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# As-Run Test Plan for EAC 2005 VVSG Certification Testing to be Performed on Election Systems & Software Voting System 5.2.1.1

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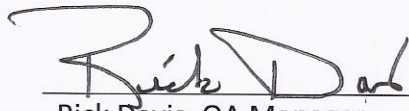
**VSTL**

EAC Lab Code 0704

## SIGNATURES

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**REVISIONS**

<b>Revision</b>	<b>Reason for Revision</b>	<b>Date</b>
NR	Initial Release	05/11/2016
A	Updated based on EAC comments	06/03/2016
B	Updated based on additional EAC comments	06/08/2016
C	Added the OKI B431d to the manufacturer submitted hardware	06/24/2016
D	Updated based on the EAC comments on the test report	07/11/2016
E	Corrected a typo in section 1.1.3	07/12/2016

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## 1.0 INTRODUCTION

Election Systems & Software (ES&S), herein referred to as manufacturer, submitted the Election Systems & Software Voting System 5.2.1.1 (EVS 5.2.1.1) to the Election Assistance Commission (EAC), for certification testing to the 2005 Voluntary Voting System Guidelines Standards (2005 VVSG). EVS 5.2.1.1 is a modification to the previously 2005 VVSG certified EVS 5.2.1.0 voting system (Certification number: ESSEVS5210), and as such, will be tested by National Technical Systems Huntsville (NTS Huntsville) based on the “modified system” requirements set forth in section 4.6.2.3 of the EAC Testing and Certification Program Manual, Version 2.0, herein referred to as the Program Manual. This National Certification Test Plan, hereafter referred to as the Test Plan, documents the process and test methods that will be used to validate 2005 VVSG compliance of EVS 5.2.1.1.

### 1.1 Description and Overview of EAC Certified System Being Modified

The following subsections describe the EAC Certified System that is baseline for the submitted modification. All information was derived from the previous Certification Test Report and/or EAC Certificate of Conformance.

#### 1.1.1 Baseline Certified System

EVS 5.2.1.0 is certified by the U.S. Election Assistance Commission to the 2005 Voluntary Voting System Guidelines (Certification number: ESSEVS5210). Tables 1-1 and 1-2 describe the hardware and software/firmware versions submitted for certification testing. For a complete description of the configuration and description of the EVS 5.2.1.0 product, refer to the EVS 5.2.1.0 Test Report located on the EAC’s website at <http://www.eac.gov>.

**Table 1-1. Previously Certified Software**

Software	Software/Firmware Version
<b>Proprietary Software</b>	
Electionware	4.7.1.0
Election Reporting Manager (ERM)	8.12.1.0
Removable Media Services (RMS)	1.4.5.0
Event Log Services (ELS)	1.5.5.0
<b>Proprietary Hardening Scripts</b>	
CreateNewUser	3.0.3.0
NoNetwork	3.0.3.0
PreInstall	3.0.5.1
PostInstall	3.0.3.0
ServerShare	3.0.3.0
<b>COTS Software</b>	
Adobe Acrobat Standard	11
Cerberus FTP	6.0.7.1
Microsoft Server 2008 R2	2008 R2 w/ SP1
Microsoft Windows 7	7 w/ SP1
WSUS Microsoft Windows Offline Update Utility	8.8
Symantec Endpoint Protection	12.1.4
Symantec Endpoint Protection Intelligent Updater	20151006-037-v5i64.exe
Micro Focus RM/COBOL Runtime	12.06

**1.1.1 Baseline Certified System (Continued)**

**Table 1-2. Previously Certified Voting System Equipment**

Component	Hardware Version	Firmware Version
<b>Proprietary Hardware</b>		
ExpressVote Accessible Voting Station	1.0	1.4.1.0
DS200 Precinct Count Scanner	1.2.1, 1.2.3, & 1.3	2.12.1.0
DS850 Central Count Scanner	1.0	2.10.1.0
AutoMARK A100	1.0	1.8.6.0
AutoMARK A200 (SBC 2.0 & SBC 2.5)	1.1	1.8.6.0
AutoMARK A300 (SBC 2.0 & SBC 2.5)	1.3	1.8.6.0
Plastic Ballot Box	1.2 & 1.3	N/A
Metal Ballot Box	1.0, 1.1, & 1.2	N/A
<b>COTS Hardware</b>		
EMS Server – Dell	PowerEdge T710	N/A
EMS Reporting Workstation – Dell	Optiplex 980	N/A
EMS Reporting Laptop – Dell	E6410	N/A
Motorola QR Code Scanner	DS9208	N/A
Delkin USB Flash Drives	512MB, 1, 2, 4, & 8GB	N/A
Delkin Compact Flash	1GB	N/A
DS850 Report Printer	OKI B430dn & B431dn	N/A
DS850 Audit Printer	OKI Microline 420	N/A
Avid Headphones	Avid FV 60	N/A
SanDisk CF Card Reader	018-6305	N/A

**1.1.2 Description of Submitted Modifications**

The changes submitted for this modification are presented in this section.

**Operating System**

- New windows offline updater package for Server 2008 R2 and Windows 7
- New offline anti-virus definition update package
- The PreInstall script was modified to change the following settings:
  - Server 2008 R2 and Windows 7:
    - Change made to allow storage of passwords and credentials for network authentication
    - Added additional Windows OS auditing.
    - Although Remote Desktop Services (RDS) is disabled through the registry the local group policy was modified to disable it as well.
    - Registry change: Removed the Map and Disconnect Network Drive Options

## 1.1.2 Description of Submitted Modifications (Continued)

### Operating System (Continued)

- Windows 7 only:
  - Users who logon with the local administrator account will not see elevation prompts on the secure desktop when opening programs that require administrator privileges.
  - Change made to prevent unsigned executables from being elevated.

### ElectionWare

- The Multi Column function was added to display candidates in a two column view on the ExpressVote screen if there are more candidates than can fit in one column on a single page. When this occurs the ExpressVote will automatically display this data in two columns.
- The user can now validate the 'multi column view' selection in the Accessible Equipment Settings Report which can be verified in the Vote Session Properties section.
- In a prior EAC test campaign, a deficiency was identified where intermittently the tree expansion indicator (+) and equipment list did not function as expected (see section 2.3 for full details) in Electionware. A software change was made to correct the tree view expansion indicator (+) to ensure that it is viewable and to ensure that the Equipment List for each Poll updates correctly.
- When an XML file is generated in the Package module, users will notice that the file name changed from users2.0 XML to users3.0 XML. This change was required to support the new version of Cerberus. No changes were made to the file structure.

### ExpressVote

- A software change was added to support the ability for a poll worker to scan a 128c barcode on the external barcode scanner in addition to manually selecting the ballot style on the touch screen.
- Modification was made to display candidates in either 1 or 2 columns in a particular contest screen based on a multi column configuration flag from Electionware.
- Copyright date updated to 2016.

### Hardware

- Added the Okidata B431d as an additional report print for the DS850.
- ~~Power Supply for ExpressVote was upgraded to be in compliance with Level Efficiency 6.~~<sup>1</sup>

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<sup>1</sup> This modification was removed from the test campaign at the request of ES&S.



### 1.1.3 Initial Assessment

An initial assessment was performed to determine the scope of testing for the submitted modification. The results of this assessment are presented in six categories: hardware, functional, software, security, accessibility, and technical data package (TDP).

#### Hardware Assessment:

Based on the assessment of submitted hardware change, NTS determined that no hardware testing will be required. The only difference between the previously certified Okidata B431dn and the submitted Okidata B431d is the removal of the network card. The Okidata B431d will be included in all DS850 functional and system integration test.

#### Functional Assessment:

Based on the assessment of submitted changes, NTS determined that a limited Functional Configuration Audit will be required to verify that the voting system continues to meet 2005 VVSG requirements. "Limited" in this instance refers to only functional changes made in this modification (new features, changes to functions, etc.) or functions that have not changed but may be impacted by the modification or changes. In addition, the voting system will be subjected to a system integration test, defined in section 4.5.4, to ensure all components interact properly and to verify that the changes to the voting system do not introduce any nonconformities or instabilities.

#### Software Assessment:

All added or modified Lines of Code (LOC) will require a source code review to ensure the 2005 VVSG requirements are met and that changes to the software do not introduce any new functions or features. In determining the extent of the required source code review, the submitted source code for EVS 5.2.1.1 was compared to the EAC certified EVS 5.2.1.0 source code. Table 1-3 provides the software comparison results. Only the products listed in Table 1-3 were modified.

**Table 1-3. Software Comparison Results**

Product	Baseline	New Version	Lines of Code Changed	
			Files	Lines
Electionware	4.7.1.0	4.7.1.2	144	3,584
ExpressVote	1.4.1.0	1.4.1.1	20	1,190
<b>Totals</b>			<b>164</b>	<b>4,774</b>

#### Security Assessment:

A security assessment will be required to verify that the changes to the local policy for Windows Server 2008 R2 and Windows 7 are correctly implemented and conform to the documented security checklists (or benchmarks) provided by ES&S. In addition, a windows security patch level assessment will be performed to ensure that any critical security patch that is exploitable locally, meaning without the requirement of external public communications, has been patched.

### 1.1.3 Initial Assessment (Continued)

#### Accessibility Assessment:

Due to the new two column enhancement for ExpressVote, NTS has determined that accessibility testing will be required. NTS will verify that the voter is able to navigate the ballot using all of the accessibility features provided by the ExpressVote.

#### TDP Assessment:

The submitted TDP is constructed with the certified EVS 5.2.1.0 TDP and the EVS 5.2.1.1 changes to the certified documents. NTS Huntsville personnel determined that the following documents are impacted by this modification:

- EVS 5211\_C\_D\_0100\_SysOvr
- EVS 5211\_C\_L\_RequirementsMatrix
- EVS5211\_C\_D\_0200\_SFD
- EVS 5211\_CM\_BP\_1011\_EMSBuildProcedureTrustedBuild1
- EVS 5211\_D\_SDS00\_ElectionWare04\_PostgreSQL Table and Field Descriptions
- EVS 5211\_DOC\_D\_1200\_ChangeNotes
- EVS5211\_CM\_SPC00\_SysSecuritySpec
- ExpressVoteHW\_M\_SPC\_0310\_SPC\_HWSpec
- EVS5211\_DOC\_SOP\_EW04Deliver
- EVS5211\_DOC\_SOP\_ExpressVote
- ESSSYS\_CM\_P\_1000\_CMProgram
- BPG\_2'3\_SOP
- EVS5211\_CM\_SPC02\_SecScriptDesc
- EVS5211\_DOC\_APPX\_ExpressVote

A review of these documents shall ensure that all EVS 5.2.1.1 changes are properly documented and compliant with 2005 VVSG.

### 1.1.4 Regression Test

Regression testing shall be conducted on the Electionware and ExpressVote to establish assurance that the modifications have no adverse impact on the compliance, integrity, or performance of the system as outlined in the 2005 VVSG.

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## 1.2 References

- 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 2.0, expiration date June 30, 2018
- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 2.0, expiration date June 30, 2018
- National Voluntary Laboratory Accreditation Program NIST Handbook 150, 2006 Edition, "NVLAP Procedures and General Requirements (NIST Handbook 150)," dated February 2006
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, "Voting System Testing (NIST Handbook 150-22)," dated May 2008
- United States 107th Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Test Guidelines Documents: EMI-001A, "Test Guidelines for Performing Electromagnetic Interference (EMI) Testing," and EMI-002A, "Test Procedure for Testing and Documentation of Radiated and Conducted Emissions Performed on Commercial Products"
- NTS Quality Assurance Program Manual, Revision 8
- ANSI/ISO/IEC 17025:2005 and ANSI/NCSL Z540.3, "Calibration Laboratories and Measuring and Test Equipment, General Requirements"
- ISO 10012:2003, "Quality Assurance Requirements for Measuring Equipment"
- EAC Requests for Interpretation (RFI) (listed on [www.eac.gov](http://www.eac.gov))
- EAC Notices of Clarification (NOC) (listed on [www.eac.gov](http://www.eac.gov))
- 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)
- NTS Test Report No. T71379.01-01 Rev B – National Certification Test Report for Certification Testing of the Election Systems & Software EVS 5.2.1.0 Voting System
- ES&S EVS 5.2.0.0 Technical Data Package
- ES&S EVS 5.2.1.1 Technical Data Package

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### 1.3 Terms and Abbreviations

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

**Table 1-4. Terms and Abbreviations**

Term	Abbreviation	Definition
Anomaly	--	Any non-repeatable testing event that is not the expected result or interrupts the test operations.
Americans with Disabilities Act 1990	ADA	ADA is a wide-ranging civil rights law that prohibits, under certain circumstances, discrimination based on disability.
Configuration Management	CM	Systems engineering process for establishing and maintaining consistency of a product's performance, functional and physical attributes with its requirements, design and operational information throughout its life.
Commercial Off-the-Shelf	COTS	Commercial, readily available hardware or software.
Deficiency	--	Any repeatable test result that was not the expected result or violates a requirement of the VVSG.
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.
ES&S Event Log Service	ELS	ES&S Event Log Service is a Windows Service that runs in the background of any active ES&S Election Management software application to monitor the proper functioning of the Windows Event Viewer.
Election Management System	EMS	Within the EVS 5.2.1.1 voting system, the EMS is comprised of five components: Electionware, ERM, ES&S Event Log Service, VAT Previewer and ExpressVote Previewer.
Election Reporting Manager	ERM	EMS reporting component.
Election Systems and Software	ES&S	Identified manufacturer dotting the equipment under test as part of this test plan.
Engineering Change Order	ECO	--
Equipment Under Test	EUT	Refers to the individual system component or multiple piece of the same component.
ES&S Voting System	EVS	Proprietary equipment owned by ES&S.
Functional Configuration Audit	FCA	Verification of system functions and combination of functions cited in the manufacturer's documentation.
Help America Vote Act	HAVA	Act created by United States Congress in 2002.
Institute of Electrical and Electronics Engineers	IEEE	--
Intelligent Mark Recognition	IMR	Visible light scanning technology to detect completed ballot targets.

### 1.3 Terms and Abbreviations (Continued)

**Table 1-4. Terms and Abbreviations (Continued)**

Term	Abbreviation	Definition
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.
Notice of Clarification	NOC	Provides further guidance and explanation on the requirements and procedures of the EAC's Voting System Certification or Voting System Testing Laboratory programs.
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
Personal Computer	PC	Computer component of the EVS 5.2.1.1 voting system.
Quality Assurance	QA	Administrative and procedural activities implemented as a way of preventing mistakes or defects
Quantity	QTY	Number/Count of items
Quick Response Code	QR Code	Two-dimensional barcode
Request for Interpretation	RFI	A means by which a registered Manufacturer or Voting System Test Laboratory may seek clarification on a specific test requirement.
System Under Test	SUT	Refers to the system as a whole (all components).
Technical Data Package	TDP	Manufacturer documentation related to voting system required to be submitted as a precondition of 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".
Underwriters Laboratories Inc.	UL	Safety consulting and certification company
Uninterruptible Power Supply	UPS	Electrical apparatus providing emergency power when an input power source fails.
Voter Assist Terminal	VAT	Electronic ballot marking device component is the ES&S AutoMARK
National Technical Systems, Inc.	NTS	Identified VSTL hosting the testing of the equipment listed in this test plan; facilities located in Huntsville, Alabama.
National Voluntary Laboratory Accreditation Program	NVLAP	Program which provides an unbiased third-party test and evaluation program to accredit laboratories in the respective fields to ISO 17025 standard.
NTS Operating Procedure	OP	NTS Test Method or Test Procedure

### 1.3 Terms and Abbreviations (Continued)

**Table 1-4. Terms and Abbreviations (Continued)**

<b>Term</b>	<b>Abbreviation</b>	<b>Definition</b>
Virtual Review Tool	VRT	Test campaign management software used by the EAC.
Voting System Test Laboratory	VSTL	---
Voluntary Voting System Guidelines	VVSG	---

### 1.4 Project Schedule

The project schedule for the test campaign is in Appendix C – Project Schedule.

### 1.5 Scope of Test

The scope of testing is limited to the modifications to the previously certified EVS 5.2.1.0 voting system.

#### 1.5.1 Block Diagram

Figure 1-1 provides a visual system overview of the submitted voting system.

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### 1.5.2 System Limits

System limitations remain unchanged for all previously certified components of the EVS 5.2.1.0 voting system.

### 1.5.3 Supported Languages

The submitted voting system supports English, Spanish, Chinese, Korean, Japanese, and Bengali.

### 1.5.4 Supported Functionality

Table 1-5 list the functionality supported by the submitted voting system.

**Table 1-5. Supported Functionality**

Functionality	Description
Election Data Management	Managing election data supports all tasks related to the creation of the election database, precinct, office, and candidate information required to configure a jurisdiction’s elections. Once an election database exists, Electionware can recall the same data for any following election. Event log management includes a series of programs that track user and equipment actions throughout the election process
Ballot Formatting and Printing	Ballot formatting and printing includes activities required for defining the image of a paper ballot, populating that ballot with information imported from the election database, and printing the ballot with ballot style code.
Voting Equipment Configuration	Configuring voting equipment converts election database information into ballot definition parameters for ES&S voting equipment. Within this functional subsystem, software users transfer the election rules specific to an election to the memory devices used to program voting equipment.
Voting and Tabulation	Voting and tabulation includes the following: <ul style="list-style-type: none"> <li>• Accessible ballot marking includes all tasks related to preparing, testing and implementing assistive voting devices for use in a polling place environment.</li> <li>• All tasks related to preparing, testing and implementing universal voting devices for use in a polling place environment with the option of precinct vote summary card tabulation.</li> <li>• Precinct ballot tabulation covers the activities required to prepare, test and scan official ballots and/or vote summary cards at a precinct location.</li> <li>• Central ballot tabulation includes all tasks required to prepare, test and scan official ballots and/or vote summary cards at a central count location.</li> </ul>
Results Consolidation and Reporting	Results consolidation and reporting encompasses the functions necessary to gather and combine results from ballot scanners and use that data to generate paper and electronic reports for election workers, candidates and the media.

## 2.0 PRE-CERTIFICATION TESTING AND ISSUES

This section describes testing performed by either VSTL or the manufacturer prior to submitting the voting system to the EAC.



### 2.1 Evaluation of Prior VSTL Testing

No prior VSTL testing was submitted for re-use consideration.

### 2.2 Evaluation of Prior Non-VSTL Testing

No Non-VSTL testing was submitted for re-use consideration.

### 2.3 Known Field Issues

The EVS 5.2.0.0 voting system has two identified field issues.

- The RSA Crypto suite used by Electionware to generate RSA keys will sometimes create a key that is too short. This causes a key mismatch issue when loading the keys into ExpressVote. The issue was corrected in EVS 5.2.0.3 and the change was incorporated in this release.
- In Electionware, intermittently the tree view indicator is not visible. In addition, sometimes list items, such as created media, do not appear or update in the list. These issues were corrected in this release.

## 3.0 MATERIAL REQUIRED FOR TESTING

The following sections list the materials required to be delivered to facilitate testing of the submitted system.

### 3.1 Software

Proprietary software and COTS identified in Table 3-1 will be provided by the manufacturer as part of this test campaign.

**Table 3-1. Required Voting System Software**

Software	Software/Firmware Version
<b>Proprietary Software</b>	
Electionware	4.7.1.2
Election Reporting Manager (ERM)	8.12.1.0
Removable Media Service (RMS)	1.4.5.0
ES&S Event Log Service (ELS)	1.5.5.0
<b>Proprietary Hardening Scripts</b>	
CreateNewUser	3.0.3.0
NoNetwork	3.0.3.0
PreInstall	3.0.5.5
PostInstall	3.0.3.0
ServerShare	3.0.3.0
<b>COTS Software</b>	
Adobe Acrobat Standard	11
Cerberus FTP	8.0.0.9
Microsoft Server 2008	R2 w/ SP1
Microsoft Windows 7	7 w/ SP1
Symantec Endpoint Protection	12.1.6

### 3.1 Software (Continued)

**Table 3-1. Required Voting System Software (Continued)**

COTS Software	
Symantec Endpoint Protection Intelligent Updater	20160320-034-v5i64.exe
WSUS Microsoft Windows Offline Update Utility	10.6.1
WSUS Microsoft Patch	Windows 6.1 - KB3018238X64.msu
Micro Focus RM/COBOL Runtime	12.06

### 3.2 Hardware

Proprietary equipment and COTS identified in Table 3-2 will be provided by the manufacturer as part of this test campaign.

**Table 3-2. Required Voting System Equipment**

Component	Hardware Version	Firmware Version
<b>Proprietary Hardware</b>		
ExpressVote Accessible Voting Station	1.0	1.4.1.1
ExpressVote Rolling Kiosk	1.0	N/A
DS200 Precinct Count Scanner	1.2.1, 1.2.3, & 1.3	2.12.1.0
DS850 Central Count Scanner	1.0	2.10.1.0
AutoMARK A100	1.0	1.8.6.0
AutoMARK A200 (SBC 2.0 & SBC 2.5)	1.1	1.8.6.0
AutoMARK A300 (SBC 2.0 & SBC 2.5)	1.3	1.8.6.0
Plastic Ballot Box	1.2 & 1.3	N/A
Metal Ballot Box	1.0, 1.1, & 1.2	N/A
<b>COTS Hardware</b>		
EMS Server – Dell	PowerEdge T710	N/A
EMS Reporting Workstation – Dell	Optiplex 980	N/A
EMS Reporting Laptop – Dell	E6410	N/A
Zebra QR Code Scanner	DS457-SR20009	N/A
Delkin USB Flash Drives	512MB, 1, 2, 4, & 8GB	N/A
Delkin Compact Flash	1GB	N/A
DS850 Report Printer	OKI B430dn, B431dn, and B431d	N/A
DS850 Audit Printer	OKI Microline 420	N/A
Avid Headphones	Avid FV 60	N/A
SanDisk CF Card Reader	018-6305	N/A
Delkin CF Card Reader	6381	N/A

### 3.3 Test Materials

Test Materials Table 3-3 describes the test materials required to execute testing. Test materials may not be fully tested during the campaign, but are used to support the tests conducted during the campaign.

### 3.3 Test Materials (Continued)

**Table 3-3. Required Test Materials**

Test Material	Quantity	Make	Model
Ballot on Demand Printer	1	OKI Data	C9650
ES&S Pens	20	BIC	Grip Roller
Ethernet Switch	1	Dell	HNC67M1

### 3.4 Deliverables

The materials listed in Table 3-4 are identified by the manufacturer as materials deliverable to the end users.

**Table 3-4. Voting System Deliverables**

Deliverable Material	Version	Description
Electionware	4.7.1.2	EMS
ERM	8.12.1.0	EMS
ES&S Event Log Service	1.5.5.0	EMS
Removable Media Services	1.4.5.0	EMS
ExpressVote	Firmware 1.4.1.1; Hardware 1.0	Accessible Voting Station
ExpressVote Rolling Kiosk	Hardware 1.0	Stand
DS200	Firmware 2.12.1.0; Hardware 1.2.1 or 1.2.3 or 1.3	Precinct Ballot Scanner
AutoMARK A100 or A200 or A300	Firmware 1.8.6.0; Hardware 1.0 or 1.1 or 1.3	Voter Assist Terminal
DS850	Firmware 2.10.1.0; Hardware 1.0	Central Ballot Scanner
OKI Printer	B430dn or B431dn	Laser Report Printer
OKI Printer	Microline 420	Dot Matrix Printer
Headphones	Avid FV 60	Stereo Headphones
EVS 5.2.1.1 Voting System Overview	1.0	TDP Document
EVS 5.2.1.1 System Functionality Description	1.1	TDP Document
ES&S Electionware Volume I: Administrator's Guide	1.0	TDP Document
ES&S Electionware Volume II: Define User's Guide	1.0	TDP Document
ES&S Electionware Volume III: Design User's Guide	1.0	TDP Document
ES&S Electionware Volume IV: Deliver User's Guide	1.0	TDP Document
ES&S Electionware Volume V: Results User's Guide	1.1	TDP Document
Election Reporting Manager User's Guide	1.1	TDP Document
ExpressLink Operator's Guide	1.0	TDP Document

### 3.4 Deliverables (Continued)

**Table 3-4. Voting System Deliverables (Continued)**

<b>Deliverable Material</b>	<b>Version</b>	<b>Description</b>
ExpressVote Operator's Guide	1.0	TDP Document
DS200 Operator's Guide	1.1	TDP Document
DS850 Operator's Guide	1.0	TDP Document
AutoMARK System Operator's Guide	1.0	TDP Document
Voting System Security Specification	1.0	TDP Document
Security Script Description	1.0	TDP Document
EMS Client Workstation Secure Setup & Configuration Guide	1.0	TDP Document
EMS Server Secure Setup & Configuration Guide	1.0	TDP Document
Standalone EMS Workstation Secure Setup & Configuration Guide	1.0	TDP Document
AutoMARK System Security Specification	7	TDP Document

### 3.5 Proprietary Data

All data considered by the manufacturer to be proprietary is marked as such.

## 4.0 TEST DESIGN AND SPECIFICATIONS

NTS Huntsville personnel shall ensure that all certification testing conducted on the manufacturer's voting system follows NTS Huntsville's procedures for testing, the requirements of the 2005 VVSG, and the Program Manual.

### 4.1 Requirements

To evaluate the modification test requirements, each section of the 2005 VVSG was analyzed to determine the applicable tests required. The following subsections detail the results of this analysis.

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#### 4.1.1 Requirements Mapping

The requirements mapping is provided in conjunction with submitted modifications. NTS Huntsville will verify and validate that the manufacturer is in compliance with stated QA and CM plans.

**Table 4-1. Modification Requirements Mapping**

Change ID	Changed Component	Change Description	Impacted 2005 VVSG Requirement
ENH35376	Electionware	This function defaults to display candidates in a two column view on ExpressVote screen if there are more candidates than can fit in one column on a page. When this occurs ExpressVote automatically displays this data in two columns. To ensure a single column view, the user can deselect this checkbox in the Configure module when setting the Accessible Equipment Options; this field is called "Show two columns when the candidates exceed one page".	Vol II Section 6.7
ENH35526	Electionware	The user can validate their Accessible Equipment Options, including the 'multi column view' selection in the Accessible Equipment Settings Report. It can be seen in the Vote Session Properties section of that report; the field is called "Show two columns when the candidates exceed one page".	Vol II Section 6.7
BUG35605	Electionware	The tree view expansion indicator (+) is now viewable and functioning as expected in the Equipment List for each Poll. The Poll List is now viewable and accessible from this screen.	Vol II Section 6.7
BUG35631	Electionware	When an XML file is generated in the Package module, users will notice a file name change from 2.0 XML to 3.0 XML	Vol II Section 6.7
ENH35374	ExpressVote	Display candidates in either 1 or 2 columns in a particular contest screen based on a configuration flag from Electionware.	Vol I Section 3.2.2.2 Vol II Section 6.7
ENH35495	ExpressVote	Support the ability for a poll worker to scan a 128c barcode on the external barcode scanner instead of manually selecting the ballot style on the touch screen	Vol II Section 6.7
ENH35612	ExpressVote	Update copyright date (code and splash screen).	Vol II Section 6.7

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#### 4.1.2 Rationale for Excluded Requirements

NTS Huntsville determined all requirements excluded from the previous test campaign were not applicable to the submitted modifications listed in Section 1.1.2 based on one or more of the following criteria:

- The submitted modification will not impact the specific requirement.
- It was previously determined that the specific requirement was not applicable to the baseline system.
- A NOC or RFI made the specific requirement not applicable.

#### 4.1.3 NOCs

Applicable NOCs released by the EAC as of the date of the Test Plan are listed in Table 4-2.

**Table 4-2. Applicable NOCs**

NOC ID	Name
2016-02	Trusted Build
2016-01	Test Readiness Review

#### 4.1.4 RFIs

Applicable RFIs released by the EAC as of the date of the Test Plan are listed in Table 4-3.

**Table 4-3. Applicable RFIs**

RFI ID	Name
2007-01	EAC Decision on Accessible Design
2007-03	EAC Decision on Summative Usability Testing
2008-03	EAC Decision on OS Configuration
2008-05	EAC Decision on Durability
2008-10	EAC Decision on Electrical Fast Transient
2009-04	EAC Decision on Audit Log Events
2010-02	EAC Decision on Coding Conventions
2010-03	EAC Decision on Database Coding Conventions
2010-04	EAC Decision on Functional Requirements with Respect to Security
2010-05	EAC Decision on Testing of Modifications to a Certified System
2010-07	EAC Decision on Module Length Comments and responses
2010-08	EAC Decision on Calling Sequence
2012-03	EAC Decision on Configuration Management of COTS Products
2012-04	EAC Decision on Software Setup Validation
2013-03	EAC Decision on Timestamps
2013-04	EAC Decision on Usability Testing
2015-05	EAC Decision on Touchscreen Technology

## 4.2 Hardware Configuration and Design

EVS 5.2.1.1 is an electronic voting system consisting of one precinct paper-based voting system, one central count voting system, and a voting system application software package. The paper-based system is comprised of four voter assistance terminals, AutoMark A100, AutoMark A200, AutoMark A300, and ExpressVote. The AutoMark is a ballot marking device that prints the voter's choices on to a ballot that is digitally scanned for tabulation by either the DS200 or the DS850. The ExpressVote produces an independent voter-verifiable paper record that is digitally scanned for tabulation by either the DS200 or the DS850. The voting System Application Software Package, Election Management System (EMS), is an application suite consisting of Electionware, Election Reporting Manager (ERM), Removable Media Service (RMS), ES&S Event Log Service (ELS), ExpressVote Previewer, and VAT Previewer.

## 4.3 Software System Functions

The required software system functions as described in Volume I Section 2.0 remain unchanged for all previously certified components of the EVS 5.2.1.0 voting system.

## 4.4 Test Case Design

Test cases are designed around what the voting system is supposed to do (per the manufacturers design specifications) and what the voting system is required to do (per the guiding standards document). The tests cases used are primarily functional in nature; however, in certain cases, NTS may use non-functional tests. The test designer selects both valid and invalid inputs and determines the correct output without any knowledge of the test object's internal structure. The acceptable range for system performance and the expected results for each test case are derived from the manufacturer's documentation and the 2005 VVSG. All test cases are validated and approved by the project lead or other qualified VSTL personnel, (i.e., VSTL QA Representative).

### 4.4.1 Software Module Test Case Design and Data

NTS Huntsville personnel implements component level testing during the Functional Configuration Audit (FCA) for each component and subcomponent exercising the functionality of each as designed and documented. NTS Huntsville will utilize limited structural-based techniques (white-box testing) mainly in the area of Source Code Review and Security Testing. NTS Huntsville will depend heavily on specification-based techniques (black-box testing) for the individual software components. The most common specification-based techniques applied to the voting system during software testing will be "equivalence partitioning", "boundary value", and "pairwise" testing.

- "Equivalence Partitioning" will be used to evaluate specific software functions and data entry points of the voting system for valid and invalid data during the FCA. For software functions and data entry points, an entry will be made for a valid data requirement and at least one invalid data requirement to test for normal and abnormal conditions.
- "Boundary Value" testing will be used to evaluate specific software functions and data entry points for minimums and maximums during the FCA. For software functions and data entry points, an entry will be made for all minimum and all maximum documented requirements to test for normal and abnormal conditions. This technique will be used for numeric ranges as well as non-numeric ranges.

**4.4.1 Software Module Test Case Design and Data (Continued)**

- “Pairwise” testing is a combinatorial method of software testing that, for each pair of input parameters to a system, tests all possible discrete combinations of those parameters. NTS Huntsville uses combinatorial test design to identify the minimum number of tests needed to get the coverage required to exercise the functionality. Combinatorial test design enables testers to get greater test coverage with fewer tests. Note that "coverage", as used here, is referring to functional combinatorial coverage, not requirements coverage.

**4.4.2 Software Functional Test Case Design and Data**

NTS Huntsville personnel shall perform the specification-based technique used at the functional test case level entitled “Use Case.” The identified actors and their responsibilities are listed in Table 4-4.

**Table 4-4. “Use Case” Identified Roles and Responsibilities**

<b>Role/Actor</b>	<b>Responsibility</b>
Election Administrator	Enters the election definition with translation and audio Maintains EMS users and the election database
Warehouse Technician	Loads the election definition onto the voting equipment Runs diagnostic test and maintains the units
Poll Worker	Sets up and closes down the voting equipment on election-day at the precinct location
Voter	Physically casts the ballot on election-day
ADA Voter	Votes unassisted on election-day with special needs
Election Official	Reports and audits the election result post-election day

“Use Case” is utilized during the FCA with a single pass through each component using only valid data. This pass is considered the “Master Copy” of data to be passed between interfacing points of applications during integration level testing. If a component downstream in the test process needs data from previous processes, the “Master Copy” of data can be used or altered to accelerate the test process. Known tests utilizing the “Master Copy” of data at the integration level are Security and Usability.

**4.4.3 System-level Test Case Design**

System-level testing examines the ability of proprietary software, hardware, and peripherals in addition to the COTS software, hardware, and peripherals to operate as a complete system. NTS Huntsville utilizes test cases designed to ensure that integrated components function as specified by the manufacturer’s documentation and meet the requirements of the 2005 VVSG.

**4.5 Test Specifications**

The following subsections provide a brief description of the testing to be performed.

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#### 4.5.1 Physical Configuration Audit Specifications

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 Huntsville 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.

#### 4.5.2 Functional Configuration Audit Specifications

The functional configuration audit encompasses an examination of manufacturer's tests, and the conduct of additional tests, to verify that the system hardware and software perform all the functions described in the manufacturer's documentation submitted in the TDP. In addition to functioning according to the manufacturer's documentation, tests will be conducted to ensure that requirements of Volume II section 6.7 and all other applicable 2005 VVSG requirements are met. This testing is accomplished through a process called sequencing.

Sequencing is the act of navigating through the user interface to verify that the system performs as described by the manufacturer and does not violate any of the 2005 VVSG requirements. The path that the tester navigates follows the logical flow of accomplishing task required to conduct an election. For example, a task in conducting an election is to add a candidate. The tester will follow the flow of the user interface to add the candidate to a contest. If there are multiple ways to achieve this, then each method will be tested. This process will continue until all tasks for conducting an election are completed. Any paths, or combination of paths, that are determined to be at risk for failure that are outside of the normal flow of the interface will be tested on an individual basis.

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#### **4.5.3 Accessibility Test Specifications**

Accessibility testing addresses the ability of both hardware and software, along with any peripherals and documentation, to assist voters with disabilities in completing the voting process independently and privately. Voting systems will be assessed to the requirements in 2005 VVSG Volume I Section 3.2 and verified to operate consistently with-in vendor specifications and documentation. In addition the manufacturer is required to conduct summative usability tests of accessible voting equipment with blind and visually impaired individuals and individuals lacking fine motor control. The results of this testing will be review by NTS.

#### **4.5.4 System Integration Test Specifications**

The system integration test addresses the integration of both hardware and software, along with any telecommunication capabilities. This includes connecting all supporting equipment and peripherals including ballot boxes, voting booths (regular and accessible), and any physical security equipment such as locks and ties. The testing process utilizes functional testing to execute the operations required to design an election, facilitate voting, and tabulate results.

#### **4.5.5 Security Testing Specifications**

The purpose of security testing is to evaluate the effectiveness of the voting system in detecting, preventing, logging, reporting, and recovering from any security risks identified by simulating attacks on the system. NTS Huntsville personnel have developed internal operating procedures to evaluate the voting system against the security requirements set forth in the 2005 VVSG.

#### **4.5.6 TDP Evaluation Specifications**

NTS Huntsville qualified personnel utilize a TDP Review Matrix which lists every 2005 VVSG requirement pertaining to TDP review. NTS Huntsville will review the modified documents listed in section 1.1.3 and other documents required to execute testing. NTS Huntsville will record the results of the review of each document to the applicable requirements listed in the TDP Review Matrix.

During the TDP review process, each document will be reviewed for completeness, clarity, correctness, and continuity. The review results will be formally reported to manufacturer. If a revised document is received, it will be re-reviewed as discussed in this section. The TDP will be continued to be reviewed during the entire testing process as these documents will be utilized to set up the systems, verify correct operational results and in other tests as needed. At the end of the TDP review process, a Deficiency Report will be issued listing the non-compliant items on a document-by-document basis, if applicable.

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#### **4.5.7 Source Code Review Specifications**

Upon receipt of the source code, a SHA256 hash value will be created for each file. NTS Huntsville will verify that every line of modified source code is compliant to the 2005 VVSG coding requirements. In circumstances where the coding language facilitates the use of automated tools, NTS will develop a process for conducting the source code review with an automated tool. In addition, NTS Huntsville personnel will perform a manual 10% review of all automated source code review to verify that the automated tool was configured properly.

A technical report of all identified violations will be sent to the manufacturer for resolution per review / re-review basis. All revised source code will be checked for compliance until all issues are resolved. All iterative review results shall be included in the final test report.

Unmodified non-voting COTS software (e.g., operating systems, programming language compilers, database management systems, and web browsers) is not subject to the detailed review process specified in this section. However, NTS Huntsville personnel will use one of the following methods to verify that the COTS software has not been modified; independently download an original copy of the COTS software from a 3rd party site, obtain an original OEM disc(s), or receive an original COTS software package sent from the 3rd party manufacturer directly to NTS. Utilizing binary comparison or sha256 hash values the COTS software shall be verified as unmodified.

COTS software that has been modified by the manufacturer in any manner is 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 Huntsville personnel to enable review.

#### **4.6 Source Code Build Process**

NTS Huntsville utilizes two build processes, a compliance build and a trusted build. Compliance builds for all software builds that are not required to be witnessed by the manufacturer. This build process follows the documented procedures of a "Trusted Build" in the Program Manual, with two exceptions: The image products will not be submitted to the EAC, and no manufacturer representative shall be required to be present or on-site for these builds. The "Trusted Build" process is described in section 5.6 of the EAC Program Manual and further clarified in NOC 16-02: Trusted Build.

#### **4.7 System Identification Tools Review**

System Identification tools are defined by the Program Manual as "Tools created by a Manufacturer of voting systems which allow elections officials to verify that the hardware and software of systems purchased are identical to the systems certified by the EAC." Section 2.14 of the Voting System Test Laboratory Manual requires that VSTLs test system identification tools during the test campaign to make sure they function properly and as intended. The manufacturer submitted system identification tools will be review for compliance with the 2005 VVSG Volume I Section 7.4.6 and RFI 2012-04.

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#### **4.8 QA & CM System Review**

The manufacturer submitted QA Plan and CM Plan will be reviewed. The review will be limited to the changes within this modification to determine compliance with 2005 VVSG Volume II Sections 2.11 and 2.12, and Volume I Sections 8 and 9, EAC stated requirements, and with the requirements of the internal manufacturer documentation. In addition, the manufacturer TDP documentation package will be reviewed to determine if the manufacturer's QA Plan and the CM Plan are being followed. The results of the TDP review shall be entered on a spreadsheet as previously described in Section 4.6 of this test plan. The results of the TDP review, including the QA and CM compliance results of the Technical Data Package Review, will be included in the final test report.

### **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 the manufacturer for resolution.

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

#### **5.2 Test Data Criteria**

NTS Huntsville will evaluate all test data against the manufacturer provided TDP and the requirements set forth in the 2005 VVSG. Per the 2005 VVSG, these parameters shall encompass the test tolerances and samples to define the minimum number of combinations or alternatives of input and output conditions that can be exercised to constitute an acceptable test of the parameters involved. The parameters will also include events with criteria defining the maximum number of interrupts, halts, or other system breaks that may occur due to non-test conditions (excluding events from which recovery occurs automatically or where a relevant status message is displayed).

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## 6.0 TEST PROCEDURES AND CONDITIONS

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 0214.40, 0214.41, and 0214.42)
- FCC Approved Contractor Test Site (Part 15, 18)

### 6.1 Test Facilities

All testing will be conducted at the NTS Huntsville, AL facility unless otherwise noted. Environmental non-operating (storage) and operating hardware testing will be conducted utilizing an adequately sized environmental test chamber or dynamic vibration (shaker) system equipped with the required data gathering support equipment. All remaining operating hardware tests will be conducted at the appropriate test site with the required support equipment. All instrumentation, measuring, and test equipment used in the performance of this test program will be listed on the Instrumentation Equipment Sheet for each test and shall be calibrated in accordance with NTS Quality Assurance Program, which complies with the requirements of ANS/ISO/IEC 17025:2005 and ANSI/NCSL Z540.3 and ISO 10012:2003.

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.

Unless otherwise specified herein, all remaining tests, including system level functional testing, shall be performed at standard ambient conditions outlined in Table 6-1.

**Table 6-1. Standard Ambient Conditions**

<b>Event</b>	<b>Ambient Range</b>
Temperature	68 to 75 degrees (°) Fahrenheit (F)
Relative Humidity	Local Site Humidity
Atmospheric Pressure	Local Site Pressure

**6.1 Test Facilities (Continued)**

The following tolerances listed in Table 6-2 shall be used unless otherwise specified herein.

**Table 6-2. Test Tolerances**

Phenomena	Tolerance Allowance
Temperature	± 3.6°F (2°C)
Vibration Amplitude	± 10%
Vibration Frequency	± 2%
Random Vibration Acceleration	20 to 500 Hertz ± 1.5 dB
	500 to 2000 Hertz ± 3.0 dB
Random Overall grms	± 1.5 dB
Acoustic Overall Sound Pressure Level	+4/-2 dB

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 system components (hardware and software), shall be received and documented utilizing NTS Huntsville Receiving Ticket (QP HSV-150, 05/04/15) and proper QA procedures. When voting system hardware is received, each test article is unpacked and inspected for obvious signs of degradation and/or damage during transit. Noticeable degradation and/or damage, if present, will be recorded, photographed, and the manufacturer shall be notified. NTS Huntsville VSTL personnel will notify NTS Huntsville QA personnel that the equipment is ready for receipt inspection. 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 will be brought to the attention of the manufacturer representative for resolution. All TDP and source code modules received are inventoried and maintained by the Project Lead assigned to testing.

For test setup, the system is configured for normal field use. This includes connecting all supporting equipment and peripherals. NTS Huntsville will properly configure and initialize the system, and verify that it is ready to be tested by following the procedures detailed in the voting system TDP.

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### **6.3 Test Sequence and Description**

The components of the voting system will undergo testing to verify that the modification performs as described by the manufacturer and meets the requirements of the 2005 VVSG. The required functional tests are outlined in the subsections below. The sequence will follow the schedule in Appendix C – Project Schedule.

#### **6.3.1 Physical Configuration Audit**

NTS Huntsville will perform a physical configuration audit on the submitted hardware to verify that it is unmodified from the certified EVS 5.2.1.0 hardware.

#### **6.3.2 Functional Configuration Audit**

The FCA for the EVS 5.2.1.1 campaign will include review of modified elements of the Electionware and ExpressVote. The FCA tests will be designed per the specifications in section 4.5.3 of this plan. During the FCA, both normal and abnormal data will be entered into the system to attempt to introduce errors and test for error recovery.

#### **6.3.3 Accessibility Testing**

The accessibility testing for EVS 5.2.1.1 will be limited to ensuring that the new two column feature meets the requirements of Volume I Section 3.2.2.2.

#### **6.3.4 System Integration**

All submitted hardware and software components will be included in the system integration test. A total of three elections will be created to test the voting systems ability to function as an integrated system. The design parameters of each election are included in this section. All elections will include a contest with enough candidates to force the two column enhancement in ExpressVote.

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### 6.3.4 System Integration (Continued)

#### 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



### 6.3.4 System Integration (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:

- ADA audio device utilized with a write-in option

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### 6.3.4 System Integration (Continued)

#### **Primary Election: PRIM-02**

The Prim-02 is a basic election held in two precincts. This election contains thirteen contests compiled into three ballot styles. One contest is in all three ballot styles and all other contests are independent. This election was designed to functionally test the handling of multiple ballot styles, support for Primary presidential delegation nominations, 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: Yes
- 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: Yes
- 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: No
- Early Voting: No

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

- Open primary election with at least one machine in each precinct
- Voting options for over-voting
- Voting options for under-voting
- Voting option for write-ins
- Voting option utilizing ADA audio device

### 6.3.5 Security Testing

The security test is designed and performed to verify compliance with the requirements defined in 2005 VVSG Volume I, Section 7. The range of risks tested is determined by the design of the system and potential exposure to risk. For EVS 5.2.1.1, the security testing will be limited to the following:

- Review of PreInstall Script 3.0.5.5 for the following:
  - Compliance to the submitted security checklists (or benchmarks) for the Windows Server 2008 R2 (Microsoft Secure Configuration Manger v 3.0 – Member Server) and Window 7 (USGCB v. 1.2).
  - Verified to ensure no malicious code is present
- Basic vulnerability scans on the EMS components to verify that the Operating System and Anti-Virus software are up-to-date as of the test execution date and that no locally exploitable vulnerabilities are detected.

### 6.3.6 TDP Review

NTS Huntsville will ensure that all submitted modifications are accurately documented and that the documents adhere to the requirements of the 2005 VVSG. A complete listing of the EVS 5.2.1.1 TDP is located in Appendix B – Technical Data Package.

### 6.3.7 System Identification Tools Review

NTS Huntsville will use the results of the trusted build process to verify that the EVS 5.2.1.1 system identification tools provided for Electionware and ExpressVote function as described by ES&S and meet the requirements of the Program Manual and Volume I Section 7.4.6 of the 2005 VVSG.

### 6.3.8 Source Code Review

The source code review of EVS 5.2.1.1 will be based on the source code changes from EVS 5.2.1.0 to EVS 5.2.1.1.

## 6.4 Test Operations Procedure

These subsections address the procedures that NTS will follow during this modification testing campaign.

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#### **6.4.1 Pass/Fail Criteria**

The PASS/FAIL criteria at the Component Level will be based on the expected result. If the System Under Test (SUT) performs as expected, the test is considered as passed. If the SUT does not perform as expected, the test will be evaluated for tester, test procedure, or test equipment errors. If it is determined there were no tester, test procedure, or test equipment errors, the test will be repeated in an attempt to reproduce the results. If the results cannot be reproduced, the anomaly will be logged and monitored throughout the test campaign and subsequent testing efforts. If the results can be reproduced and the expected results are not met, the SUT will have failed the test. NTS Huntsville personnel will document the error and track the error through resolution.

The PASS/FAIL criterion for System Level testing is whether the system can continue to operate as expected. The System Level test is considered as passed if either 1) no errors are found, or 2) an error is encountered but the system continues to operate and engineering analysis determines that the root cause does not affect system level testing. The system level test is considered failed when an error is encountered and the system is too unstable to continue or engineering analysis determines the root cause could affect further testing. If an error occurs during system level testing, the error shall be documented. If the voting system is able to recover and continue, the test will continue. If the error causes the system to become unstable, the test shall be halted. All errors documented during System Level Testing shall be tracked through resolution.

#### **6.4.2 Anomalies**

NTS Huntsville defines an anomaly as any unexpected result and/or event that deviates from what is standard, normal, or expected in which no root cause has been determined. All anomalies are logged in the NTS issue tracking system (JIRA) and monitored throughout the test campaign and subsequent testing efforts. Anomalies may become deficiencies when a root cause is established.

#### **6.4.3 Deficiencies and Resolutions**

NTS Huntsville defines a deficiency as any repeatable test result or event that is counter to the expected result or violates the specified requirements. The manufacturer will be required to submit a root cause analysis and correct any deficiency before testing can be resumed. Engineering analysis will be performed to determine what effect the resolution has on the component. A determination will be made whether Regression Testing will be sufficient or a complete re-test is necessary. All deficiencies and their resolutions will be documented on the NTS Huntsville Deficiency tracking system (JIRA) and the EAC Virtual Review Tool.

#### **6.4.4 Test Results and Assessment**

NTS Huntsville personnel will test every 2005 VVSG requirement impacted by the submitted modification. NTS Huntsville personnel will report all deficiencies discovered during this test campaign to the manufacturer and the EAC. If NTS Huntsville determines there is not enough data to ensure a requirement was met, the test plan will be altered and further testing will be done.

#### **6.4.5 Terms of NTS Huntsville Recommendation for Certification**

The EAC has the final decision as to whether the system meets all the requirements for an EAC-certified system. NTS Huntsville will recommend approval, if the system meets all applicable sections of the 2005 VVSG. If the system does not meet all applicable sections of the 2005 VVSG, NTS will report that to EAC.

## **APPENDIX A – ADDITIONAL TESTING**

**A.1 Manufacturer Requested Additional Testing**

The following tests will be performed by NTS Huntsville at the request of the manufacturer. These modifications or additions represent functionality or tools that are outside the scope of the certification.

**A.1.2 Election Support Software and Hardware**

The following software and hardware components are used to support the operations of the EMS and ExpressVote:

- ExpressLink – ExpressLink is a Windows PC application that can run in either a standalone mode, or in a monitor mode, where the application monitors requests from a voter registration (VR) system over a shared network folder. The application imports an election definition from Electionware, accepts requests to print a voter’s ExpressVote activation card, determines the voter’s ballot style and then prints the activation card on the ExpressVote Activation Card Printer.
- ExpressVote Activation Card Printer – The ExpressVote Activation Card Printer is a small, thermal, on demand printer used to print the ballot activation code on the ExpressVote activation card.
- Electionware Toolbox – Electionware Toolbox is a set of utilities that can be integrated into the Electionware EMS to enhance the software usability experience and streamline various processes. These add-on utilities are called Test Deck and Text to Speech.
- Ballot Online ExpressPass – Ballot Online is an optional system that allows a user to access their ballot online and make sample ballot selections on any device connected to the Internet. When finished, the output from this system is the ExpressPass – a selection summary with scannable QR code that the user can either print or save in an electronic format on their mobile device. If submitting the vote selections for official tabulation, the user is required to go to the polling place to submit the vote selections on their ExpressPass, following standard voter authentication at the polling place. The voter operates the ExpressVote to scan, review and validate vote selections. The vote summary card may then be submitted for tabulation on an ES&S tabulator: DS200 or DS850.

NTS Huntsville will perform limited testing as requested by the manufacturer. Table A-1 outlines the requested testing.

**Table A-1. Manufacturer Requested Testing Outside of Certification**

Component	Version	Requested Testing
ExpressLink	1.3.0.0	2005 VVSG Source code Compliance, Functional Integration Test
ExpressVote Activation Card Printer	N/A	Functional Integration Test
Electionware Toolbox	2.4.0.0	Functional Integration Test
Ballot Online ExpressPass	N/A	Functional Integration Test

**APPENDIX B – TECHNICAL DATA PACKAGE**

## B.1 Technical Data Package

The documents listed in Table B-1 comprise the EVS 5.2.1.1 Voting System TDP.

**Table B-1. EVS 5.2.1.1 TDP**

<b>EVS 5.2.1.1 TDP Documents</b>	<b>Version</b>	<b>Doc No.</b>	<b>Document Code</b>
<b>System Overview</b>			
Voting System Overview	1.1	01-01	EVS5211_C_D_0100_SysOvr
<b>System Functionality Description</b>			
System Functionality Description	1.1	02-01	EVS5211_C_D_0200_SFD
<b>System Hardware Specification</b>			
AutoMARK System Hardware Overview	8	03-01	AutoMARK_System_Hardware_Overview_AQS-18-5002-000-S
AutoMARK System Hardware Specification	6	03-02	AutoMARK_System Hardware Specification_AQS-18-5000-001-F
System Hardware Specification – DS200 HW Rev 1.2	3.0	03-03	DS200HW_M_SPC_0312_HWSpec
System Hardware Specification – DS200 HW Rev 1.3	4.0	03-04	DS200HW_M_SPC_0313_HWSpec
System Hardware Specification – DS850 HW Rev 1.0	1.2	03-05	DS850HW_M_SPC_0310_HWSpec
System Hardware Specification – ExpressVote HW Rev 1.0	3.4	03-06	ExpressVoteHW_M_SPC_0310_HWSpec
<b>Software Design and Specification</b>			
ES&S Coding Standards	3.0	04-01	ESSSYS_D_P_0400_CodingStandards
ES&S System Development Program	2.0	04-02	ESSSYS_SG_P_0400_SystemDevProgram
Software Design Specifications DS200	1.0	04-03	EVS5211_D_SDS00_DS200
Software Design Specifications DS850	1.0	04-04	EVS5211_D_SDS00_DS850
Software Design Specifications ElectionWare	1.0	04-05	EVS5211_D_SDS00_ElectionWare
Software Design and Specification – ELS	1.0	04-06	EVS5211_D_SDS00_ELS
Software Design and Specification – ERM	1.0	04-07	EVS5211_D_SDS00_ERM
Software Design and Specification – ERM Appendices	1.0	04-08	EVS5211_D_SDS00_ERM01_Appendices
Software Design and Specification – ExpressVote	1.1	04-09	EVS5211_D_SDS00_ExpressVote
AutoMark Software Design and Specifications	--	04-02	01_AutoMARK Software Design and Specification (Folder)
AutoMARK Ballot Image Processing Specifications	6	04-02-01	AutoMARK ESS Ballot Image Processing Specification AQS-18-5002-003-S
AutoMARK Ballot Scanning and Printing Specification	5	04-02-02	AutoMARK ESS Ballot Scanning and Printing Specification AQS-18-5002-007-S
AutoMARK Driver API Specification	5	04-02-03	AutoMARK ESS Driver API Specification AQS-18-5000-002-F
AutoMARK Embedded Database Interface Specifications	5	04-02-04	AutoMARK ESS Embedded Database Interface Specifications AQS-18-5002-005-S
AutoMARK GUI Design Specifications	6	04-02-05	AutoMARK ESS GUI Design Specifications AQS-18-5001-005-R
AutoMARK Operating Software Design Specifications	5	04-02-06	AutoMARK ESS Operating Software Design Specifications AQS-18-5001-002-R
AutoMARK Operations and Diagnostic Log Specifications	5	04-02-07	AutoMARK Operations and Diagnostic Log Specs AQS-18-5002-004-S
AutoMARK Programming Specifications Details	5	04-02-08	AutoMARK ESS Programming Specifications Details AQS-18-5001-011-R
AutoMARK Software Design Specifications	5	04-02-09	AutoMARK ESS Software Design Specs AQS-18-5001-004-S
AutoMARK Software Design Specification Overview	N/A	04-02-10	AutoMARK ESS Software Design Spec Overview



**B.1 Technical Data Package (Continued)**
**Table B-1. EVS 5.2.1.1 TDP (Continued)**

<b>EVS 5.2.1.1 TDP Documents</b>	<b>Version</b>	<b>Doc No.</b>	<b>Document Code</b>
AutoMARK Software Development Environment	5	04-02-11	AutoMARK ESS Software Development Environment AQS-18-5001-006-R
AutoMARK Software Diagnostics Specifications	5	04-02-12	AutoMARK ESS Software Diagnostics Specifications AQS-18-5000-004-F
AutoMARK Software Standards Specification	5	04-02-13	AutoMARK ESS Software Standards Specification AQS-18-4000-000-S
Electionware PostgreSQL Table and Field Descriptions	--	04-03	EVS5211_D_SDS00_ElectionWare04_PostgreSQL Table and Field Descriptions (Folder)
Readme Election_ware_4_7_1_2	--	04-03-01	Election_ware_4_7_1_2
Readme Election_ware_admin_4_7_1_2	--	04-03-02	Election_ware_admin_4_7_1_2
<b>System Test/Verification Specification</b>			
Voting System Test Plan ES&S Voting System 5.2.1.1	1.0	05-01	EVS5211_QA_D_0500_SysTestPlan
Usability Test	--	05-02	Usability Test Reports (folder)
Common Industry Format Usability Test Report – AutoMARK (VAT)	1.0	05-02-01	AMVATHW_P_D_0510_CIFRptAMVAT
CIF Usability Test Report – DS200	1.2.1	05-02-02	DS200HW_P_D_0512_CIFRptDS200
CIF Usability Test Report – ExpressVote	N/A	05-02-03	ExpressVoteHW_P_D_0509_CIFRptExpressVote
<b>System Security Specification</b>			
AutoMARK System Security Specification	7	06-01	AutoMARK ESS System Security Specification AQS-18-5002-001-S
EMS Client Workstation Secure Setup & Configuration Guide	1.0	06-02	ESSSYS_5'2'1'1_SPC_ClientWorkstationSetupConfigGuide
EMS Server Secure Setup & Configuration Guide	1.0	06-03	ESSSYS_5'2'1'1_SPC_EMSServerSetupConfigGuide
Standalone EMS Workstation Secure Setup & Configuration Guide	1.0	06-04	ESSSYS_5'2'1'1_SPCStandaloneWorkstationSetupConfigGuide
System Security Specification	1.0	06-05	EVS5211_CM_SPC00_SysSecuritySpec
Security Script Description	1.0	06-06	EVS5211_CM_SPC02_SecScriptDesc
<b>System Operations Procedure</b>			
ExpressVote Operator's Guide Appendices	1.0	07-01	EVS5211_DOC_APPX_ExpressVote
System Operations Procedures – AutoMARK	1.0	07-02	EVS5211_DOC_SOP_AMVAT
System Operations Procedures – DS200	1.1	07-03	EVS5211_DOC_SOP_DS200
System Operations Procedures – DS850	1.0	07-04	EVS5211_DOC_SOP_DS850
System Operations Procedures – Event Log Service	1.0	07-05	EVS5211_DOC_SOP_ELS
System Operations Procedures – Election Reporting Manager	1.1	07-06	EVS5211_DOC_SOP_ERM
Electionware Administrator's Guide	1.0	07-07	EVS5211_DOC_SOP_EW01Admin
Electionware Define: User's Guide	1.0	07-08	EVS5211_DOC_SOP_EW02Define
Electionware Design: User's Guide	1.0	07-09	EVS5211_DOC_SOP_EW03Design
Electionware Deliver: User's Guide	1.0	07-10	EVS5211_DOC_SOP_EW04Deliver
Electionware Results: User's Guide	1.1	07-11	EVS5211_DOC_SOP_EW05Results
System Operations Procedures – ExpressLink	1.0	07-12	EVS5211_DOC_SOP_ExpressLink
System Operations Procedures – ExpressVote	1.0	07-13	EVS5211_DOC_SOP_ExpressVote

**B.1 Technical Data Package (Continued)**

**Table B-1. EVS 5.2.1.1 TDP (Continued)**

<b>EVS 5.2.1.1 TDP Documents</b>	<b>Version</b>	<b>Doc No.</b>	<b>Document Code</b>
<b><i>System Maintenance Manuals</i></b>			
System Maintenance Manual – ES&S AutoMARK	1.0	08-1	EVS5211_DOC_SMM_AMVAT
System Maintenance Manual – ES&S DS200	1.0	08-2	EVS5211_DOC_SMM_DS200
System Maintenance Manual – ES&S DS850	1.0	08-3	EVS5211_DOC_SMM_DS850
System Maintenance Manual – ES&S ExpressVote	1.0	08-4	EVS5211_DOC_SMM_ExpressVote
<b><i>Personnel Deployment and Training</i></b>			
Personnel Deployment and Training Program	3.0	09-01	ESSSYS_T_D_0900_TrainingProgram
<b><i>Configuration Management Plan</i></b>			
Configuration Management Program	2.1	10-1	ESSSYS_CM_P_1000_CMProgram
Technical Documentation Program	5.0	10-2	ESSSYS_DOC_P_1000_TDProgram
<b><i>QA Program</i></b>			
Manufacturing Quality Assurance Plan	2.0	11-01	ESSSYS_M_P_1100 _MNFQualityAssurancePlan
Software Quality Assurance Program	2.0	11-02	ESSSYS_QA_P_1100 _SoftwareQualityAssuranceProgram
Software/Firmware Acceptance	2.0	11-03	ESSSYS_QA_L_1100 _SoftwareFirmwareAcceptance
Acceptance Checklists	--	11-02	Acceptance Checklists (folder)
ES&S 1.3 Hardware DS200 Acceptance Checklist	A	11-02-01	1 3 Hardware DS200_AcceptChklist_001RevA
DS850 Acceptance Checklist	D	11-02-02	850_AcceptChklist_revD
DS850 Onsite Acceptance Checklist	B	11-02-03	850_OAcceptChklist_revB
AutoMARK VAT Acceptance Checklist	A	11-02-04	AutoMark_AcceptChklist_001Rev.A
AutoMARK QC Checklist	A	11-02-05	AutoMark_QC_Chklist_001Rev.A
ES&S DS200 Acceptance Checklist	D	11-02-06	DS200_AcceptChklist_001RevD
ES&S ExpressVote Acceptance Checklist	B	11-02-07	ExpressVote_AcceptChklist_001Rev B
<b><i>System Change Notes</i></b>			
System Change Notes	1.1	12-01	EVS5211_DOC_D_1200_ChangeNotes
System Change Notes	1.0	12-02	EVS5211_DOC_D_1200_ChangeNotes_QA
<b><i>Other TDP Documents</i></b>			
ES&S Ballot Production Handbook	2.3	13-01	BPG_2'3_SOP

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**APPENDIX C – PROJECT SCHEDULE**

## C.1 - Project Schedule

Table C-1 provides the project schedule based on the estimated time to complete each task.

**Table C-1. Project Schedule**

ID	Task Name	Duration	Start	Finish
<b>1</b>	<b>EAC Application Approval Process</b>	<b>2 days</b>	<b>Mon 5/2/16</b>	<b>Tue 5/3/16</b>
<b>2</b>	<b>TDP</b>	<b>22 days</b>	<b>Mon 5/2/16</b>	<b>Tue 5/31/16</b>
<b>3</b>	<b>Test Plan</b>	<b>40 days</b>	<b>Wed 5/4/16</b>	<b>Tue 6/28/16</b>
4	Test Plan Creation	4 days	Wed 5/4/16	Mon 5/9/16
5	ES&S Review	2 days	Tue 5/10/16	Wed 5/11/16
6	NTS Corrections/Submission	1 day	Thu 5/12/16	Thu 5/12/16
7	EAC Review	20 days	Fri 5/13/16	Thu 6/9/16
8	NTS Test Plan Revision	3 days	Fri 6/10/16	Tue 6/14/16
9	EAC Re-Review	10 days	Wed 6/15/16	Tue 6/28/16
<b>10</b>	<b>Source Code Review</b>	<b>1 day</b>	<b>Wed 5/4/16</b>	<b>Wed 5/4/16</b>
<b>11</b>	<b>Compliance Build</b>	<b>1 day</b>	<b>Thu 5/5/16</b>	<b>Thu 5/5/16</b>
<b>12</b>	<b>Receipt Inspection</b>	<b>1 day</b>	<b>Wed 5/4/16</b>	<b>Wed 5/4/16</b>
<b>13</b>	<b>System Setup</b>	<b>5 days</b>	<b>Fri 5/6/16</b>	<b>Thu 5/12/16</b>
<b>14</b>	<b>Security</b>	<b>4 days</b>	<b>Fri 5/13/16</b>	<b>Wed 5/18/16</b>
<b>15</b>	<b>FCA</b>	<b>10 days</b>	<b>Fri 5/13/16</b>	<b>Thu 5/26/16</b>
<b>16</b>	<b>Accessibility</b>	<b>1 day</b>	<b>Fri 5/13/16</b>	<b>Fri 5/13/16</b>
<b>17</b>	<b>Usability</b>	<b>1 day</b>	<b>Fri 5/13/16</b>	<b>Fri 5/13/16</b>
<b>18</b>	<b>System Integration</b>	<b>10 days</b>	<b>Fri 5/13/16</b>	<b>Thu 5/26/16</b>
<b>19</b>	<b>Hardware Testing</b>	<b>18 days</b>	<b>Fri 5/6/16</b>	<b>Tue 5/31/16</b>
20	Power Disturbance	3 days	Fri 5/6/16	Tue 5/10/16
21	Electromagnetic Radiation	3 days	Wed 5/11/16	Fri 5/13/16
22	Electromagnetic Susceptibility	3 days	Wed 5/18/16	Fri 5/20/16
23	Electrical Fast Transient	2 days	Mon 5/23/16	Tue 5/24/16
24	Lightning Surge	3 days	Wed 5/25/16	Fri 5/27/16
25	Conducted RF Immunity	2 days	Mon 5/30/16	Tue 5/31/16
<b>26</b>	<b>Trusted Builds</b>	<b>3 days</b>	<b>Wed 6/1/16</b>	<b>Fri 6/3/16</b>
<b>27</b>	<b>Test Report</b>	<b>36 days</b>	<b>Wed 6/29/16</b>	<b>Wed 8/17/16</b>
28	Test Report Creation	1 day	Wed 6/29/16	Wed 6/29/16
29	ES&S Review	2 days	Wed 6/29/16	Thu 6/30/16
30	NTS Corrections/Submission	1 day	Fri 7/1/16	Fri 7/1/16
31	EAC Review	20 days	Mon 7/4/16	Fri 7/29/16
32	NTS Test Report Revision	3 days	Mon 8/1/16	Wed 8/3/16
33	EAC Re-Review	10 days	Thu 8/4/16	Wed 8/17/16
<b>34</b>	<b>Job Closeout</b>	<b>1 day</b>	<b>Thu 8/18/16</b>	<b>Thu 8/18/16</b>

**END OF TEST PLAN**