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# Test Plan for EAC 2005 VVSG Certification Testing to be Performed on Election Systems & Software Voting System 5.2.1.0

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Prepared for: **Election Systems & Software, Inc.**  
11208 John Galt Blvd  
Omaha, NE 68137

Prepared by: **National Technical Systems Huntsville**  
7800 Hwy 20 West  
Huntsville, AL 35806



## SIGNATURES

Reviewed by: *Lisa C. Johnson* Date: 10/19/15  
Lisa Johnson, VSTL Quality Manager

Approved by: *James R. Long* Date: 10/19/15  
James Long, Program Manager

Approved by: *Robert Hardy* Date: 10/19/15  
Robert Hardy, Department Manager

Reviewed by: *Bonda Mose* Date: 10/19/15  
~~Bob~~ Rick Davis, QA Manager



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## 1.0 INTRODUCTION

Election Systems & Software (ES&S), herein referred to as manufacturer, submitted the Election Systems & Software Voting System 5.2.1.0 (EVS5210) to the Election Assistance Commission (EAC), for certification testing to the 2005 Voluntary Voting System Guidelines Standards (2005 VVSG). EVS 5.2.1.0 is a modification to the previously 2005 VVSG certified EVS 5.2.0.0 voting system (Certification number: ESSEVS5200), 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 5.2.1.0 and follows the outline in Appendix D of the Program Manual.

### 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 5.2.0.0 is certified by the U.S. Election Assistance Commission to the 2005 Voluntary Voting System Guidelines (Certification number: ESSEVS5200). 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 5.2.0.0 product, refer to the EVS 5.2.0.0 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	4.6.0.0
Election Reporting Manager (ERM)	8.11.0.0
ES&S Event Log Service (ELS)	1.5.5.0
Removable Media Service (RMS)	1.4.5.0
VAT Previewer	1.8.6.0
ExpressVote Previewer	1.4.0.0
<b>COTS Software</b>	
Adobe Acrobat Standard	11
Cerberus FTP	6.0.7.1
Microsoft Server 2008	R2 w/ SP1
Microsoft Windows 7, SP1	5.1 w/ SP1
Microsoft Visual C++ 2008 Redistributable – x64	9.0.30729
Microsoft Visual C++ 2010 x64 Redistributable	10.0.40219
Microsoft Visual C++ 2010 x86 Redistributable	10.0.40219
Microsoft .net Framework	4.5.1
Micro Focus RM/COBOL Runtime	12.06
Symantec Endpoint Protection - Small Business Edition 2013	12.1.4

### 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	1.4.0.0
DS200 Precinct Count Scanner	1.2.1, 1.2.3, & 1.3	2.12.0.0
DS850 Central Count Scanner	1.0	2.10.0.0
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 & B 431dn	N/A
DS850 Audit Printer	OKI Microline 420	N/A
Avid Headphones	Avid FV 60	N/A

### 1.1.2 Description of Submitted Modifications

Descriptions of submitted modifications to the voting system include changes to address specific requirements for the State of Maryland, cryptographic key generation discrepancy, and other stability enhancing features. In addition, a new hardware component was added; the ExpressVote Rolling Kiosk. A full description of submitted modifications can be found in Appendix D – Details of Submitted Modifications.

### 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 four categories: functional, software, hardware, and technical data package (TDP).

**Functional Assessment:**

Based on the assessment of submitted changes, it was 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 that were made in this modification (new features, changes to functions, etc.) or functions that have not changed but may be impacted by the modification. In addition, the voting system shall be subjected to a system integration test to ensure all components interact properly and to verify that the modifications to the voting system do not introduce any nonconformities or instabilities.

### 1.1.3 Initial Assessment (Continued)

#### 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 outside of the modifications in Appendix D – Details of Submitted Modifications. In determining the extent of the required source code review, the submitted source code for EVS 5.2.1.0 was compared to the EAC certified EVS 5.2.0.0 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	4.6.0.0	4.7.1.0	299	9,429
ERM	8.11.0.0	8.12.1.0	68	9,349
DS200	2.12.0.0	2.12.1.0	66	13,745
DS850	2.10.0.0	2.10.1.0	5	1,885
ExpressVote	1.4.0.0	1.4.1.0	84	8,837
<b>Totals</b>			<b>522</b>	<b>43,245</b>

#### Hardware Assessment:

The new hardware component, ExpressVote Rolling Kiosk, will require physical security, mobility, and vibration tests to ensure that the submitted hardware meets the requirements of the 2005 VVSG.

#### TDP Assessment:

The submitted TDP is constructed with the certified EVS 5.2.0.0 TDP and the EVS 5.2.1.0 changes to the certified documents. NTS Huntsville personnel determined that the following documents are impacted by this modification:

- EVS 5210\_C\_D\_0100\_SysOvr
- EVS 5210\_C\_L\_RequirementsMatrix
- EVS5210\_C\_D\_0200\_SFD
- EVS 5210\_CM\_BP\_1011\_EMSBuildProcedureTrustedBuild1
- EVS 5210\_D\_SDS00\_ElectionWare04\_PostgreSQL Table and Field Descriptions
- EVS 5210\_SDS00\_ElectionWare
- EVS5210\_DOC\_SOP\_DS200
- EVS5210\_DOC\_SOP\_DS850
- EVS 5210\_DOC\_SOP\_ERM
- EVS 5210\_DOC\_D\_1200\_ChangeNotes
- EVS 5210\_D\_SDS00\_ERM



### 1.1.3 Initial Assessment (Continued)

- EVS5210\_CM\_SPC00\_SysSecuritySpec
- EVOTE\_1'0\_SPC\_HWSpec
- EVS5210\_DOC\_SOP\_EW01Admin
- EVS5210\_DOC\_SOP\_EW02Define
- EVS5210\_DOC\_SOP\_EW03Design
- EVS5210\_DOC\_SOP\_EW04Deliver
- EVS5210\_DOC\_SOP\_EW05Results
- EVS5210\_DOC\_SOP\_ExpressVote
- EVS5210\_DOC\_SMM\_ExpressVote

A review of these documents shall ensure that all EVS 5.2.1.0 changes are properly documented and compliant with 2005 VVSG.

### 1.1.4 Regression Test

Regression testing shall be conducted on the ERM 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 July 2017
- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 2.0, expiration date July 2017
- 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 7
- 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 5.2.0.0 Voting System
- ES&S EVS 5.2.0.0 Technical Data Package
- ES&S EVS 5.2.1.0 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 2005 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 5.2.1.0 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)**

<b>Term</b>	<b>Abbreviation</b>	<b>Definition</b>
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 5.2.1.0 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 (VSTL) may seek clarification on a specific Voluntary Voting System Guidelines (2005 VVSG) standard
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)**

Term	Abbreviation	Definition
Virtual Review Tool	VRT	Test campaign management software used by the EAC and manufacturers applying for qualification testing
Voting System Test Laboratory	VSTL	NTS
Voluntary Voting System Guidelines	VVSG	EAC Voluntary Voting System Guidelines Version 1.0

### 1.4 Project Schedule

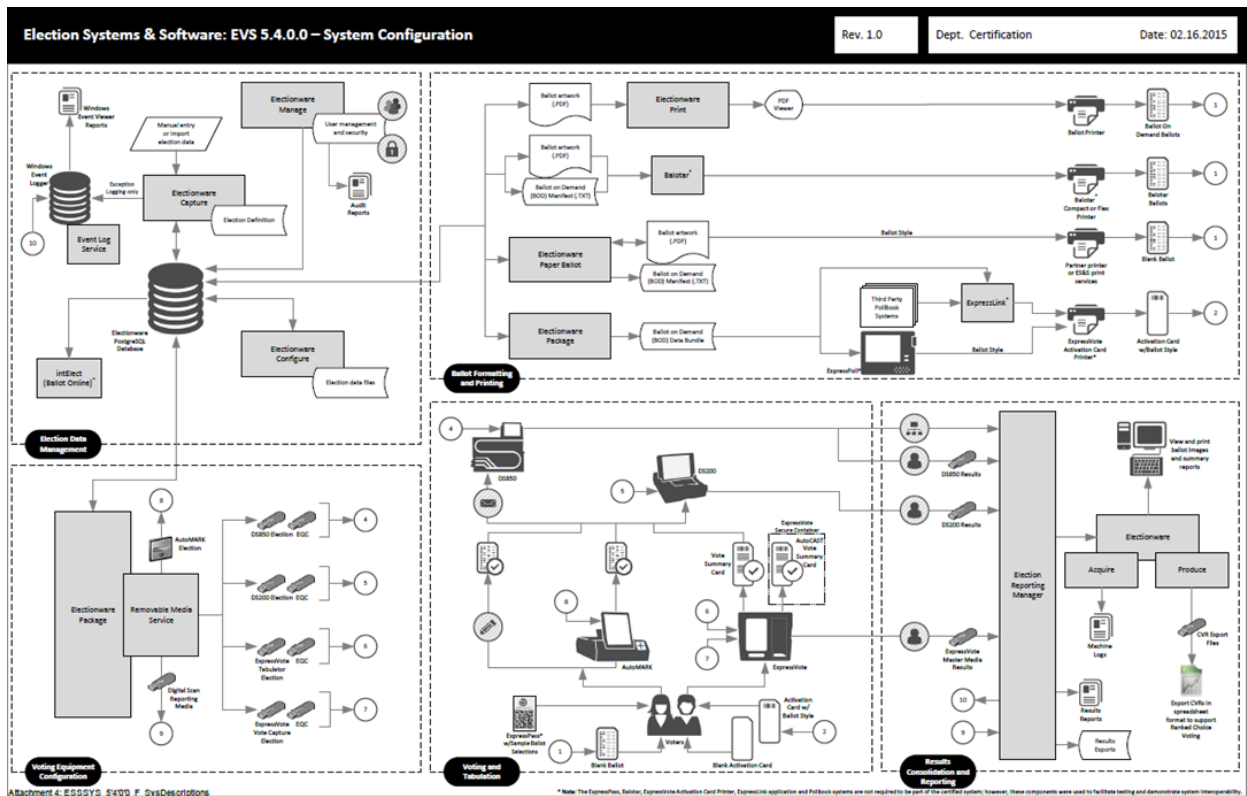
The project schedule for the test campaign is in Appendix C – Project Schedule.

### 1.5 Scope of Test

The scope of testing is limited to the modifications introduced into the previously certified EVS 5.2.0.0 voting system. The modifications are described in Appendix D – Details of Submitted Modifications.

#### 1.5.1 Block Diagram

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



**Figure 1-1. System Overview Diagram**

### **1.5.2 System Limits**

System limitations remain unchanged for all previously certified components of the EVS 5.2.0.0 voting system. The introduction of the ExpressVote Kiosk adds one additional limitation; the secure card container attached to the ExpressVote Tabulator has a storage capacity of 300 vote summary cards.

### **1.5.3 Supported Languages**

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

### **1.5.4 Supported Functionality**

Supported functionality remains unchanged for all previously certified components of the EVS 5.2.0.0 voting system.

## **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**

#### **Hardware Testing**

The manufacturer has requested that prior non-VSTL testing be accepted for reuse consideration. In response to this request, NTS evaluated NTS Test Report No. PR035098, "2005 VVSG Compliance Testing for Election Systems & Software ECO 1822, ExpressVote Rolling Kiosk."

NTS personnel performed a hardware qualitative examination to 1) assess if the testing was performed under the guidelines of the EAC program, 2) assess if the tests were performed per the EAC 2005 VVSG, and 3) determine if engineering changes were implemented since test performance that would cause testing to be repeated.

Based on the evaluation, NTS recommends the EAC accept the results for physical security (Vol I Sec 7.3), mobility (Vol I Sec 3.2.4) and vibration (Vol I Sec 4.2.3).

## 2.1 Evaluation of Prior VSTL Testing (Continued)

### Software Testing

Prior to submitting EVS 5.2.1.0, ES&S submitted EVS 5.3.0.0-IL and EVS 5.2.0.2 for source code review. This source code review was performed in accordance with the 2005 VVSG and EAC Testing and Certification Program Manual, Version 1.0. Table 2-1 outlines the source code changes.

**Table 2-1. Source Code Comparison**

Test Campaign	Product	Baseline	New Version	Lines of Code Changed	
				Files	Lines
EVS 5.3.0.0-IL	Electionware	4.6.0.0	4.7.1.0	23	3847
EVS 5.3.0.0-IL	ERM	8.11.0.0	8.12.1.0	13	1005
EVS 5.2.0.2	DS200	2.12.0.0	2.12.1.0	4	120
<b>Totals</b>				<b>40</b>	<b>4972</b>

NTS Huntsville recommends the EAC accept the results of this source code review as re-use for the EVS 5.2.1.0 modification. All code modified or added subsequent to the EVS 5.3.0.0-IL and EVS 5.2.0.2 source code reviews will be reviewed as part of the 5.2.1.0 test campaign.

## 2.2 Evaluation of Prior non-VSTL Testing

The manufacturer has requested that prior non-VSTL testing be accepted for reuse consideration. In response to this request NTS evaluated the following two documents:

- NTS Test Report No. PR035098, “2005 VVSG Compliance Testing for Election Systems & Software ECO 1822, ExpressVote Rolling Kiosk” and
- UL60950-1 Section 0.2.5 “Mechanical Hazards”

NTS personnel performed a hardware qualitative examination to 1) assess if the testing was performed under the guidelines of the EAC program, 2) assess if the tests were performed per the EAC 2005 VVSG, and 3) determine if engineering changes were implemented since test performance would cause testing to be repeated.

Based on the evaluation, NTS recommends the EAC accept the result for mechanical hazards compliance with UL60950-1 and 2005 VVSG Section 4.3.8.

## 2.3 Known Field Issues

The EVS 5.2.0.0 voting system has one identified field issue. 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.

### 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	4.7.1.0
Election Reporting Manager (ERM)	8.12.1.0
ES&S Event Log Service (ELS)	1.5.5.0
Removable Media Service (RMS)	1.4.5.0
VAT Previewer	1.8.6.0
ExpressVote Previewer	1.4.0.0
<b>COTS Software</b>	
Adobe Acrobat Standard	11
Cerberus FTP	6.0.7.1
Microsoft Server 2008	R2 w/ SP1
Microsoft Windows 7	5.1 w/ SP1
Microsoft Visual C++ 2008 Redistributable – x64	9.0.30729
Microsoft Visual C++ 2010 x64 Redistributable	10.0.40219
Microsoft Visual C++ 2010 x86 Redistributable	10.0.40219
Microsoft .net Framework	4.5.1
Micro Focus RM/COBOL Runtime	12.06
Symantec Endpoint Protection - Small Business Edition 2013	12.1.4

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### 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	1.4.1.0
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
Motorola QR Code Scanner	DS9208	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	N/A
DS850 Audit Printer	OKI Microline 420	N/A
Avid Headphones	Avid FV 60	N/A

### 3.3 Test Materials

Table 3-3 describes the test materials required to execute the required testing.

**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
CF Card Reader	1	SanDisk	018-6305

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### 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
ExpressVote	Firmware 1.4.1.0; 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
Electionware	4.6.1.0	EMS
ERM	8.11.1.0	EMS
ES&S Event Log Service	1.5.5.0	EMS
Removable Media Services	1.4.5.0	EMS
VAT Previewer	1.8.6.0	EMS
EVS 5.2.1.0 Voting System Overview	1.0	TDP Document
EVS 5.2.1.0 System Functionality Description	1.0	TDP Document
ES&S ElectionWare Volume I: Administrator's Guide	4.7	TDP Document
ES&S ElectionWare Volume II: Define User's Guide	4.7	TDP Document
ES&S ElectionWare Volume III: Design User's Guide	4.7	TDP Document
ES&S ElectionWare Volume IV: Deliver User's Guide	4.7	TDP Document
ES&S ElectionWare Volume V: Results User's Guide	4.7	TDP Document
Election Reporting Manager User's Guide	8.1	TDP Document
ExpressLink Operator's Guide	1.0	TDP Document
ExpressVote Operator's Guide	2.1	TDP Document
DS200 Operator's Guide	2.14	TDP Document
DS850 Operator's Guide	2.11	TDP Document
AutoMARK System Operator's Guide	1.8	TDP Document
Voting System Security Specification	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>
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	12	TDP Document

### 3.5 Proprietary Data

All data considered by the manufacturer as 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 EAC 2005 VVSG, and Program Manual.

### 4.1 Requirements

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

#### 4.1.1 Requirements Mapping

The requirements mapping is provided in conjunction with submitted modification description in Appendix D – Details of Submitted Modifications. NTS Huntsville will verify and validate that the manufacturer is in compliance with stated QA and CM plans.

#### 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

There are no applicable NOCs released by the EAC as of the date of the Test Plan.

### 4.1.4 RFIs

Applicable RFIs the EAC has released as of the date of the Plan pertaining to this test campaign are listed in Table 4-3.

**Table 4-3. Applicable RFIs**

RFI ID	Name
2007-01	EAC Decision on Accessible Design
2007-02	EAC Decision on Variable Names
2007-04	EAC Decision on Presentation of Alternative Language
2007-05	EAC Decision on Testing Focus and Applicability
2008-04	EAC Decision on Supported Languages
2008-05	EAC Decision on Durability
2008-08	EAC Decision on Automatic Bar Code Readers
2008-09	EAC Decision on Safety Testing
2009-02	EAC Decision on Alternate Languages
2009-04	EAC Decision on Audit Log Events
2010-02	EAC Decision on Coding Conventions
2010-03	EAC Decision on Database Coding Conventions
2010-05	EAC Decision on Testing of Modifications to a Certified System
2010-07	EAC Decision on Module Length
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

## 4.2 Hardware Configuration and Design

EVS 5.2.1.0 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, and AutoMark A300. The ExpressVote is the fourth terminal, which as 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

Software system functions 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 specifications and requirements, i.e., 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 non-functional tests may also be used. 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.
- "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.

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#### 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” will be utilized during the FCA with a single pass through each component using only valid data. This pass will be 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 that will utilize 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**

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**

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 EAC 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 200 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 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.

### **4.5.4 TDP Evaluation Specifications**

NTS Huntsville qualified personnel utilize a TDP Review Matrix which lists every EAC 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.

### **4.5.5 Source Code Review**

As the source code is received, a SHA256 hash value will be created for each source code file. NTS Huntsville source code team will conduct a visual scan of each line of source code for an initial review and every line of modified source code for acceptance for all languages. This is done to verify compliance of EAC 2005 VVSG coding standards. Each identified violation shall be recorded by making notes of the standards violation along with directory name, file name, and line number.

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 on a regular basis. All revised source code will be checked for corrections until the final issue is resolved. At the end of the source code review process, a Deficiency will be issued listing all non-compliances. The results will be included in the final test report.

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 Huntsville 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 Huntsville will verify by downloading the software directly from the manufacturer site, verifying against NRSL, or by being provided original OEM discs.



#### **4.5.5 Source Code Review (Continued)**

If there is COTS generated software source code, NTS Huntsville 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 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.

#### **4.7 QA & CM System Review**

The manufacturer submitted QA Plan and CM Plan will be reviewed. The review will be limited to only the changes within this modification to determine compliance with EAC 2005 VVSG Volume II Section 2, 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.

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**5.2 Test Data Criteria**

NTS Huntsville will evaluate all test data against the manufacturer provided TDP and the requirements set forth in the EAC 2005 VVSG. Per the EAC 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).

**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 annotated. 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**

Event	Ambient Range
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 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 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 shall be brought to the attention of the manufacturer representative for resolution. All TDP and source code modules received will be inventoried and maintained by the Project Lead 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 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 5.2.0.0 hardware.

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

The FCA for the EVS 5.2.1.0 campaign will include review of modified elements of the Electionware, and ERM. The FCA tests will be designed per the specifications in section 4.5.3. During the FCA, both normal and abnormal data was input into the system to attempt to introduce errors and test for error recovery.

#### **6.3.3 System Integration**

All submitted hardware and software components will be included in the system integration test. A total of six 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.

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### 6.3.3 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

### 6.3.3 System Integration (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
- Audio ballots utilizing ADA capabilities

### 6.3.3 System Integration (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:

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

### 6.3.3 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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### 6.3.3 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

### 6.3.3 System Integration (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-in option
- Bengali language ballot with basic voting pattern with write-in option
- Bengali language utilizing ADA device
- Binary input to support ADA option
- Binary input to support ADA audio device

#### **6.3.4 TDP**

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 5.2.1.0 TDP is located in Appendix B – Technical Data Package.

#### **6.3.5 Source Code Review**

The source code review of EVS 5.2.1.0 will be based on the source code changes from EVS 5.2.0.0 to EVS 5.2.1.0.

### **6.4 Test Operations Procedure**

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

#### **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 and monitored throughout the test campaign and subsequent testing efforts. Anomalies may become deficiencies when a root cause is established.

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#### **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 and the EAC Virtual Review Tool.

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

NTS Huntsville personnel will test every EAC 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, or report that the system does not meet all applicable sections of the 2005 VVSG.

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**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 include Test Deck and Text to Speech.
- Ballot Online ExpressPass – Ballot Online is an optional system that allows a user to access 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 Vote Capture to scan, review and validate vote selections. The vote summary card may then be submitted for tabulation on an ES&S tabulator: ExpressVote Tabulator, DS200 or DS850.

NTS Huntsville will perform limited testing as requested by the manufacturer. Table A-2 outlines the requested testing.

**Table A-2. Manufacturer Requested Testing Outside of Certification**

Component	Version	Requested Testing
ExpressLink	1.3.0.0	2005 VVSG Source code Compliance
ExpressVote Activation Card Printer	N/A	Functional Integration Test
ElectionWare Toolbox	2.3.0.0	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 5.2.1.0 Voting System TDP.

**Table B-1. EVS 5.2.1.0 TDP**

<b>EVS 5.2.1.0 TDP Documents</b>	<b>Version</b>	<b>Doc No.</b>	<b>Document Code</b>
<b>System Overview</b>			
Voting System Overview	1.0	01-01	EVS5210_C_D_0100_SysOvr
<b>System Functionality Description</b>			
System Functionality Description	1.0	02-01	EVS5210_C_D_0200_SFD
<b>System Hardware Specification</b>			
AutoMARK System Hardware Overview	8	03-01	AutoMARK_ESS_System_Hardware_Overview_AQS-18-5002-000-S
AutoMARK System Hardware Specification	6	03-02	AutoMARK_ESS_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	310	03-06	EVOTE_1'0_SPC_HWSpec
<b>Software Design and Specification</b>			
AutoMARK Ballot Image Processing Specifications	6	04-01	AQS-18-5002-003-S
AutoMARK Ballot Scanning and Printing Specification	5	04-02	AQS-18-5002-007-S
AutoMARK Driver API Specification	5	04-03	AQS-18-5000-002-F
AutoMARK Embedded Database Interface Specifications	5	04-04	AQS-18-5002-005-S
AutoMARK GUI Design Specifications	6	04-05	AQS-18-5001-005-R
AutoMARK Operating Software Design Specifications	5	04-06	AQS-18-5001-002-R
AutoMARK Operations and Diagnostic Log Specifications	5	04-07	AQS-18-5002-004-S
AutoMARK Programming Specifications Details	5	04-08	AQS-18-5001-011-R
AutoMARK Software Design Specifications	5	04-09	AQS-18-5001-004-S
AutoMARK Software Design Specification Overview	1.8	04-10	AutoMARK ESS Software Design Spec Overview
AutoMARK Software Development Environment	5	04-11	AQS-18-5001-006-R
AutoMARK Software Diagnostics Specifications	5	04-12	AQS-18-5000-004-F
AutoMARK Software Standards Specification	5	04-13	AQS-18-4000-000-S
ES&S Coding Standards	3.0	04-14	ESSSYS_D_P_0400_CodingStandards
ES&S System Development Program	2.0	04-15	ESSSYS_SG_P_0400_SystemDevProgram
Software Design Specifications DS200	1.0	04-16	EVS5210_D_SDS00_DS200
Software Design Specifications DS850	1.0	04-17	EVS5210_D_SDS00_DS850
ElectionWare PostgreSQL Table and Field Descriptions	--	04-02	EVS5210_D_SDS00_ElectionWare04_PostgreSQL Table and Field Descriptions (Folder)
ElectionWare Appendix 4: ElectionWare PostgreSQL Table and Field Descriptions	1.0	04-02-01	ElectionWare04_Readme
Software Design and Specification – ELS	1.0	04-18	EVS5210_D_SDS00_ELS
Software Design and Specification – ERM	1.0	04-19	EVS5210_D_SDS00_ERM
Software Design and Specification – ERM Appendices	1.0	04-20	EVS5210_D_SDS00_ERM01_Appendices



**B.1 Technical Data Package (Continued)**
**Table B-1. EVS 5.2.1.0 TDP (Continued)**

<b>EVS 5.2.1.0 TDP Documents</b>	<b>Version</b>	<b>Doc No.</b>	<b>Document Code</b>
Software Design and Specification – ExpressVote	1.0	04-21	EVS5210_D_SDS00_ExpressVote
Software Design and Specification – Electionware	1.0	04-22	EVS5210_SDS00_ElectionWare
<b>System Test/Verification Specification</b>			
Voting System Test Plan ES&S Voting System 5.2.1.0	1.0	05-01	EVS5210_QA_D_0500_SysTestPlan
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	1.2.1	05-02-02	DS200HW_P_D_0512_CIFRptDS200
CIF Usability Test Report – ExpressVote 1.0	N/A	05-02-03	ExpressVoteHW_P_D_0509_CIFRptExpressVote
<b>System Security Specification</b>			
AutoMARK System Security Specification	6	06-01	AutoMARK ESS System Security Specification AQS-18-5002-001-S
Network Setup Guide	1.0	06-02	EVS5210_CM_SOP_NetworkConfigGuide
System Security Specification	1.0	06-03	EVS5210_CM_SPC00_SysSecuritySpec
Hardening Procedures for ES&S	1.0	06-04	EVS5210_CM_SPC01_HardeningProcedures
Security Script Description	1.0	06-05	EVS5210_CM_SPC02_SecScriptDesc
<b>System Operations Procedure</b>			
System Operations Procedures – AutoMARK	1.0	07-01	EVS5210_DOC_SOP_AMVAT
System Operations Procedures – DS200	1.0	07-02	EVS5210_DOC_SOP_DS200
System Operations Procedures – DS850	1.0	07-03	EVS5210_DOC_SOP_DS850
System Operations Procedures – Event Log Service	1.0	07-04	EVS5210_DOC_SOP_ELS
System Operations Procedures – Election Reporting Manager	1.0	07-05	EVS5210_DOC_SOP_ERM
Electionware Administrator’s Guide	1.0	07-06	EVS5210_DOC_SOP_EW01Admin
Electionware Define: User’s Guide	1.0	07-07	EVS5210_DOC_SOP_EW02Define
Electionware Design: User’s Guide	1.0	07-08	EVS5210_DOC_SOP_EW03Design
Electionware Deliver: User’s Guide	1.0	07-9	EVS5210_DOC_SOP_EW04Deliver
Electionware Results: User’s Guide	1.0	07-10	EVS5210_DOC_SOP_EW05Results
System Operations Procedures – ExpressLink	1.0	07-11	EVS5210_DOC_SOP_ExpressLink
System Operations Procedures – ExpressVote	1.0	07-12	EVS5210_DOC_SOP_ExpressVote
System Operations Procedures – ExpressVote Appendices	1.0	07-13	EVS5210_DOC_SOP_ExpressVote_APPX
<b>System Maintenance Manuals</b>			
System Maintenance Manual – ES&S AutoMARK	1.0	08-1	EVS5210_DOC_SMM_AMVAT
System Maintenance Manual – ES&S DS200	1.0	08-2	EVS5210_DOC_SMM_DS200
System Maintenance Manual – ES&S DS850	1.0	08-3	EVS5210_DOC_SMM_DS850
System Maintenance Manual – ES&S ExpressVote	1.0	08-4	EVS5210_DOC_SMM_ExpressVote

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

**Table B-1. EVS 5.2.1.0 TDP (Continued)**

<b>EVS 5.2.1.0 TDP Documents</b>	<b>Version</b>	<b>Doc No.</b>	<b>Document Code</b>
<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	2.0	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
<b><i>System Change Notes</i></b>			
System Change Notes	1.0	12-01	EVS5210_DOC_D_1200_ChangeNotes
<b><i>Other TDP Documents</i></b>			
ES&S Ballot Production Handbook	1.3	13-01	EVS5210_DOC_SOP_BPG

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**APPENDIX C – PROJECT SCHELDULE**

### 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 Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names	Sep 27, '15							
								S	M	T	W	T	F	S	S
1	✓	EAC Application Approval Process	5 days	Mon 9/28/15	Fri 10/2/15										
2		TDP	4 days	Mon 10/5/15	Thu 10/8/15	1									
3		Test Plan	41 days	Mon 10/5/15	Wed 12/2/15	1									
4		Test Plan Creation	5 days	Mon 10/5/15	Fri 10/9/15										
5		ES&S Review	2 days	Mon 10/12/15	Tue 10/13/15	4									
6		Submit to EAC	1 day	Wed 10/14/15	Wed 10/14/15	5									
7		EAC Review	20 days	Thu 10/15/15	Wed 11/11/15	6									
8		NTS Test Plan Revision	3 days	Thu 11/12/15	Mon 11/16/15	7									
9		EAC Re-Review	10 days	Tue 11/17/15	Wed 12/2/15	8									
10		Source Code Review	8 days	Mon 10/5/15	Wed 10/14/15	1									
11		Compliance Build	2 days	Thu 10/15/15	Fri 10/16/15	10									
12		Receipt Inspection	1 day	Mon 10/19/15	Mon 10/19/15	11									
13		FCA	8 days	Mon 10/19/15	Wed 10/28/15	11									
14		Trusted Build	3 days	Thu 10/29/15	Mon 11/2/15	13									
15		Regression Test	3 days	Tue 11/3/15	Thu 11/5/15	14									
16		Test Report	36 days	Thu 12/3/15	Tue 1/26/16										
17		ES&S Review	2 days	Thu 12/3/15	Fri 12/4/15	3,13									
18		Submit to EAC	1 day	Mon 12/7/15	Mon 12/7/15	17									
19		EAC Review	20 days	Tue 12/8/15	Thu 1/7/16	18									
20		NTS Test Report Revision	3 days	Fri 1/8/16	Tue 1/12/16	19									
21		EAC Re-Review	10 days	Wed 1/13/16	Tue 1/26/16	20									
22		Job Closeout	1 day	Wed 1/27/16	Wed 1/27/16	16									

Project: EVS 5210 10-7-15 Date: Wed 10/7/15	Task		External Milestone		Manual Summary Rollup	
	Split		Inactive Task		Manual Summary	
	Milestone		Inactive Milestone		Start-only	
	Summary		Inactive Summary		Finish-only	
	Project Summary		Manual Task		Deadline	
	External Tasks		Duration-only		Progress	

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**APPENDIX D – DETAILS OF SUBMITTED MODIFICATIONS**

**D.1 Submitted Modification**

**Table D-1. Submitted Modification**

Change ID	Changed Component	Change Description	Impacted 2005 VVSG Requirement
ENH34179	DS200	Support version of straight party required for US Virgin Islands.	Vol II Section 6.7
ENH34221	DS200	Support Bengali language for voter facing U/I content.	Vol I Section 3.1.3
ENH34234	DS200	Add support of data from election to enable auto printing of the write-in snippet report and passing size of the print used on ExpressVote card to allow for write-in snippet detection.	Vol II Section 6.7
ENH34410	DS200	Clarify wording on undervote screen to make clearer.	Vol I Section 3.1.2.a, 3.1.4.b, 3.1.4.d
BUG34299	DS200	Enhance write-in snippet capture to prevent dense ballots from occasionally cutting off part of snippet.	Vol II Section 6.7
ENH34181	DS850	Support version of straight party required for US Virgin Islands.	Vol II Section 6.7
ENH33844	ElectionWare	Include a new version of RSACRYPTO in the ElectionWare Install that now uses the PKCS1 padding scheme to ensure compatibility with the MS Crypto library used by the ExpressVote.	Vol II Section 6.7
ENH34130	ElectionWare	The default for the "Force Unique Ballot Styles" option on the Poll Record has been switched to off.	Vol II Section 6.7
ENH34119 ENH34120 ENH34121	ElectionWare	A write-in review flag can be set to allow for a global setting of the write-in snippet report.	Vol II Section 6.7
ENH34294	ElectionWare	The setting of the selected ExpressVote font size will be provided to the DS200 to help with write-in capture.	Vol II Section 6.7
ENH34118	ElectionWare	Updates were made to allow for EXP use in Maryland.	Vol II Section 6.7
ENH34123	ElectionWare	Updates were made for adding Bengali and Vrinda font support to Electionware.	Vol I Section 3.1.3
ENH34133	ElectionWare	Updates were made for adding Bengali support to the ExpressVote.	Vol I Section 3.1.3
ENH34180	ElectionWare	Flag for requested Straight Party handling for USVI will be passed when "Virgin Islands of the U.S." is selected in Election Information.	Vol II Section 6.7
ENH34503	ElectionWare	Comments were updated in the Electionware Code per NTS requirement.	Vol II Section 5.4

**D.1 Submitted Modification (Continued)**
**Table D-1. Submitted Modification (Continued)**

Change ID	Changed Component	Change Description	Impacted 2005 VVSG Requirement
ENH34349	ElectionWare	When Bengali is added to an election, the Vrinda font will be added to the ExpressVote poll stick.	Vol I Section 3.1.3
BUG34465 BUG34545	ElectionWare	Write-in snippets will be handled for landscape ballots.	Vol II Section 6.7
BUG34128	ElectionWare	In a ballot style with contests in multiple districts of the same type, contest order will be determined by district order.	Vol I Section 2.1.6
BUG34101	ElectionWare	Changes have been made to Acquire for better handling of DS200 results media which have been closed on more than one DS200 Terminal.	Vol I Section 2.4.3
BUG33881	ERM	Creating ERM from XML for a 2nd time and adding additional groups will not check for duplicates between 0 value columns.	Vol II Section 6.7
BUG33886	ERM	Changes were made to remove an outdated file version check.	Vol II Section 6.7
BUG33887	ERM	Pre-populated NNNNNNNNNNNN was removed from file names.	Vol II Section 6.7
BUG33888	ERM	Users will now be able to indicate Update Precincts Counted in an election with only one group.	Vol II Section 6.7
BUG33889	ERM	Users will be notified of 0 ballot cast precincts in the reading of a 2 <sup>nd</sup> stick from the DS850.	Vol II Section 6.7
BUG33892	ERM	EL45 will no longer report precincts as counted when Update Precinct Counted is turned off.	Vol I Section 2.4.3
BUG34011	ERM	Update Precinct Results from SFTP Server is not a selectable option in this release.	Vol II Section 6.7
BUG34220	ERM	ERM can be created from XML files when ERM is mapped to a network drive.	Vol II Section 6.7
BUG34228	ERM	ERM will show all parties for a Cross-Endorsed candidate.	Vol I Section 2.4.3
BUG34316	ERM	2nd users will no longer be asked to create Results Database when it has already been created.	Vol II Section 6.7
BUG34412	ERM	The correct totals will show for the Name and District Totals Canvass for parties which do not have party ballots in all precincts.	Vol I Section 2.4.3
BUG34413	ERM	Subset elections can again be created when the election is located on a network drive.	Vol II Section 6.7
ENH33890	ERM	Users are able to skip all precincts with zero ballots cast.	Vol II Section 6.7
ENH33893	ERM	Users are able to set a time interval for the automatic creation of the Results XML file.	Vol II Section 6.7

**D.1 Submitted Modification (Continued)**

**Table D-1. Submitted Modification (Continued)**

Change ID	Changed Component	Change Description	Impacted 2005 VVSG Requirement
ENH33927	ERM	Users are able to Generate the Names and District Totals report for a specific contest.	Vol I Section 2.4.3
EN34195	ExpressVote	New OS to support Uniscribe(Bengali).	Vol I Section 3.1.3
EN34306	ExpressVote	Add security check with additional font transfer.	Vol II Section 6.7
EN34340	ExpressVote	Error message addition for clarification.	Vol I 2.1.5.1
EN34363	ExpressVote	Synchronized SPE firmware between EVS5400 and EVS5210.	Vol II Section 6.7
EN34550	ExpressVote	Updated picture of barcode scanner in configuration screen.	Vol II Section 6.7
BUG34293	ExpressVote	Added additional language support for Bengali.	Vol I Section 3.1.3
BUG34330	ExpressVote	Holding voted card on insertion caused card to be seen as blank.	Vol II Section 6.7
BUG34335	ExpressVote	Code maintenance no features added.	Vol II Section 6.7
BUG34398	ExpressVote	Copyright screen date change.	Vol II Section 6.7
BUG34402	ExpressVote	Updated Windows CE version number.	Vol II Section 6.7
BUG34443 BUG34448	ExpressVote	Imperfect bar code caused card to be seen as blank.	Vol II Section 6.7
BUG34449	ExpressVote	Florida rule to have all responses on the same screen.	Vol I 3.1.4.b
N/A	TDP	Voting System Overview	Vol II Section 2.2.1
N/A	TDP	Software Design and Specification - Electionware	Vol II Section 2.5
N/A	TDP	Software Design and Specification - Electionware Database Descriptions	Vol II Section 2.5
N/A	TDP	Software Design and Specification - ERM	Vol II Section 2.5
N/A	TDP	System Change Notes	Vol II Section 2.11

**END OF TEST PLAN**