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# TEST REPORT

NATIONAL CERTIFICATION TEST REPORT  
 FOR  
 CERTIFICATION TESTING  
 OF THE  
 ELECTION SYSTEMS & SOFTWARE  
 EVS 5.0.1.0 VOTING SYSTEM

for

Election Systems & Software, LLC.  
 11208 John Galt Boulevard  
 Omaha, NE 68137

STATE OF ALABAMA }  
 COUNTY OF MADISON }

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

*Robert Hardy*

SUBSCRIBED and sworn to before me this 13 day of Jan 20 14

*Sandra A. Daniel*  
 Notary Public in and for the State of Alabama at Large

My Commission expires June 2, 2015

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## **1.0 INTRODUCTION**

### **1.1 Testing Scope**

This report presents the procedures followed and the results obtained during certification testing of the Election Systems & Software (ES&S) EVS 5.0.1.0 Voting System. ES&S submitted the EVS 5.0.1.0 Voting System to Wyle Laboratories, Inc. for compliance to the United States Election Assistance Commission (EAC) 2005 Voluntary Voting Systems Guidelines (VVSG). The EVS 5.0.1.0 Voting System is a modification to the EAC certified EVS 5.0.0.0 Voting System documented by Wyle Laboratories' Test Report Number T59087.01-01, dated May 16, 2013. All testing on the modifications to the voting system was tested to the EAC 2005 VVSG.

The focus of this test campaign was to test all additions and modifications made to both the system's software and hardware, since the last certification. Wyle Laboratories performed functionality testing on the reporting enhancements to the DS200 and DS850, as listed in the TDP. Wyle Laboratories performed system integration testing and accuracy testing to verify the hardware and software changes to the DS200.

The changes to the DS200 hardware for version 1.3 include:

- New Motherboard – VT6070 Mini-ITX (Replace EOL, 'End-of-Life')
- New System RAM – DDR3 Ram Module (Replaced to fit new motherboard)
- New Scanner Board – (Replace EOL)
- Removal of the ATX power supply (now incorporated in the motherboard)
- ECO 1281 – DS200 Transport Assembly
  - Redesign spring plate (improve handling of damaged ballots)
  - Redesign beveled Contact Image Sensor (improve handling of damaged ballots)
  - Add the ultrasonic detect shield and grommet
  - Redesign closing linkage
  - Revise fit and tolerance on five sheet metal parts (improve manufacturing tolerances)
    - Right side of the transport assembly – change round holes to slots to allow horizontal adjustability in stainless steel guide plates
    - Bottom front stainless steel platen – add additional clearance around bushing openings to allow horizontal adjustability in stainless steel guide plates
    - Drive belt cover on the left side of transport – added access holes for CIS mounting hardware
    - Bottom rear stainless steel platen – add additional clearance around bushing openings to allow horizontal adjustability in stainless steel guide plates
    - Top front stainless steel platen – add additional clearance around bushing openings to allow horizontal adjustability in stainless steel guide plates
- Replace CFL backlight with LED backlight (Replace EOL)
- Removable rails for attachment to ballot box (Replace built in feet)
- Battery access door
- Improve power/close switch fit
- Plastic housing change to update company logo

The changes to the DS200 hardware for version 1.2.3.0 include ECO 1281 (described above).

The changes to the DS200 2.7.0.0 software include:

- Print scanner board hardware type on tape
- Implemented the use of the 8-bit "Scanner ID" field to report the scanner board firmware
- Integrated ability to read and report Power Management Board firmware version
- Report motherboard version on configuration report and in log
- Modify HAL for new VIA motherboard

## 1.0 INTRODUCTION (Continued)

### 1.1 Testing Scope (Continued)

Datawin issued updates to their COTS firmware on the DS850. There were no proposed changes or modifications to the proprietary firmware on the DS850. The Datawin firmware change increased the rising and lowering speed of the input and output trays.

There were no proposed changes or modifications to the AutoMARK or the EMS software in this test campaign; therefore, no component level testing was included for this equipment.

### 1.2 Objective

The objective of this system modification test program was to ensure that EVS 5.0.1.0 complied with the hardware and software requirements of the EAC 2005 VVSG. The scope and detail of the requirements tested in the certification were selected to correspond to the scope of the system detailed in the application submitted by ES&S. An in-depth examination of the system further confirmed the applicable requirements selected for compliance testing. This included the inspection and evaluation of system documentation, and the execution of functional tests to verify system performance and function under normal/abnormal conditions.

### 1.3 Test Report Overview

This test report consists of five main sections (including appendices):

- **Introduction:** Provides the architecture of the National Certification Test Report (hereafter referred to as Test Report); a brief overview of the testing scope of the Test Report; a list of documentation, customer information, and references applicable to the voting system hardware, software, and this test report.
  - **System Identification and Overview:** Provides information about the system tested that includes the system under test, test support hardware, and specific documentation provided by the vendor used to support testing.
  - **Certification Test Background:** Contains information about the certification test process and the system tested.
  - **Test Findings and Recommendation:** Provides a summary of the results of the testing process.
- Appendices:** Information and data supporting testing of the voting system and hardware analysis are included as appendices to this report. This includes: System Modifications, Notices of Anomaly, Test Setup Photographs, Hardware Test Results, Deficiency Report, and the “As Run” Test Plan.

### 1.4 Customer

Election Systems & Software, LLC  
11208 John Galt Boulevard  
Omaha, NE 68137

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**1.0 INTRODUCTION (Continued)**

**1.5 References**

The documents listed were utilized to perform certification testing.

- Wyle Laboratories' "National Certification Test Report for the Certification Testing of the Election Systems & Software EVS 5.0.0.0 Voting System Revision B", Test Report Number T59087.01-01, dated May 16, 2013
- Wyle Laboratories' "Hardware Compliance of the Election Systems & Software FL EVS 4.5.0.0 Voting System DS200 Hardware Version 1.3," Test Report Number T71013.01-01, dated September 18, 2013.
- 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
- United States Federal Election Commission Voting System Standards Volume I, "Performance Standards" and Volume II, "Test Standards," dated April 2002
- Election Assistance Commission Testing and Certification Program Manual, Version 1.0, effective date January 1, 2007
- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 1.0, effective date July 2008
- National Voluntary Laboratory Accreditation Program NIST Handbook 150, 2006 Edition, "NVLAP Procedures and General Requirements (NIST Handbook 150)," dated February 2006
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, "Voting System Testing (NIST Handbook 150-22)," dated May 2008
- United States 107<sup>th</sup> Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Wyle Laboratories' Test Guidelines Documents: EMI-001A, "Wyle Laboratories' 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"
- Wyle Laboratories' Quality Assurance Program Manual, Current Revision
- Wyle Laboratories' Quality Program Manual, Current Revision
- ANSI/NCSL Z540-1, "Calibration Laboratories and Measuring and Test Equipment, General Requirements"
- ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment"
- EAC Requests for Interpretation (listed on [www.eac.gov](http://www.eac.gov))
- EAC Notices of Clarification (listed on [www.eac.gov](http://www.eac.gov))

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## 2.0 SYSTEM IDENTIFICATION AND OVERVIEW

### 2.1 System Overview

The ES&S EVS 5.0.1.0 Voting System is a modification EVS 5.0.0.0 Voting System. The full EVS 5.0.1.0 Voting System description can be found in Section 2.0 of Wyle Laboratories' ES&S EVS 5.0.0.0 Test Report No. T59087.01-01, dated May 16, 2013. For the ES&S EVS 5.0.1.0 Voting System, Wyle Laboratories only tested the modifications to the DS200, DS850 and their interface with the EMS. Therefore, Wyle Laboratories only documented the configuration used during testing conducted at Wyle Laboratories.

### 2.2 System Identification

The materials required for testing of the EVS 5.0.1.0 Voting System included software, hardware, test materials, and deliverable materials shipped directly to Wyle Laboratories by ES&S. The materials documented in the following sections are the materials used during Wyle Laboratories' testing of only the DS200 and its interface with the EMS and are not a complete list of materials used in the previously-certified EVS 5.0.0.0 Voting System.

#### 2.2.1 Hardware

This subsection categorizes the equipment the manufacturer submitted for testing listed in Table 2-1. Each test element is included in the list of the equipment required for testing of that element, including system hardware, general purpose data processing and communications equipment, and any required test instrumentation.

**Table 2-1 EVS 5.0.1.0 Voting System Equipment Description**

Equipment	Manufacturer	Specifications	Serial Number	COTS/ Non-COTS
EMS Client Laptop	Dell Latitude E6410	Intel Core i5 CPU M580 @ 2.67 GHz 4.00 GB Installed RAM / Hard Drive Capacity 250 GB	2FD65Q1	COTS
EMS Server	Dell T710	Intel Xeon CPU E5645 @ 2.40 GHz (2 processors) 12.0 GB Installed RAM / Hard Drive Capacity 320 GB	JPZ6VR1	COTS
EMS Client Desktop	Dell OptiPlex 980	Intel Core i5 CPU 650 @ 3.20 GHz 4.0 GB Installed RAM / Hard Drive Capacity 320 GB	3TZJFQ1	COTS
Communications Server	Dell T410	Intel Xeon CPU E5504 @ 2.00 GHz 4.0 GB Installed RAM / Hard Drive Capacity 300 GB	4D6BQM1	COTS

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

**2.2 System Identification (Continued)**

**2.2.1 Hardware (Continued)**

**Table 2-2 EVS 5.0.1.0 Build Machine Description**

Equipment	Manufacturer	Specifications	Serial Number	COTS/ Non-COTS
Build 1	Dell OptiPlex 760	Processor: Intel Duo Core E8400 Wolfdale Memory: 4x1 GB, 800 MHz Ram Hard Drive Capacity: 80 GB	6D7DJG1	COTS
Build 2	Dell OptiPlex 760	Processor: Intel Duo Core E8400 Wolfdale Memory: 4.0 GB Installed Ram Hard Drive Capacity: 80 GB	6DCKJG1	COTS
Build 3	Dell Precision T3500	Processor: Intel X5650 2.66/6.4 12 MB Xeon Westmere Memory: 2.0 GB Installed Ram Hard Drive Capacity: 160 GB	15TMMN1	COTS
Build 4	Dell Precision T3500	Processor: Intel X5650 2.66/6.4 12 MB Xeon Westmere Memory: 2.0 GB Installed Ram Hard Drive Capacity: 160 GB	15TNMN1	COTS

**Table 2-3 EVS 5.0.1.0 Voting System Equipment**

Equipment	Description	Serial Number
AutoMARK	Voting Assist Terminal (A200)	AM0308421809
DS200 Hardware Version 1.3	Precinct Count Digital Scanner	DS0313350010
DS200 Hardware Version 1.3	Precinct Count Digital Scanner	DS0313350002
DS200 Hardware Version 1.2.3.0	Precinct Count Digital Scanner	DS0113360186
DS200 Hardware Version 1.2.1.0	Precinct Count Digital Scanner	DS0313340087
DS200 Hardware Version 1.2.1.0	Precinct Count Digital Scanner	ES0108340026
DS850 Hardware Version 1.0	Central Count Digital Scanner	DS8511090075
Ballot Box Hardware Version 1.2; 1.3	Plastic Box	002, 003, 004, 005
Ballot Box Hardware Version 1.2	Metal Box with Diverter	001

**2.2.2 Software**

The software evaluated was limited to ElectionWare, Election Reporting Manager (ERM), and the firmware build for the DS200. Only the changes incorporated since the EVS 5.0.0.0 test campaign were evaluated by Wyle Laboratories. Wyle Laboratories utilized an EMS setup with new versions of ElectionWare and ERM to load election information onto transport media and to upload election data from the DS200 to the EMS via the transport media. Wyle Laboratories did not test the EMS for any other functionality.

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

**2.2 System Identification (Continued)**

**2.2.2 Software (Continued)**

**Table 2-4 EVS 5.0.1.0 EMS Software Platform Component Descriptions**

<b>Software Required For Testing</b>	<b>Software Version</b>
ElectionWare	4.1.0.0
Election Reporting Manager (ERM)	8.6.0.0
Event Logging Service (ELS)	1.5.0.0
VAT Previewer	1.8.1.0
Removable Media Service (RMS)	1.4.0.0
DS200 Firmware	2.7.1.0
DS850 Firmware	2.4.0.0

**Table 2-5 EVS 5.0.1.0 EMS COTS Software Platform Component Descriptions**

<b>Software Required For Testing</b>	<b>Description</b>
Windows 7 Professional, with SP1	Original Disk
Windows Server 2008 R2, with SP1	Original Disk
Adobe Acrobat Standard version 9.0 or better	Original Disk
RM/Cobol	12.06
Microsoft Office Excel 2007 or better	Original Disk
Adobe Acrobat Standard 9.0	Original Disk
AVG AntiVirus Business Edition 2012	Original Disk & virus definition updates

**2.3 System Limits**

No system limits were impacted by this modification.

**2.4 Test Support Materials**

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

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

**2.4 Test Support Materials (Continued)**

The following test materials were required to support the EVS 5.0.1.0 test campaign:

**Table 2-6 Test Support Equipment**

Test Material	Quantity
Paper Rolls	25 rolls total
COTS Printer	1
Security Seals	50
ES&S Pens	20
Security Sleeves	3
Security Locks	5
Transport Media (USB Flash Drives) Delkin 1 GB Delkin 4 GB	20
Delkin Devices 1 GB Compact Flash	3

**2.5 Deliverable Materials**

The materials listed in Table 2-7 are to be delivered as part of the EVS 5.0.1.0 Voting System to the users.

**Table 2-7 Deliverable Materials for EVS 5.0.1.0 Voting System**

Deliverable Material	Version	Description
ElectionWare	4.1.0.0	EMS
ERM	8.6.0.0	EMS
Event Logging Service (ELS)	1.5.0.0	EMS
VAT Previewer	1.8.1.0	EMS
Removable Media Service (RMS)	1.4.0.0	EMS
DS200	Firmware 2.7.1.0; Hardware 1.2.1.0, 1.2.3.0 and 1.3	Precinct ballot scanner
AutoMARK™	Firmware 1.8.1.0; Hardware 1.0, 1.1 and 1.3	Voter Assist Terminal
DS850	Firmware 2.4.0.0; 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
Router/Firewall	Cisco ASA 5505	Router/Firewall
Voting System Overview EVS 5.0.1.0	19.0	TDP Document
ES&S DS200 System Operations Procedures Hardware version 1.2	10.1	TDP Document

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

**2.5 Deliverable Materials (Continued)**

**Table 2-7 Deliverable Materials for EVS 5.0.1.0 Voting System (Continued)**

Deliverable Material	Version	Description
ES&S DS200 System Operations Procedures Hardware version 1.3	1.0	TDP Document
ES&S DS850 System Operations Procedures	11.1	TDP Document
ES&S AutoMARK™ System Operations Procedures	5.0	TDP Document
ES&S ElectionWare 4.1 Vol II: Admin User's Guide	4.8	TDP Document
ES&S ElectionWare 4.1 Vol II: Define User's Guide	4.0	TDP Document
ES&S ElectionWare 4.1 Vol III: Design User's Guide	3.2	TDP Document
ES&S ElectionWare 4.1 Vol IV: Deliver User's Guide	5.6	TDP Document
ES&S ElectionWare 4.1 Vol V: Results User's Guide	1.5	TDP Document
EVS Event Logging Service System Operations Procedures	1.0	TDP Document
ES&S ERM System Operations Procedures	13.1	TDP Document
ES&S Voting System Security Specification	3.1	TDP Document
ES&S Voting System Security: Best Practices for Physically Securing ES&S Equipment	2.0	TDP Document
ES&S Hardening Procedures	4.3	TDP Document

**2.6 Vendor Technical Data Package**

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

Since the EVS 5.0.1.0 Voting System is a modification to the previously certified EVS 5.0.0.0 Voting System, Table 2-8 only lists the documents in the TDP that were modified for the EVS 5.0.1.0 Voting System. For a complete list of all documents, please refer to the EVS 5.0.0.0 Voting System documented by test report number T59087.01-01 dated May 16, 2013.

2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)

2.6 Vendor Technical Data Package (Continued)

**Table 2-8 ES&S EVS 5.0.1.0 Voting System TDP**

<b>EVS 5.0.1.0 TDP Documents</b>	<b>Version</b>	<b>Doc. No.</b>	<b>Document Code</b>
Voting System Overview	19.0	01-01	EVS5010_OVR00
<i><b>System Functionality Description</b></i>			
System Functionality Description	9.0	02-01	EVS5010_SFD00
<i><b>System Hardware Specification</b></i>			
System Hardware Specification – DS200 hardware V 1.2	1.0	03-02	DS200HW_M_SPC_0312_HWSpec
System Hardware Specification – DS200 hardware V 1.3	3.0	03-02	DS200HW_M_SPC_0313_HWSpec
<i><b>Software Design and Specification</b></i>			
Software Design and Specification – ERM	1.0	04-03	EVS5010_SDS00_ERM
Software Design and Specification – DS200	1.0	04-04	EVS5010_SDS00_DS200
Software Design and Specification – DS850	1.0	04-04	EVS5010_SDS00_DS850
<i><b>System Operations Procedures</b></i>			
System Operations Procedures – DS200	1.0	07-09	EVS5010_SOP00_DS200
<i><b>System Maintenance Manuals</b></i>			
System Maintenance Manual – DS200	1.0	08-02	EVS5010_SMM00_DS200
<i><b>System Change Notes</b></i>			
EVS 5.0.1.0 System Change Notes	2.0	12-01	EVS5010_DOC_D_1200_ChangeNotes

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### **3.0 TEST BACKGROUND**

Wyle Laboratories 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. Wyle Laboratories holds the following accreditations:

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

### **3.1 General Information about the Test Process**

All testing performed as part of the test effort was performed at Wyle Laboratories' Huntsville, AL, facility. Testing was limited to EVS 5.0.1.0 which includes items listed in Section 2.0 of this test report.

The strategy for evaluation of the EVS 5.0.1.0 was to review the change log, source code, and the engineering changes submitted for the modified system. Wyle Laboratories also evaluated test results from previous test campaigns performed by EAC accredited VSTL's as well as test cases and results of any developmental testing conducted by ES&S during the pre-certification process that were provided by ES&S in their TDP. The purpose of this evaluation was to determine the scope of testing required for system certification.

### **3.2 Testing Scope**

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

- Section 2: Functional Requirements – The requirements in this section were tested during the FCA, utilizing test cases specially designed for the ES&S EVS 5.0.1.0 Voting System.
- Section 3: Usability and Accessibility – The requirements in this section were not tested during this test campaign.
- Section 4: Hardware Requirements – The requirements in this section were tested during the FL EVS 4.5.0.0 test campaign. The FL EVS 4.5.0.0 test campaign tested the hardware modifications to the DS200. The FL EVS 4.5.0.0 Hardware Test Report Number T71013.01-01 is presented in Appendix B.
- Section 5: Software Requirements – The requirements in this section were tested during source code review, TDP review, and FCA. A combination of review and functional testing was performed to insure these requirements are met.
- Section 6: Telecommunication – The requirements in this section were not tested during this test campaign.
- Section 7: Security Requirements – The requirements in this section were tested during source code review, FCA, and Security Tests.

**3.0 TEST BACKGROUND (Continued)**

**3.2 Testing Scope (Continued)**

- Section 8: Quality Assurance (QA) Requirements – The requirements in this section were tested throughout the test campaign via various methods. The TDP review was performed on the EVS 5.0.1.0 QA documentation to determine compliance to EAC 2005 VVSG requirements and the requirements stated in the ES&S QA Program document. All source code was checked to ensure that proper QA documentation had been completed. All equipment received for initial testing and follow up testing was checked against ES&S documentation to ensure their QA process is being followed.
  
- Section 9: Configuration Management (CM) Requirements – The requirements in this section were tested throughout the test campaign. The TDP review was performed on the ES&S configuration management documentation to determine EAC 2005 VVSG compliance and to further determine whether ES&S is following its documented CM requirements within the TDP. Any anomalies were formally reported to ES&S. During source code review, Wyle Laboratories-qualified personnel verified that ES&S was following EAC 2005 VVSG CM requirements as well as ES&S CM requirements. Any anomalies were formally reported to ES&S. All equipment received for initial testing and follow-up testing was checked against ES&S documentation to ensure their CM process is being followed.

The EVS 5.0.1.0 Voting System is a paper-based precinct counting system; therefore, all EAC 2005 VVSG requirements pertaining to DRE's were excluded from this test campaign. Additionally, the following requirements were also excluded from the campaign:

- Volume I Section 6 (Telecommunication Requirements)
- Volume I Section 7.5.2-7.5.4 (Telecommunications and Data Transmission)
- Volume I Section 7.6 (Use of Public Communication Networks)
- Volume I Section 7.7 (Wireless Communications)
- Volume I Section 7.9 (Voter Verifiable Paper Audit Trail Requirements)

The rationale for not evaluating the EVS 5.0.1.0 Voting System to the requirements contained in the indicated sections of the EAC 2005 VVSG is described in Table 3-1.

**Table 3-1 Not Applicable Requirements**

<b>EAC 2005 VVSG Volume I Section</b>	<b>Rationale for 'Not Applicable'</b>
6, 7.5.2-7.5.4	These requirements are written for use on public networks. The EVS 5.0.1.0 Voting System as configured for this certification does not use public networks.
7.6	This section pertains to "Voting systems that transmit data over public telecommunications..." The EVS 5.0.1.0 Voting System as configured for this certification does not permit transmission over public networks.
7.7	No wireless technology is present in the EVS 5.0.1.0 Voting System.
7.9	The EVS 5.0.1.0 Voting System is a paper based system.

**3.0 TEST BACKGROUND (Continued)**

**3.3 Wyle Quality Assurance**

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

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

**3.4 Test Equipment and Instrumentation**

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

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**3.0 TEST BACKGROUND (Continued)**

**3.5 Terms and Abbreviations**

Table 3-2 in this subsection defines all terms and abbreviations applicable to this Test Report.

**Table 3-2 Terms and Abbreviations**

<b>Term</b>	<b>Abbr.</b>	<b>Definition</b>
Americans with Disabilities Act of 1990	ADA	ADA is a wide-ranging civil rights law that prohibits, under certain circumstances, discrimination based on disability.
Configuration Management	CM	---
Commercial Off the Shelf	COTS	Commercial, readily available hardware or software.
Direct Record Electronic	DRE	An electronic voting system that utilizes electronic components for the functions of ballot presentation, vote capture, vote recording, and tabulation which are logically and physically integrated into a single unit. A DRE produces a tabulation of the voting data stored in a removable memory component and in printed hardcopy.
United States Election Assistance Commission	EAC	Commission created per the Help America Vote Act of 2002, assigned the responsibility for setting voting system standards and providing for the voluntary testing and certification of voting systems.
Election Management System	EMS	Within the EVS system, the EMS is ElectionWare in addition with ERM.
Election Results Manager	ERM	A component of the EMS that is used for results gathering and reporting.
Equipment Under Test	EUT	---
Help America Vote Act	HAVA	Act created by United States Congress in 2002.
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.
Personal Computer	PC	Computer component of the OpenElect Voting System
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. A witnessed build of the executable system is performed to ensure the certified release is built from tested components.
Quality Assurance	QA	---
Specimen Under Test	SUT	---
Technical Data Package	TDP	Manufacturer documentation related to the voting system required to be submitted as a precondition of certification testing.
Uninterruptible Power Supply	UPS	---
Voluntary Voting System Guidelines	EAC 2005 VVSG	Published by the EAC, the third iteration of national level voting system standards.
Wyle Operating Procedure	WoP	Wyle Test Method or Test Procedure
Functional Configuration Audit	FCA	Exhaustive verification of every system function and combination of functions cited in the manufacturer's documentation.
Secure File Transfer Protocol	SFTP	A network protocol that provides file access, files transfer, and file management functionality over any reliable data stream.

## **4.0 TEST PROCEDURES AND RESULTS**

### **4.1 Source Code Review**

As part of the testing activities, the ES&S EVS 5.0.1.0 Voting System received a 100% source code review to the EAC 2005 VVSG coding standards and the manufacturer supplied coding standards. The manufacturer supplied coding standards (ESSSYS\_D\_D\_0100\_Coding Standards) can be found within the vendor provided TDP. The review was conducted per the guideline described in the following paragraph.

As the updated source code was received, a SHA1 hash value was created for each source code file. The source code team then conducted a visual scan of every line of modified source code. This was done to identify any violation of EAC 2005 VVSG coding standards or manufacturer supplied coding standards. The COTS tools utilized by the source code group were Beyond Compare and Crimson Editor. Each identified violation was then recorded by making notes of the standards violation along with directory name, file name, and line number.

#### **Summary Findings**

Two header revision history standards violations were identified and sent to ES&S for resolution. ES&S then corrected the standards violations and re-submitted the source code for re-review. No additional standards violations were identified during the re-review. The Notice of Anomaly (NOA No. 2) documenting that source code discrepancies were found is included in Appendix C of this report.

### **4.2 Trusted Build**

A Trusted Build of the software was created using ES&S's trusted build documents. The "Trusted Builds" were performed by completing the following tasks in the order listed:

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

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

#### 4.2 Trusted Build (Continued)

The “Trusted Builds” for the ES&S EVS 5.0.1.0 include source code, data, and script files, in clear text form. The builds also include COTS software on commercially available media, COTS software downloaded by the VSTL, COTS software verified by SHA1 from the software supplier, and picture and sound files in binary format provided by ES&S. The first step of the process was to clean the hard drives by writing data to every sector of the hard drive, so the drive is cleared of existing data. The designated operating system was then loaded and the applications from the VSTL-reviewed source along with the VSTL verified COTS software was built. The final step was installing the applications on the hardware.

#### Summary Findings

Wyle Laboratories performed Trusted Builds for each system component of EVS 5.0.1.0 on December 20, 2013. A Technical Representative was present for each of the Witnessed Builds. The outputs from the Witness Builds have been supplied to the EAC as part of the certification effort.

#### 4.3 Technical Data Package (TDP) Review

The ES&S, EVS 5.0.1.0 Technical Data Package was reviewed to the 2005 VVSG. This review was performed as part of the pre-testing activities.

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

The TDP documents were reviewed for accuracy, completeness, and compliance to the VVSG. The TDP documentation served as the basis for design and development of the functional tests. Functional testing also identified text in the TDP that conflicted with the actual operation of the system. These discrepancies were reported to ES&S and tracked as test exceptions until verified that the applicable documents had been corrected.

#### Summary Findings

The TDP review results were recorded in a worksheet and sent to ES&S. ES&S corrected all issues and resubmitted the associated documents for review. This process continued until the TDP accurately described the modifications to the system and complied with all TDP Standards. All noted TDP issues were resolved prior to the conclusion of the review process. Notice of Anomaly (NOA No. 1) documenting that TDP discrepancies were found is included in Appendix C of this report.

A summary of the TDP issues encountered is provided below:

- Some descriptive information included was inaccurate.
- Some documents included functionality that was not supported in the voting system.

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

**4.4 Hardware Testing**

EVS 5.0.1.0 is a paper-ballot based optical scan voting system. EVS 5.0.1.0 system consists of four major components: ElectionWare, ERM, DS200 precinct scanner, and DS850 central count scanner. EVS 5.0.1.0 is comprised of two proprietary pieces of hardware; DS200 and DS850. Wyle Laboratories determined that the COTS PCs and laptops are not subject to hardware testing per the EAC 2005 VVSG. The provided PCs and laptops documented in Section 3 Materials Required For Testing all contained CE, UL, and FCC labeling.

DS200 hardware 1.3 – Wyle Laboratories previously performed testing to the EAC 2005 VVSG during the state testing campaign for FL EVS 4.5.0.0 (Wyle Test Report No. T71013.01-01). All hardware testing as noted in table 4-1 was accepted for reuse based on the findings of the evaluation.

**Table 4-1 Hardware Test Examination Results**

Test/EAC 2005 VVSG Section	Procedure/Description	EVS 5.0.1.0 Voting System Component
		DS200 1.3
Electromagnetic Radiation/4.1.2.9	FCC Part 15 Class B for both radiated and conducted emissions	Accept EVS 4.5.0.0
Low Temperature/4.1.2.14	MIL-STD-810D minimum temperature shall be -4°F	Accept EVS 4.5.0.0
Vibration/4.1.2.14	MIL-STD-810D, Method 514.3 physical shock and vibration during handling and transport	Accept EVS 4.5.0.0
Lightning Surge/4.1.2.7	IEC 61000-4-5 (1995-02)	Accept EVS 4.5.0.0
High Temperature/4.1.2.14	MIL-STD-810D, Method 501.2 maximum temperature shall be 140°F	Accept EVS 4.5.0.0
Bench Handling	MIL-STD-810D, Method 516.3 Procedure VI six 4” drops on each edge totaling 24 drops	Accept EVS 4.5.0.0
Electrical Fast Transient/4.1.2.6	IEC 61000-4-4 (2004)	Accept EVS 4.5.0.0
Humidity Test/4.1.2.14	MIL-STD-810D, Method 501.2 ten 24 hour humidity cycles	Accept EVS 4.5.0.0
Electrostatic Disruption/4.1.2.8	IEC 61000-4-2 (1995-01) 15kV air discharge and 8kV contact discharge	Accept EVS 4.5.0.0
Electromagnetic Susceptibility/4.1.2.10	IEC 61000-4-3 (2006) electromagnetic field of 10V/m modulated by a 1kHz, 80% AM modulation at 80MHz to 1000MHz frequency	Accept EVS 4.5.0.0
Conducted RF Immunity/4.1.2.11	IEC 61000-4-6 (1996-04) conducted radio frequency energy	Accept EVS 4.5.0.0
Magnetic Fields Immunity/4.1.2.12	IEC 61000-4-8 (1993-06) AC magnetic fields of 30 A/m at 60Hz	Accept EVS 4.5.0.0
Electrical Power Disturbance/4.1.2.5	IEC 61000-4-11 (1994-06) power surges and dips	Accept EVS 4.5.0.0
Temperature/Power Variation/4.1.2.13	MIL-STD-810D, Method 502.2 and Method 501.2 163 hours at 50°F to 95°F	Accept EVS 4.5.0.0
Safety/4.3.8	UL 60950-1 product safety review	Accept EVS 4.5.0.0

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

##### **4.4.1 Electrical Supply Testing**

Electrical Supply Testing was performed in accordance with Section 4.1.2.4 of Volume I of the VVSG. This test was performed to ensure that the DS200 will continue to provide the capability for any voter who is voting at the time of a failure of the main power supply external to the voting system to complete the casting of a ballot. Additionally, it is required that the voting system perform a successful shutdown without loss or degradation of the voting and audit data, and allow voters to resume voting once the voting system has reverted to back-up power.

To perform the test, the EUT was configured as for normal operation. The EUT was then operated as designed for fifteen minutes prior to the removal of the AC input power. Once AC power was interrupted, the DS200 was continuously operated for a minimum period of two hours until backup power was exhausted. Following the exhaustion of backup power, the AC power was restored and the system was operated for an additional fifteen minutes.

##### **Summary Findings**

The DS200 successfully completed the requirements of the Electrical Supply Test.

##### **4.4.2 Maintainability**

Maintainability Testing was performed in accordance with Section 4.7.2 of Volume II of the VVSG. This test was performed to evaluate the ease with which preventive and corrective maintenance actions can be performed based on the design characteristics of equipment and software and the processes the vendor and election officials have in place for preventing failures and for reacting to failures. It includes the ability of equipment and software to self-diagnose problems and make non-technical election workers aware of a problem and addresses all scheduled and unscheduled events which are performed to determine operational status and make component adjustments or repairs. The DS200 was evaluated with the appropriate vendor documentation, and maintainability was determined based on the presence of specific physical attributes that aid system maintenance activities, and the ease with which system maintenance tasks were able to be performed.

##### **Summary Findings**

The DS200 successfully completed the requirements of the Maintainability Test.

##### **4.5 System Level Testing**

System Level Testing was performed to evaluate the integrated operation of the voting system hardware and software. The suite of tests that comprise the System level Testing includes: System Integration Test, Security Test, Usability and Accessibility Tests, Data Accuracy, as well as the Physical and Functional Configuration Audits.

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

#### 4.5 System Level Testing (Continued)

##### 4.5.1 System Integration Test

An overview of the suite of tests performed during System Level Testing is provided in the following paragraphs, along with the summary findings of each test.

System Integration Testing was performed to test all system hardware, software, and peripherals. System Integration Testing focused on the complete system including all proprietary software, proprietary hardware, proprietary peripherals, COTS software, COTS hardware, and COTS peripherals configured as a precinct count unit as described in the ES&S-submitted TDP for the EVS 5.0.1.0 Voting System. To perform the System Integration Testing, Wyle Laboratories developed specific procedures and test cases designed to test the system as a whole. These procedures demonstrated compliance of the EVS 5.0.1.0 Voting System, to Sections 2, 3, 4, 5, and 6 of Volume I of the VVSG.

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

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

##### Summary Findings

Through System Integration Testing, it was demonstrated that the system performed as documented with all components performing their intended functions.

##### 4.5.2 Security

EVS 5.0.1.0 was subjected to Security Testing in accordance with the requirements of Section 7.0 of Volume I and Section 6.4 of Volume II of the VVSG. The purpose of the Security Test was to verify that the modifications to the EVS 5.0.1.0 did not compromise the security of the DS200 or the ballot box. All other previously certified components of the EVS 5.0.1.0 system were unmodified and therefore accepted for the current test campaign.

##### Summary Findings

The security tie straps/tamper evident seals and their documented installation were analyzed and found to be adequate. Wyle has determined the EVS 5.0.1.0 Voting System to be compliant with the security requirements of the EAC 2005 VVSG.

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

**4.5 System Level Testing (Continued)**

**4.5.3 Accuracy Test**

Per the VVSG, data accuracy is defined in terms of ballot position error rate. This rate applies to the voting functions and supporting equipment that capture, record, store, consolidate, and report the selections (or absence thereof) made by the voter for each ballot position. To meet the requirements of this test, the voting system must be subjected to the casting of a large number of ballots to verify vote recording accuracy, i.e. at least 1,549,703 ballot positions correctly read and recorded.

ES&S-provided ballots that were machine marked and hand marked. The machine marked ballots made up 30% of the ballots, and the hand marked ballots made up 70% of the ballots for the accuracy test. The ballots were used to achieve 1,574,400 ballot positions accurately during this test. The DS200 achieved the necessary ballot positions of 1,549,703 by casting ballots on three DS200. Three machines were utilized for this test and all four ballot orientations were processed during the execution. In addition to the scanning, all results were transmitted to EMS via the wireless and landline modems with all results being verified and determined to be accurate.

Table 4-2 shows the breakdown of how many ballots of the specified ballot size were scanned during the accuracy test.

**Table 4-2 EVS 5.0.1.0 Accuracy Test DS200**

<b>Ballot size</b>	<b>No. of Ballots</b>	<b>No. of Machine Marked</b>	<b>No. of Hand Marked</b>	<b>No. Ballot Positions per Ballot</b>	<b>No. of Machines in Test</b>	<b>No. of times Voted per machine</b>	<b>Total Ballot Positions</b>
11 inch	100	30	70	392	3	2	235,200
14 inch	100	30	70	512	3	2	307,200
17 inch	100	30	70	640	3	2	384,000
19 inch	100	30	70	720	3	3	648,000
<b>Total</b>	<b>400</b>	<b>120</b>	<b>280</b>	<b>N/A</b>	<b>3</b>	<b>N/A</b>	<b>1,574,400</b>

**Summary Findings**

The DS200 successfully met the requirements of the Data Accuracy Test by scanning and processing at least 1,549,703 ballot positions. Wyle Laboratories also transmitted and imported the results successfully to the EMS. No anomalies were noted during the performance of the Accuracy test.

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

#### 4.5 System Level Testing (Continued)

##### 4.5.4 Physical Configuration Audit

A Physical Configuration Audit (PCA) of the EVS 5.0.1.0 Voting System was performed in accordance with Section 6.6 of Volume II of the VVSG. The PCA compares the voting system components submitted for certification with the vendor's technical documentation and confirms that the documentation submitted meets the requirements of the Guidelines. The PCA included the following activities:

- Establishing 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,
- Verifying 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,
- Reviewing drawings, specifications, technical data, and test data associated with system hardware, and to establish system baseline,
- Reviewing manufacturer's documents of user acceptance test procedures and data against system's functional specifications; resolve any discrepancy or inadequacy in manufacturer's plan or data prior to beginning system integration functional and performance tests,
- Subsequent changes to baseline software configuration made during testing, as well as system hardware changes that may produce a change in software operation are subject to re-examination

The PCA performed on EVS 5.0.1.0 consisted of inspecting the following:

- DS200 Hardware Revision 1.2.3.0
- DS200 Hardware Revision 1.3

The PCA performed on the EVS 5.0.1.0 Voting System consisted of inspecting the DS200 scanner, firmware/software, and the TDP used in the EVS 5.0.1.0 Voting System. The PCA for DS200 hardware revision 1.3 was performed during the FL EVS 4.5.0.0 test campaign. Please refer to Appendix C (FL EVS 4.5.0.0 Hardware Test Report T71013.01-01) for additional information. DS200 Hardware revision 1.2.3.0 was examined as part of this campaign.

#### **Summary Findings**

A focused PCA was performed to baseline the system's hardware and software components that were used during the test campaign. No discrepancies were noted during the PCA.

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

#### 4.5 System Level Testing (Continued)

##### 4.5.5 Functional Configuration Audit

An abbreviated Functional Configuration Audit (FCA) was performed on the ES&S EVS 5.0.1.0 Voting System in accordance with Section 6.7 of Volume II of the VVSG. The purpose of the FCA was to verify the modifications to the DS200 and the EMS performed as documented in the ES&S-supplied technical documentation and validate that the modifications meet the requirements of the EAC 2005 VVSG.

To perform the FCA, the EVS 5.0.1.0 Voting System was subjected to a series of tests to test all modifications to the certified system and retest areas around the modification to ensure that those areas continued to function properly. The modification included:

- Functional change to update print results report candidates in rotation order to match ballot layout.
- Print scanner board hardware type on tape
- Implemented the use of the 8-bit "Scanner ID" field to report the scanner board firmware
- Integrated ability to read and report Power Management Board firmware version
- Report motherboard version on configuration report and in log

Testing was performed on the DS200 for hardware Version 1.2.3 (ECO 1281) to verify the modifications functioned properly.

Testing was also performed on the DS850 for the Datawin COTS firmware updates to verify the modifications functioned properly.

##### Summary Findings

A Functional Configuration Audit of the DS200, DS850, and the EMS was performed to verify that the modification and added functionality operated as described in the system's technical documentation. The voting system successfully met the requirements of the 2005 VVSG.

##### 4.5.6 Usability and Accessibility

The EVS 5.0.1.0 Voting System was subjected to Usability and Accessibility Tests in accordance with Volume I, Section 3 of the EAC 2005 VVSG. The purpose of this testing was to assess the modified DS200 conforms to the usability and accessibility requirements in the EAC 2005 VVSG. Conformance to these requirements should result in quality interaction between the voter and the voting system and the effectiveness with which the system provides a comfortable and efficient voting session that provides confidence to the voter that their votes are cast correctly.

The Usability and Accessibility requirements set forth by the VVSG and the Help America Vote Act (HAVA) ensure that all eligible voters are provided the ability to vote without discrimination regardless of any disabilities. As stated in the VVSG, to meet the requirements of the Usability and Accessibility Test, the voting system shall: conform to the specified usability requirements of Volume I, Section 3.1; provide the capabilities required by Volume I, Section 3.2; and operate consistently with vendor specifications and documentation.

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

#### 4.5 System Level Testing (Continued)

#### 4.5.6 Usability and Accessibility (Continued)

##### Summary Findings

The DS200 successfully completed the requirements of the Usability and Accessibility Test.

#### 4.5.7 Quality Assurance and Configuration Management

A limited QA/CM review was performed on all applicable system components to verify that the submitted modifications follow ES&S documented QA/CM process. This review concentrated on Functional Configuration Audit, Configuration Identification, Release Process and Quality Conformance Inspection as these are the areas impacted by modifications.

##### Summary Findings

EVS 5.0.1.0 successfully met the requirements of the Quality Assurance and Configuration Management review.

#### 4.6 Anomalies and Resolutions

A total of two Notices of Anomaly were issued throughout the test campaign upon occurrence of a verified failure, an unexpected test result, or any significant unsatisfactory condition. All anomalies encountered during testing were successfully resolved prior to test completion. The Notices of Anomaly generated during testing are presented in their entirety in Appendix C and are summarized below along with their resolution.

##### Notice of Anomaly No. 1: TDP Review

Review of the submitted documentation revealed discrepancies between the TDP and the EAC 2005 VVSG requirements. Each noted discrepancy was documented in detail in the Wyle Laboratories generated TDP issues matrix that is on file as raw data.

##### Resolution to Anomaly No. 1:

EVS 5.0.1.0 is a Modification of a previously certified system. As such the TDP was only reviewed where modified or where impacted by system modification. ES&S corrected each nonconformance observation and resubmitted the associated documents for review. This process continued until the TDP complied with all applicable requirements.

##### Notice of Anomaly No. 2: Source Code Review

Review of the submitted source code comprising the EVS 5.0.1.0 Voting System revealed deviations from the 2005 VVSG.

##### Resolution to Anomaly No. 2:

Upon completion of the review for each source code submission, a technical summary report of all identified standards violations was sent to ES&S for resolution. ES&S then corrected the reported discrepancies and re-submitted the source code for re-review. All discrepancies were resolved by ES&S before the conclusion of the test campaign.

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

**4.5 System Level Testing (Continued)**

**4.7 Recommendation for Certification**

Wyle Laboratories concludes that EVS 5.0.1.0, submitted by ES&S, meets all applicable requirements for certification as set forth in the Election Assistance Commission (EAC) 2005 Voluntary Voting Systems Guidelines, Version 1.0, as well as passes all additional tests performed at Wyle Laboratories' discretion. As such, Wyle Laboratories recommends that the EAC grant the ES&S EVS 5.0.1.0, certification to the VVSG.

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

**Due to the varying requirements of individual jurisdictions, it is recommended by the EAC 2005 VVSG that local jurisdictions perform pre-election logic and accuracy tests on all systems prior to their use in an election within their jurisdiction.**

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