Precincts: No
- Vote for N of M: Yes
- Recall issues, with options: No
- Cumulative voting: No
- Ranked order voting: No
- Provisional or challenged ballots: Yes
- Early Voting: No

In addition to the parameters listed above, the following will also be tested:

- Spanish language ballot with a basic voting pattern and write-in candidates
- Spanish audio input to simulate ADA device with write-in option
- Character based language with basic voting pattern
- Character based language utilizing an ADA option
- Binary input to support ADA option
- Binary input to support ADA audio device

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**6.0 TEST PROCEDURES AND CONDITIONS (Continued)**

**6.2 Test Set-Up (Continued)**

**Primary Election: PRIM-01**

The Prim-01 is a closed primary election in two precincts (one precinct is a split), containing thirty contests compiled into five ballot styles. Each ballot style contains six contests. This election was designed to functionally test an open primary with multiple ballot styles, support for two languages, and support for common voting variations.

The parameters of this election are listed below:

- Closed Primary: Yes
- Open Primary: No
- Partisan offices: Yes
- Non-Partisan offices: Yes
- Write-in voting: Yes
- Primary presidential delegation nominations: No
- Ballot Rotation: No
- Straight Party voting: No
- Cross-party endorsement: No
- Split Precincts: Yes
- Vote for N of M: Yes
- Recall issues, with options: No
- Cumulative voting: No
- Ranked order voting: No
- Provisional or challenged ballots: Yes
- Early Voting: No

In addition to the parameters listed above, the following will also be tested:

- Alternative language utilized with a write-in option
- ADA audio device utilized with a write-in option

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**6.0 TEST PROCEDURES AND CONDITIONS (Continued)**

**6.2 Test Set-Up (Continued)**

**Primary Election: PRIM-03**

The Prim-03 is a basic election held in two precincts. This election contains ten contests and is compiled into two ballot styles. Two of the contests are in both ballot styles. The other eight contests are split between the two party ballots. This election was 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.

The parameters of this election are listed below:

- Closed Primary: Yes
- Open Primary: No
- Partisan offices: Yes
- Non-Partisan offices: Yes
- Write-in voting: Yes
- Primary presidential delegation nominations: No
- Ballot Rotation: No
- Straight Party voting: No
- Cross-party endorsement: No
- Split Precincts: No
- Vote for N of M: Yes
- Recall issues, with options: No
- Cumulative voting: No
- Ranked order voting: No
- Provisional or challenged ballots: Yes
- Early Voting: No

In addition to the parameters listed above, the following will also be tested:

- Spanish ballot with basic voting pattern and write-in option
- Spanish language ballot using ADA audio device with write-n option
- Character based language ballot with basic voting pattern
- Character based language utilizing ADA device
- Binary input to support ADA option
- Binary input to support ADA audio device

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## **6.0 TEST PROCEDURES AND CONDITIONS (Continued)**

### **6.3 Test Sequence**

The components of the Democracy Suite 4.14-A.1 voting system will undergo testing to verify that the modification performs as described by Dominion Voting Systems and meets the requirements of the 2005 VVSG. The following sections provide a list of each test and a brief description of each test. NTS personnel will utilize a combination of functional testing and TDP reviews to evaluate the system performance. (The tests are not in a specific sequence.)

#### **6.3.1 Hardware Test Descriptions**

All of the hardware tests have been previously performed during prior VSTL test campaigns.

#### **6.3.2 Software Test Descriptions**

The software tests include the following:

COTS Source Code Review – Unmodified, general purpose COTS non-voting software (e.g., operating systems, programming language compilers, database management systems, and web browsers) is not subject to the detailed examinations specified in this section; however, NTS personnel will examine such software to ensure that the specific version of software being used is identical to the design specification in order to confirm that the software has not been modified. NTS will verify by downloading the software directly from the manufacturer site, verifying against NRSI, or by being provided original OEM discs.

If there is COTS generated software source code, NTS qualified personnel will inspect the COTS generated software source code in preparation of test plans and to provide some minimal scanning or sampling to check for embedded code or unauthorized changes. For purposes of code analysis, the COTS units shall be treated as unexpanded macros. These will be identified in the Test Report.

The portions of COTS software that have been modified by the manufacturer in any manner are subject to review. Source code generated by a COTS package and embedded in software modules for compilation or interpretation will be provided in human readable form to NTS personnel to enable review.

Trusted Build – The trusted build is a process of converting the reviewed source code into machine-readable binary instructions for a computer. This test will follow Section 5.6 of the EAC Testing and Certification Program manual.

#### **6.3.3 System Testing**

TDP Review – The technical data package must be submitted as a precondition of national certification testing. These items are necessary to define the product and its method of operation; to provide technical and test data supporting the manufacturer's claims of the system's functional capabilities and performance levels; and to document instructions and procedures governing system operation and field maintenance. Any information relevant to the system evaluation shall be submitted to include source code, object code, and sample output report formats.

## **6.0 TEST PROCEDURES AND CONDITIONS (Continued)**

### **6.3.3 System Testing (Continued)**

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

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

The components of the Dominion Voting Systems' Version 4.14-A.1 shall only undergo the tests described in Table 6-1.

**Table 6-1 Dominion Voting Systems version 4.14-A.1 Test Sequence**

<b>Test</b>	<b>Procedure/Description</b>	<b>Specimen</b>
Technical Data Package (TDP) Review	Documentation review for compliance, correctness, and completeness	TDP package submitted for Democracy Suite 4.14-A.1
Physical Configuration Audit	Audit hardware and software models and versions	System hardware and test artifacts submitted for Democracy Suite 4.14-A.1
Functional Tests	Functional testing to the system documentation and EAC 2005 VVSG requirements	System hardware and test artifacts submitted for Democracy Suite 4.14-A.1
System Integration	System testing to test the integrated operation of both hardware and software.	System hardware and test artifacts submitted for Democracy Suite 4.14-A.1

## **7.0 TEST OPERATIONS PROCEDURES**

### **7.1 Proprietary Data**

All proprietary data that is marked will be distributed only to those persons that the manufacturer or EAC identifies as needing the information to conduct qualification testing. The manufacturer is required to mark all proprietary documents as such. All organizations and individuals receiving proprietary documents will ensure those documents are not available to non-authorized persons.

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**APPENDIX A**

**CHANGE NOTES**

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Item Number	Module Affected	Version Number	Modification
1	EMS	4.14.2301	Added new level of code security by implementing code obfuscation during the build process.
2	ICE	410A	I&CQ 100216 - Introduced optional switch shield to protect the unit's on/off switch from tampering.
3	ICE	4.14.10A1	Added translation files to support ten languages by removing static file references in SVG files and updating software package to include language resources, as well as updating the application and root file system versions.
4	EMS	4.14.2301	Specified use of a hardware RAID controller.

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**APPENDIX B**  
**TESTING TO REFLECT ADDITIONAL CAPABILITIES**

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#### **1.0 Introduction**

The Voluntary Voting System Guidelines (VVSG) allows for vendors to provide additional system capabilities in order to respond to the requirements of individual states. The scope of testing for these additional capabilities is defined by the vendor rather than the Election Assistance Commission's 2005 Voluntary Voting System Guidelines.

#### **2.0 Scope of Testing**

The scope of the additional capabilities of the Democracy Suite 4.14-A.1 system includes the source code obfuscation of the Adjudication application. The purpose is to conceal the code's purpose in order to prevent tampering and reverse engineering.

Like the source code obfuscation performed on the EMS application, there are no source code changes claimed for **Adjudication 1.0.14.17603\_Source\_20130523**. NTS qualified personnel will confirm this by performing a source code comparison. Afterwards, a Trusted Build will be performed using the updated documentation.

The scope of testing for Adjudication testing includes a subset of the tests previously conducted as part of the Democracy Suite 4.14-A test campaign. The intended purpose of the functional testing is to confirm the application does not encounter any unexpected events, loss of data or changes in functionality.

#### **3.0 Deliverables**

The VSTL will provide a summary report for state certification authorities detailing the functionality tested, along with the functions not tested. Additionally, any functional issues identified during testing will be logged and identified in the letter. However, Dominion Voting Systems will be responsible for determining if the issues are resolved prior to releasing the application. Alternatively, Dominion Voting Systems may choose to correct these issues and have the additional capabilities re-tested.

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**APPENDIX C**

**TESTING TO REFLECT ADDITIONAL CAPABILITIES**

## **1.0 Introduction**

The Voluntary Voting System Guidelines (VVSG) provides guidelines for vendors to include additional system capabilities in order to respond to the requirements of individual states. The scope of testing for these capabilities is defined by the vendor.

## **2.0 Scope of Testing**

The scope of testing for the Democracy Suite 4.14-A.1 System's additional capabilities included a Source Code Review, Trusted Build, and Functional Verification of the EMS Adjudication client application. The purpose of the source code obfuscation is to conceal the code's purpose in order to prevent tampering and reverse engineering.

## **3.0 Test Procedures and Results**

### **3.1 Source Code Review**

The Source Code Review for the Adjudication application was conducted in accordance with the 2005 VVSG requirements, and included verifying the previously-reviewed Adjudication 1.0.14.17603\_Source\_20130523 was not altered prior to obfuscation. This was accomplished by creating a SHA256 hash value for the source code submitted and verifying the hash values matched those for the baseline source code.

The Source Code Review for Adjudication 1.0.14.17603\_Source\_20130523 included the following verification:

- Selection of programming languages
- Software integrity
- Software modularity and programming
- Control constructs
- Naming conventions
- Coding conventions
- Comment conventions

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### **3.2 Trusted Build**

NTS qualified personnel performed a Trusted Build for the obfuscated Adjudication application in accordance with all EAC 2005 VVSG requirements. The Trusted Build of the Adjudication client software was completed using Dominion's Trusted Build documentation. The builds were performed according to the following steps:

- Clear hard drive of existing data
- Retrieve the compliant source code
- Retrieve the installation media for OS, compilers, and build software
- Construct the build environment
- Create digital signatures of the pre-source build environment
- Create a disk image of the pre-source build environment
- Load the compliant source code into the build environment
- Create a digital signature of the post-source build environment
- Create a disk image of the post-source build environment
- Build the executable code
- Create the installation media
- Create a digital signature of the final build environment
- Create a disk image of the final build environment
- Create a digital signature of the installation media
- Install executable code onto the hardware and validate the software/firmware
- Deliver source code with digital signature, disk image of pre-build environment with digital signatures, disk image of post-build environment with digital signatures, executable code with digital signatures, and installation media to the EAC Repository.

The Trusted Build for the Dominion Democracy Suite 4.14-A.1 included source code, data, and script files in clear text form. Additionally, Dominion Voting Systems provided commercially available media and download links for the required COTS software. NTS Huntsville verified all COTS software by generating and verifying hash values from each software supplier. Prior to performing the build, a commercially-available software tool was used to clear each sector of the disk drive of any existing data. Afterwards, the designated Operating System was loaded and the application was built using the previously-verified source code and COTS software. The final step in the process included verifying the functionality by installing the application and executing the tests described in the following section.

The Trusted Build process was successfully completed for **Adjudication 1.0.14.17603 Obfuscation**.

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### **3.3    Functionality Testing**

The purpose of functional testing was to confirm the application did not encounter any unexpected events, loss of data or changes in functionality.

The Functionality Testing for the Adjudication application included verifying the functions listed below.

- Installation and Uninstallation of the EMS Adjudication client application
- Adding/Deleting application user accounts
- Transmitting election results from the Central Count server
- Removing a contest from adjudication
- Adding/Removing Write-ins
- Submitting a batch to tally
- Removing a batch from tally
- Reopening a ballot
- Producing reports
- General navigation throughout the application ensuring high-level error conditions are met

### **4.0    Technical Data Package Review**

The following document submitted for Adjudication was confirmed to comply with the EAC 2005 VVSG requirements. The procedures contained in the Adjudication build document were followed to successfully perform a Trusted Build of the application.

<b>Democracy Suite 4.14- A.1 Adjudication Documents</b>	<b>Version</b>	<b>Date</b>	<b>Document Number</b>
Build Adjudication_4 14_v0 10	0.10	4/7/14	N/A

**<END OF TEST REPORT>**

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