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TEST REPORT

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NATIONAL CERTIFICATION TEST REPORT
FOR
CERTIFICATION TESTING
OF THE
ELECTION SYSTEMS & SOFTWARE
EVS 5.0.0.0 VOTING SYSTEM

for

Election Systems & Software, LLC
11208 John Galt Blvd.
Omaha, NE 68137-2364

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

SEAL

SUBSCRIBED and sworn to before me this 1 day of May 2013

Sandra A. Daniel

Notary Public in and for the State of Alabama at Large

My Commission expires June 2, 2015

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

PREPARED BY: Stephen Han, Project Engineer — 5-1-13 Date

APPROVED BY: Frank Padilla, Voting Systems Manager — 5-1-13 Date

WYLE Q. A.: Raul Terceno, Q. A. Manager — 5/1/13 Date

NVLAP LAB CODE 200771-0

EAC Lab Code 0704

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APPENDICES

1.0 INTRODUCTION

1.1 Scope

This report presents the test results for a full certification testing campaign of the Election Systems & Software (ES&S) EVS 5.0.0.0 voting system. The primary purpose of Certification Testing was to demonstrate that the system meets or exceeds the requirements of the Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (VVSG). The certification test procedure was intended to discover non-conformities to the EAC 2005 VVSG for system operations which, should they occur in actual election use, could result in failure to complete election operations in a satisfactory manner. The tests were also intended to demonstrate system compliance with levels of design, performance, and quality claimed by the manufacturer.

This report is valid only for the system identified in Section 2 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.

1.2 Objective

The objective of this test program was to ensure that the ES&S EVS 5.0.0.0 complied with the hardware and software requirements of the EAC 2005 VVSG. The scope and detail of the requirements tested in certification were selected to correspond to the design and complexity of the system submitted by ES&S for testing. The examination included focused in-depth examination of the voting system, the inspection and evaluation of system documentation and execution of functional tests to verify system performance and function under normal and abnormal conditions.

1.3 Test Report Overview

This test report consists of four main sections and appendices:

- 1.0 Introduction – Provides: the architecture of the National Certification Test Report (hereafter referred to as Test Report), a brief overview of the testing scope of the Test Report, a list of documentation, customer information, and references applicable to the voting system hardware, software, and this test report.
- 2.0 System Identification – Provides information about the system tested that includes the system name and major subsystems, test support hardware, and specific documentation provided by the vendor used to support testing.
- 3.0 Test Background – Contains information about the certification test process and a list of terms and nomenclature pertinent to the Test Report and system tested.
- 4.0 Test Procedures and Results – Provides a summary of the results of the testing process.
- Appendices– Information supporting reviews and testing of the voting system are included as appendices to this report. These includes: Notices of Anomaly, Hardware Test Report, Functional Configuration Audit Test Case Procedure Specification, Security Test Case Procedure Specification, Usability Test Case Procedure Specification, Election Definitions, Technical Data Package Review Report, Source Code Review Report, Physical Configuration Audit Report, Security Assessment Report, Deficiency Report, Summative Usability Report, Warrant of Accepting Change Control responsibility letter; Witnessed Build, as-run Certification Test Plan, Requirement Matrix, Conformity Statement, and Attestation of Durability.

1.0 INTRODUCTION (Continued)

1.4 Customer

Election Systems & Software, LLC
11208 John Galt Blvd.
Omaha, NE 68137-2364

1.5 References

The documents listed were utilized to perform testing.

- Election Assistance Commission 2005 Voluntary Voting System Guidelines, Volume I, Version 1.0, "Voting System Performance Guidelines," and Volume II, Version 1.0, "National Certification Testing Guidelines", dated December 2005
- Election Assistance Commission Testing and Certification Program Manual, Version 1.0, effective date 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 107th 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, Revision 5
- ANSI/NCSL Z540-1, "Calibration Laboratories and Measuring and Test Equipment, General Requirements"
- ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment"
- EAC Requests for Interpretation and Notices of Clarification (listed on www.eac.gov)

A listing of the EVS 5.0.0.0 Voting System Technical Data Package (TDP) Documents submitted for this test effort is listed in Section 2.5, "Vendor Technical Data Package,"

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2.0 SYSTEM IDENTIFICATION AND OVERVIEW

2.1 System Overview

The ES&S EVS 5.0.0.0 Voting System is a paper-based, digital scan voting system. The EVS 5.0.0.0 Voting System hardware consists of five major components:

1. Election Management System (EMS) Server
2. Election Management System (EMS) client (desktop and/or laptop) with Election Reporting Manager (ERM)
3. Polling Place Scanner – DS200
4. Polling Place American Disability Act (ADA) Devices – AutoMARK A100, AutoMARK A200, and AutoMARK A300
5. Central Count Digital Scanner – DS850

The following paragraphs describe the design and structure of the EVS 5.0.0.0 Voting System as taken from the ES&S Technical Documentation.

2.1.1 System Hardware

Precinct Ballot Tabulator: DS200

The precinct ballot tabulator component is the DS200. The DS200 is a digital scan paper ballot tabulator designed for use at the polling place level. After the voter marks a paper ballot, their ballot is inserted into the unit and immediately tabulated. The tabulator uses a high-resolution image-scanning device to image the front and back of the ballot simultaneously. The resulting ballot images are then processed by a proprietary mark recognition engine.

The system includes a 12-inch touch screen display providing voter feedback and poll worker messaging. Once a ballot is tabulated and the system creates cast vote records, the ballot is dropped into an integrated ballot box. The DS200 includes an internal thermal printer for the printing of the zero reports, log reports, and polling place totals upon the official closing of the polls.

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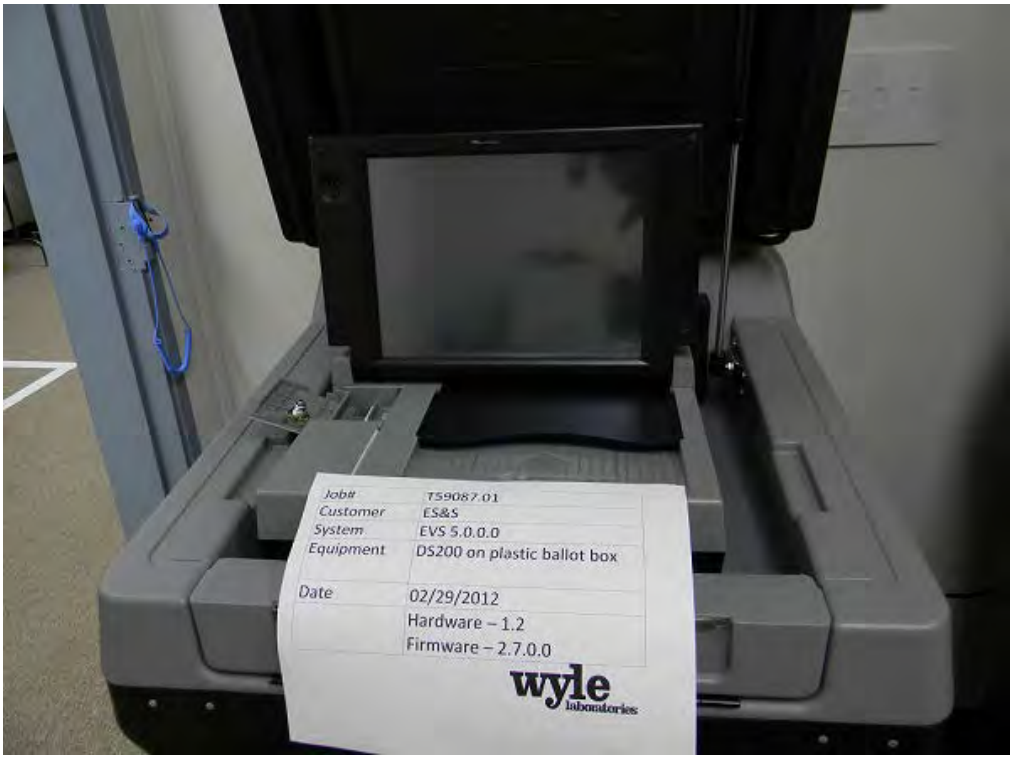

Photograph No. 1: DS200 (on plastic ballot box)

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Photograph No. 2: DS200 (on metal ballot box)

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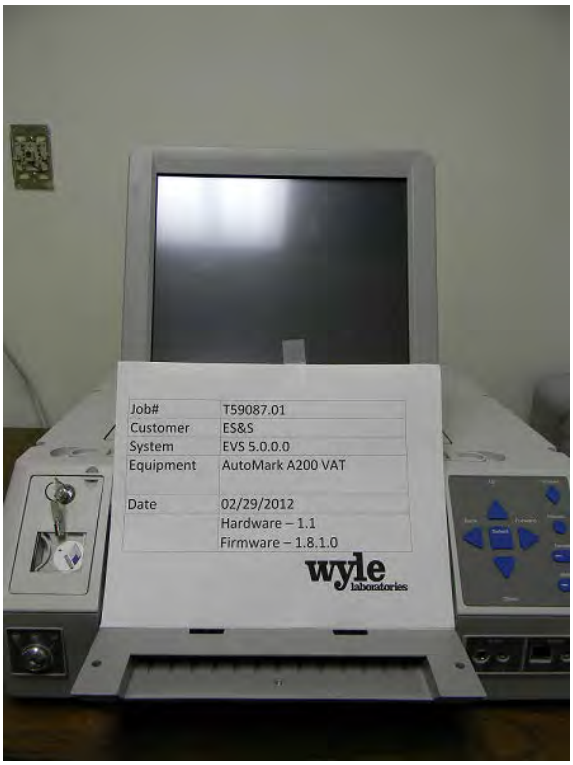
Electronic Ballot Marking Device: AutoMARK™ Voter Assist Terminal (VAT)

The electronic ballot marking device component is the ES&S AutoMARK™ Voter Assist Terminal (VAT). The AutoMARK™ VAT assists voters with disabilities by marking optical scan ballots.

The AutoMARK™ VAT includes two user interfaces to accommodate voters who are visually or physically impaired or voters who are more comfortable reading or hearing instructions and choices in an alternative language. The AutoMARK™ is equipped with a touch-screen and keypad. The touch-screen interface includes various colors and effects to prompt and guide the voter through the ballot marking process. Each key has both Braille and printed text labels designed to indicate function and a related shape to help the voter determine its use.

Regardless whether the voter uses the touch-screen or other audio interface, changes can be made throughout the voting process by navigating back to the appropriate screen and selecting the change or altering selections at the mandatory vote summary screen that closes the ballot-marking session.

The A100, A200 and A300 all operate the same and have the same features. The difference between the models is the location of two printed circuit boards and related wiring harness and cables. In the A200, the Printer Engine Board and Power Supply Board were moved from under the machine to the top. The A300 has a different lock and label. Since this change is so minor, the A300 equipment was only tested in the Accuracy and System Integration Tests. Therefore, the A300 is included in the recommendation for certification.



Photograph No. 3: AutoMARK™ A200 VAT

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Photograph No. 4: AutoMARK™ A100 VAT

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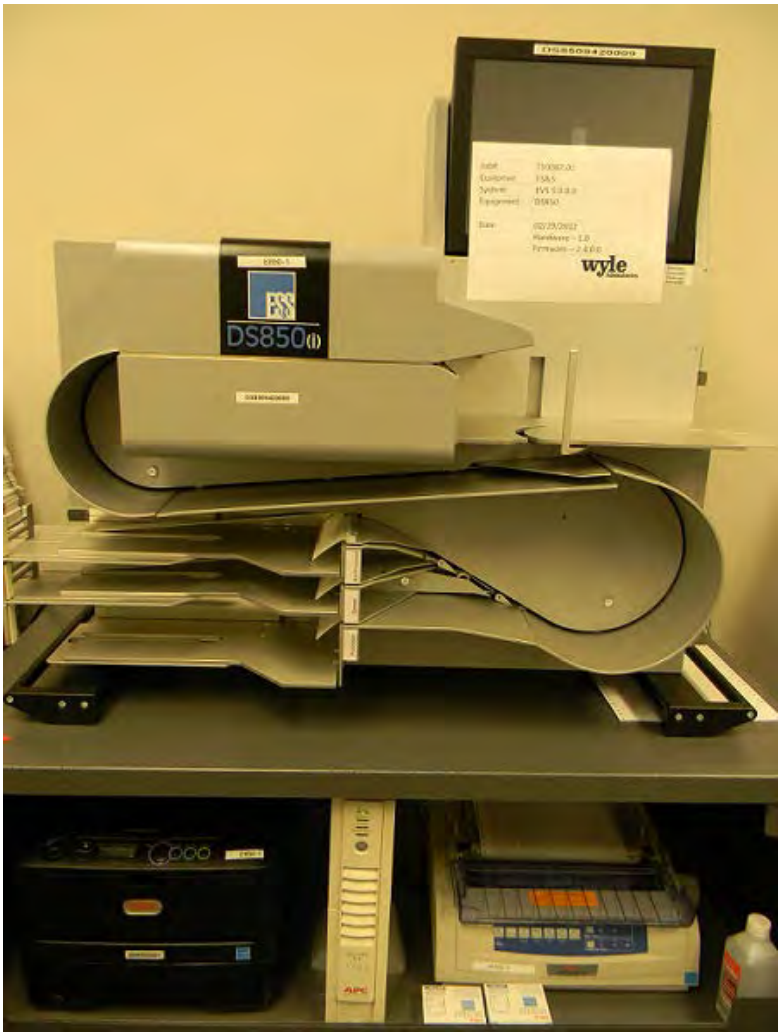
Tabulator: DS850

The DS850 is a high-speed, digital scan central ballot counter. During scanning, the DS850 prints a continuous audit log to a dedicated audit log printer and can print results directly from the scanner to a second connected printer. The scanner saves results internally and to results collection media that officials can use to format and print results from a PC running Election Reporting Manager. The DS850 has an optimum throughput rate of 300 ballots per minute and uses cameras and imaging algorithms to image the front and back of a ballot, evaluate the results and sort ballots into discrete bins to maintain continuous scanning.



Photograph No. 5: DS850

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EMS Client Server Configuration

EVS 5.0.0.0 Voting System Election Management System (EMS) was configured with a Server running Windows Server 2008 R2 and a combination of a client laptop and a client desktop running Windows 7 Professional.

Photograph No. 6: EMS Server

Photograph No. 7: EMS Client Laptop

Photograph No. 8: EMS Client Desktop

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2.1.2 System Software

The EVS 5.0.0.0 Voting System EMS is an application suite comprised of five components: ElectionWare, Election Reporting Manager (ERM), Removable Media Service (RMS), ES&S Event Logging Service (UELS), and VAT Previewer.

ElectionWare

ElectionWare integrates the election administration functionality into a unified application. Its intended use is to define an election and create the resultant media files used by the DS200 tabulator, AutoMARK Voter Assist Terminal (VAT), the DS850 Central Ballot Scanner, and Election Reporting Manager (ERM). An integrated ballot viewer allows election officials to view the scanned ballot and captured ballot data side-by-side and produce ballot reports.

Election Reporting Manager (ERM)

Election Reporting Manager (ERM) generates paper and electronic reports for election workers, candidates, and the media. Jurisdictions can use a separate ERM installation to display updated election totals on a monitor as ballot data is tabulated, and send the results' reports directly to the media outlets.

ERM supports accumulation and combination of ballot results data from all ES&S tabulators. Precinct and accumulated total reports provide a means to accommodate candidate and media requests for totals and are available upon demand. High-speed printers are configured as part of the system accumulation/reporting stations PC and related software.

Removable Media Service (RMS)

Removable Media Service (RMS) is an application that runs in the background of the EMS client workstation and supports the insertion and removal of election and results USB media.

ES&S Event Logging Service (UELS)

ES&S Event Logging Service leverages the Windows Event Viewer, included with a standard Windows installation, to audit user interactions with the ES&S Election Management System.

VAT Previewer

The VAT Previewer is an application within the EMS program that allows the user to preview audio text and screen layout prior to burning Election Day media for the AutoMARK.

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2.1.3 System Operational Concept

The operational flow and low-level system interfaces for the EVS 5.0.0.0 Voting System is illustrated in Figure 1-1.

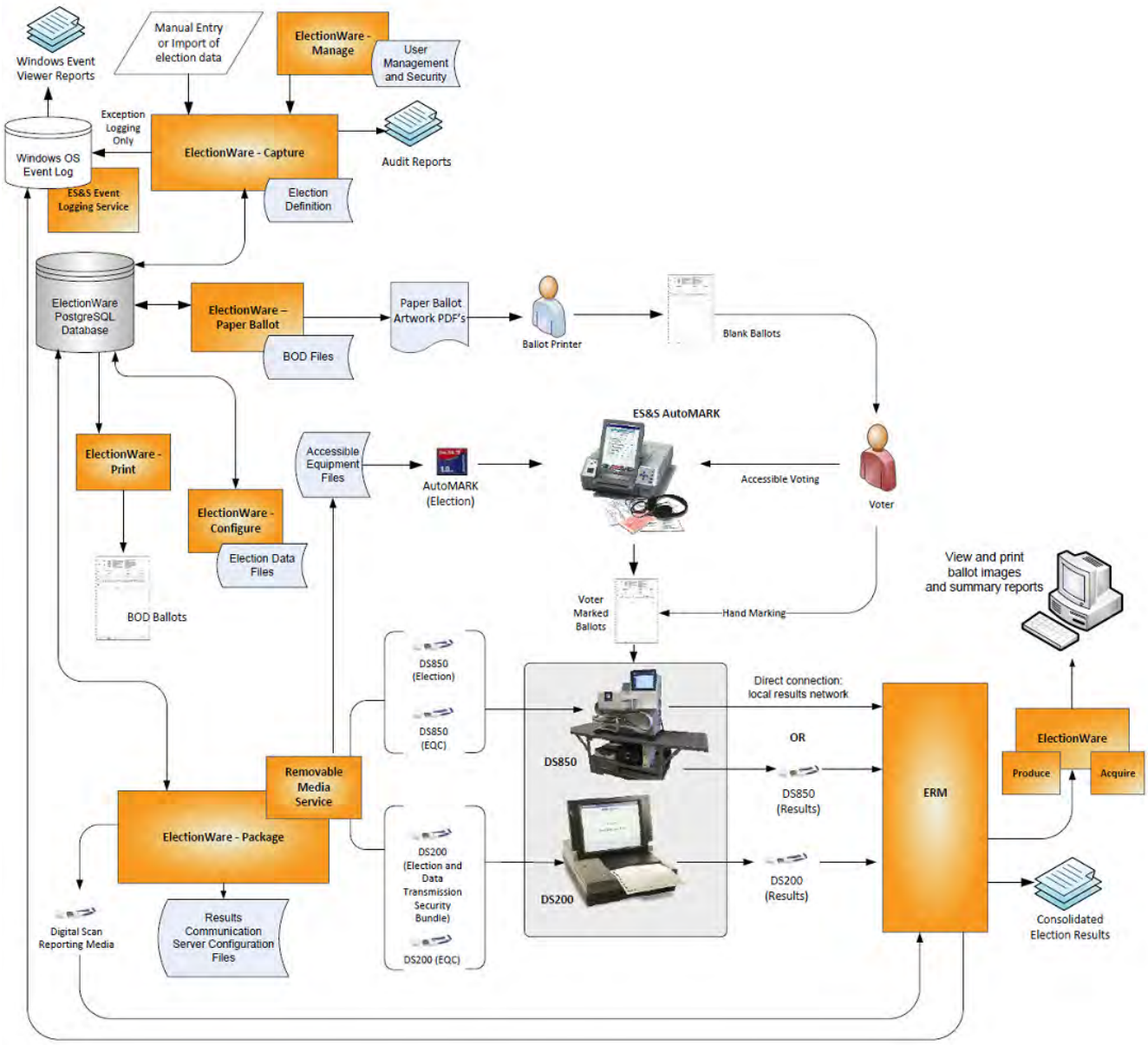

Figure 1-1 System Overview Diagram

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2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)

2.2 Software

This section defines the two types of software required for testing: software used for the testing of hardware, software, security and system integration; and supporting software required for the test environment (operating systems, compliers, assemblers, database managers, and any other supporting software). All COTS third-party software was downloaded or retrieved by Wyle qualified personnel. These products were verified not to have been modified and were built into the EVS 5.0.0.0 for the entire test campaign. Wyle believes these components to have proven performance in other commercial applications. Both COTS and non-COTS software components are listed in this section.

Table 2-1 EVS 5.0.0.0 EMS Software Platform Component Descriptions

Software Required For Testing	Software Version
ElectionWare	4.1.0.0
Election Reporting Manager (ERM)	8.6.0.0
ES&S Event Logging Service	1.5.0.0
VAT Previewer	1.8.1.0
Removable Media Service	1.4.0.0

Table 2-2 EVS 5.0.0.0 EMS COTS Software Platform Component Descriptions

Software Required For Testing	Description
Windows 7 Professional, with SP1	Original Disk
Windows Server 2008 R2, with SP2	Original Disk
Adobe Acrobat Standard version 9.0 or better	Original Disk
RM/Cobol	12.06
Microsoft Office Excel 2007 or better	Original Disk

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2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)

2.3 Hardware

The system submitted by ES&S for certification testing consisted of the following hardware, firmware, and software source code components.

Table 2-3 EVS 5.0.0.0 Voting System Equipment Description

Equipment	Manufacturer	Version/Model	Specifications	Serial Number
EMS Client Laptop	Dell	Latitude E6410	Intel Core i5 CPU M580 @ 2.67GHz 4.00 GB Installed RAM HD Capacity 250 GB	2FD65Q1
EMS Server	Dell	T710	Intel Xeon CPU E5645 @ 2.40GHz (2 processors), 12.0 GB Installed RAM HD Capacity 300 GB	JPZ6VR1
EMS Client Desktop	Dell	OptiPlex 980	Intel Core i5 CPU 650 @ 3.20 GHz 4.0 GB Installed RAM HD Capacity 320 GB	3TZJFQ1

Table 2-4 Build Machine Description

Equipment	Manufacturer	Version/Model	Serial Number	COTS/ Non-COTS
Build 1	Dell OptiPlex 760	Processor: Intel Duo Core E8400 Wolfdale Memory: 4x 1GB, 800 MHz Ram Hard Drive Capacity: 80 GB	6D7DJG1	COTS
Build 2	Dell OptiPlex 760	Processor: Intel Duo Core E8400 Wolfdale Memory: 4x 1GB, 800 MHz Ram Hard Drive Capacity: 80 GB	6DCKJG1	COTS
Build 3	Dell Precision T3500	Processor: Intel X5650 2.66/6.4 12MB Xeon Westmere Memory: 1x 2GB, 1333 MHz Ram Hard Drive Capacity: 160 GB	15TMMN1	COTS
Build 4	Dell Precision T3500	Processor: Intel X5650 2.66/6.4 12MB Xeon Westmere Memory: 1x 2GB, 1333 MHz Ram Hard Drive Capacity: 160 GB	15TNMN1	COTS

Table 2-5 EVS 5.0.0.0 Voting System Equipment

Equipment	Description	Serial Numbers
AutoMARK	Voting Assist Terminal (A100)	AM0106421217
AutoMARK	Voting Assist Terminal (A100)	AM0106431607
AutoMARK	Voting Assist Terminal (A200)	AM0106431648
AutoMARK	Voting Assist Terminal (A200)	AM0206442952
AutoMARK	Voting Assist Terminal (A200)	AM0206443671
AutoMARK	Voting Assist Terminal (A200)	AM0206443734

2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)

2.3 Hardware (Continued)

Table 2-5 EVS 5.0.0.0 Voting System Equipment (Continued)

Equipment	Description	Serial Numbers
AutoMARK	Voting Assist Terminal (A200)	AM0208470626
AutoMARK	Voting Assist Terminal (A200)	AM0208470638
AutoMARK	Voting Assist Terminal (A200)	AM0208470705
AutoMARK	Voting Assist Terminal (A200)	AM0208470828
AutoMARK	Voting Assist Terminal (A300)	AM0307420270
AutoMARK	Voting Assist Terminal (A300)	AM0307430730
AutoMARK	Voting Assist Terminal (A300)	AM0307431421
AutoMARK	Voting Assist Terminal (A300)	AM0308421809
DS200	Precinct Count Digital Scanner	DS0110340034
DS200	Precinct Count Digital Scanner	DS0110340480
DS200	Precinct Count Digital Scanner	ES0108330100
DS200	Precinct Count Digital Scanner	ES0108340085
DS200	Precinct Count Digital Scanner	ES0108340579
DS850	Central Count Digital Scanner	DS8509420009
DS850	Central Count Digital Scanner	DS8509420037
DS850	Central Count Digital Scanner	DS8511090074
DS850	Central Count Digital Scanner	DS8511090075
Ballot Box Hardware v. 1.2,1.3	Plastic Ballot Box	E076, E089, E099, T59087-Box 2, T59087-Box 3, T59087-Box 5
Ballot Box Hardware v. 1.0,1.1,1.2	Metal Box with Diverter	E015, E017, T59087 –Metal Box-12, T59087 – Metal Box-13

2.4 Test Tools/Materials

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

The following test materials are required to support the EVS 5.0.0.0 certification testing:

Table 2-6 Test Support Materials

Test Material	Quantity	Make	Model
Ballot on Demand Printer	1	OKI Data	C9650
8 ½" X 11" Paper in Speed Loading Box (2700 Sheets)	4	Dot Matrix	951027
Security Seals	5000	Intab	800-0038R

2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)

2.4 Test Tools/Materials (Continued)

Table 2-6 Test Support Materials (Continued)

Test Material	Quantity	Make	Model
Security Locks	20	E. J. Brooks	86022
	25	E. J. Brooks	6024
	50	American Casting Corp.	00561-03
ES&S Pens	20	BIC	Grip Roller
Ethernet Switch	1	Dell	HNC67M1
Security Sleeves	7	ES&S	PS-S7-936
CF Card Reader	1	SanDisk	018-6305
Magnifier	3	---	---
Blue Security Ballot Storage/Transport Box	2	---	---
Headphone Covers	30	---	---
Paddles (yes/no)	3	---	---
Transport Media (USB Flash Drives)	5	Delkin	512 MB Capacity
	10	Delkin	1.0 GB Capacity
	5	Delkin	2.0 GB Capacity
	75	Delkin	4.0 GB Capacity
	5	Delkin	8.0 GB Capacity
Compact Flash	10	SanDisk	1.0 GB Capacity
	10	SanDisk	2.0 GB Capacity
	10	Toshiba	1.0 GB Capacity

2.5 Vendor Technical Data Package

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

The documents listed in Table 2-7 comprise the EVS 5.0.0.0 Voting System TDP:

2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)

2.5 Vendor Technical Data Package (Continued)

Table 2-7 EVS 5.0.0.0 Voting System TDP

EVS 5.0.0.0 TDP Documents	Version	Doc. No.	Document Code
Voting System Overview	15.0	01-01	EVS5000_OVR00
System Functionality Description			
System Functionality Description – Voting System	8.0	02-01	EVS5000_SFD00
System Hardware Specification			
System Hardware Specification – DS850	3.0	03-01	EVS5000_SHS00_DS850
System Hardware Specification – DS200	2.0	03-02	EVS5000_SHS00_DS200
AutoMARK™ System Hardware Overview	5.0	03-04	AutoMARK™_ESS_System_Hardware_Overview_AQS-18-5002-000-S
AutoMARK™ System Hardware Specification	5.0	03-05	AutoMARK™_ESS_System_Hardware_Specification_AQS-18-5000-001-F
Software Design and Specification			
Software Design and Specification – ES&S Event Logging Service	1.0	04-01	EVS5000_SDS00_UELS
Software Design and Specification - ElectionWare	7.0	04-02	EVS5000_SDS00_ElectionWare
Software Design and Specification – ERM	3.0	04-03	EVS5000_SDS00_ERM
Software Design and Specification – DS850	10.0	04-04	EVS5000_SDS00_DS850
Software Design and Specification – DS200	7.0	04-05	EVS5000_SDS00_DS200
Software Design and Specification – AutoMARK™	1.8	04-06	EVS5000_SDS00_AutoMARK™ SDS Overview
System Development Program	1.0	04-07	ESSSYS_SG_P_1000_SystemDevProgram
ES&S Standards and Procedure Coding Standards	1.0	04-08	ESSSYS_D_D_0100_Coding Standards
System Test/Verification Specification			
Voting System Test Plan	4.0	05-01	EVS5000_STP00
Test Cases - ElectionWare: Manage	4.1.0.0	05-02	EVS5000_TC00_ElectionWare01_Manage
Test Cases - ElectionWare: Define	4.1.0.0	05-03	EVS5000_TC00_ElectionWare02_Define
Test Cases - ElectionWare: Design	3.3	05-04	EVS5000_TC00_Electionware03_Design
Test Cases - ElectionWare: Deliver	4.1.0.0	05-05	EVS5000_TC00_Electionware04_Deliver
Test Cases - ElectionWare: Resolve	4.2.0.0	05-06	EVS5000_TC00_Electionware05_Resolve
Test Cases - ERM	8.6.0.0	05-07	EVS5000_TC00_ERM
Test Cases - DS850	2.4.0.0	05-08	EVS5000_TC00_DS850
Test Cases - DS200	2.7.0.0	05-09	EVS5000_TC00_DS200
Test Cases - AutoMARK™	1.8.1.0	05-10	EVS5000_TC00_AutoMARK™

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2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)

2.5 Vendor Technical Data Package (Continued)

Table 2-7 EVS 5.0.0.0 Voting System TDP (Continued)

EVS 5.0.0.0 TDP Documents	Version	Doc. No.	Document Code
System Security Specification			
System Security Specification	3.1	06-01	EVS5000_SSS00
AutoMARK™ System Security Specifications	6.0	06-02	AutoMARK™ ESS System Security Specification AQS-18-5002-001-S
System Operations Procedure			
System Operations Procedures - UELS	1.0	07-01	EVS5000_SOP00_ELS
User's Guide- ElectionWare Admin	4.8	07-02	EVS5000_SOP00_ElectionWare02_Admin
User's Guide- ElectionWare Define	4.0	07-03	EVS5000_SOP00_ElectionWare02_Define
User's Guide - ElectionWare Design	3.2	07-04	EVS5000_SOP00_ElectionWare03_Design
User's Guide - ElectionWare Deliver	5.6	07-05	EVS5000_SOP00_ElectionWare04_Deliver
User's Guide - ElectionWare Results	1.5	07-06	EVS5000_SOP00_ElectionWare05_Results
User's Guide - ERM	8.6	07-07	EVS5000_SOP00_ERM
Operator's Guide - DS850	11.4	07-08	EVS5000_SOP00_DS850
Operator's Guide - DS200	10.1	07-09	EVS5000_SOP00_DS200
System Operations Procedures - AutoMARK™	5.0	07-10	EVS5000_SOP00_AMVAT
Network Configuration Guide	3.1	07-12	EVS5000_SOP00_NetworkConfigGuide
System Maintenance Manuals			
Maintenance Guide- DS850	3.1	08-01	EVS5000_SMM00_DS850
Maintenance Guide- DS200	3.1	08-02	EVS5000_SMM00_DS200
Maintenance Guide- AutoMARK™	4.0	08-03	EVS5000_SMM00_AMVAT
Personnel Deployment and Training			
Personnel Deployment and Training Program	1.0	09-01	ESSSYS_T_D_1000_TrainingProgram
Configuration Management Plan			
ES&S Configuration Management Program	1.0	10-1	ESSSYS_CM_P_1000_ESSCMProgram
CM Plan Appendices	---	10-2	Multiple Documents
QA Program			
Manufacturing Quality Assurance Plan	1.0	11-01	ESSSYS_M_P_1000_MNFQualityAssurancePlan
Engineering Change Order Process	1.0	11-02	ESSSYS_M_P_0500_ECOProcess
Software Quality Assurance Program	1.0	11-03	ESSSYS_Q_P_0100_SoftwareQualityAssuranceProgram
Other TDP Documents			
ES&S Ballot Production Guide	4.0	13-01	U3400R1_ORPT02_BallotProductionGuide

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2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)

2.6 Deliverable Materials

The materials listed on Table 2-8 are identified by ES&S to be delivered as part of the EVS 5.0.0.0 Voting System to the end users.

Table 2-8 EVS 5.0.0.0 Voting System Deliverables

Deliverable Material	Version	Description
ERM	8.6.0.0	EMS
ElectionWare	4.1.0.0	EMS
ES&S Event Logging Service	1.5.0.0	EMS
Removable Media Services	1.4.0.0	EMS
VAT Previewer	1.8.1.0	EMS
DS200	Firmware 2.7.0.0; Hardware 1.2	Precinct ballot scanner
AutoMARK™ A100	Firmware 1.8.1.0; Hardware 1.0	Voter Assist Terminal
AutoMARK™ A200	Firmware 1.8.1.0; Hardware 1.1, 1.3	Voter Assist Terminal
AutoMARK™ A300	Firmware 1.8.1.0; Hardware 1.3	Voter Assist Terminal
DS850	Firmware 2.4.0.0; Hardware 1.0	Central ballot scanner
OKI Printer	B430dn, B431dn	Laser Report Printer
OKI Printer	Microline 420	Dot Matrix Printer
Headphones	Avid FV 60	Stereo headphones
Voting System Overview EVS 5.0.0.0	15.0	TDP Document
ES&S ElectionWare 4.1 Vol. I: Administrator's Guide	4.8	TDP Document
ES&S ElectionWare 4.1 Vol. II: Define User's Guide	3.8	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
ES&S DS200 System Operations Procedures	10.1	TDP Document
ES&S DS850 System Operations Procedures	2.4	TDP Document
AutoMARK™ system Operations Procedures	5.0	TDP Document
ES&S ERM System Operations Procedures	8.6	TDP Document
Network Configuration Guide	3.1	TDP Document
EVS Event Logging Service System Operations Procedures	1.0	TDP Document
Voting System Security Specification EVS 5.0.0.0	3.1	TDP Document
Jurisdiction Security Practices Template	1.0.0.1	TDP Document
Hardening the EMS PC Guide	4.0	TDP Document

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2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)

2.7 End User Documentation

The following documents constitute the deliverables to the end user at election central:

- Voting System Overview EVS 5.0.0.0, Version 15.0
- ES&S ElectionWare 4.1 Vol. I: Administrator's Guide, Revision 4.8
- ES&S ElectionWare 4.1 Vol. II: Define User's Guide, Revision 4.0
- ES&S ElectionWare 4.1 Vol. III: Design User's Guide, Revision 3.2
- ES&S ElectionWare 4.1 Vol. IV: Deliver User's Guide, Revision 5.6
- ES&S ElectionWare 4.1 Vol. V: Results User's Guide, Revision 1.5
- ES&S DS200 System Operations Procedures, Revision 10.1
- ES&S DS850 System Operations Procedures, Revision 2.4
- AutoMARK™ System Operations Procedures, Revision 5.0
- ES&S ERM System Operations Procedures, Revision 13.1
- Network Configuration Guide, Revision 3.1
- EVS Event Logging Service System Operations Procedures, Revision 1.0
- Voting System Security Specification EVS 5.0.0.0, Revision 3.1
- Personnel Deployment and Training, Revision 1.0

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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 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)

3.1 General Information

All testing performed as part of the test effort was performed at the Wyle Laboratories' Huntsville, Alabama facility with the exception of the DS200 and AutoMARK Product Safety Review which was performed by a third party test laboratory at the location listed below. DS850 Product Safety Review was performed by Wyle Laboratories for iBeta as part of the Unity 5.0.0.0 Certification Effort. Certification testing included: the inspection and evaluation of voting system documentation, tests of voting system under conditions simulating the intended storage, operation, transportation, and maintenance environments; and operational tests verifying system performance and function under normal and abnormal conditions. Qualification/Certification testing was limited to the ES&S EVS 5.0.0.0 Voting System, which includes items listed in Section 2 of this report.

The DS200 and AutoMARK Product Safety Reviews were performed by the following NRTL and OSHA certified laboratory and all testing was witnessed onsite by Wyle Laboratories:

MET Laboratories, Inc.
Safety Certifications
901 Sheldon Drive
Cary, NC 27513

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 and System Integration test utilizing the "Wyle Baseline Test Cases" along with test cases specially designed for the ES&S EVS 5.0.0.0. The data input during these tests consisted of the predefined election definitions as contained in Appendix A.6 of this report.
- **Section 3: Usability and Accessibility** – The requirements in this section were tested during the Usability Test, FCA, and System Integration test utilizing a combination of the "Wyle Baseline Test Cases" and the "Wyle Baseline Usability Test Cases." The data input during this test consisted of the predefined election definitions contained in Appendix A.6 of this report.
- **Section 4: Hardware Requirements** – The requirements in this section were tested by trained Wyle personnel per sections 4.5 of this report.
- **Section 5: Software Requirements** – The requirements in this section were tested during source code review, TDP review, and FCA. A combination of review and functional testing was performed to ensure these requirements were met.

3.0 TEST BACKGROUND (Continued)

3.2 Testing Scope (Continued)

- **Section 6: Telecommunication** – The requirements in this section only apply to the EMS components and the DS850. They were tested in FCA, System Integration, and Accuracy
- **Section 7: Security Requirements** – The requirements in this section were tested during source code review, FCA, System Integration, and Security Tests.
- **Section 8: Quality Assurance (QA) Requirements** – The requirements in this section were tested throughout the test campaign via various methods. TDP review was performed on the ES&S 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. 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. During source code review, Wyle qualified personnel verified that ES&S was following EAC 2005 VVSG CM requirements as well as ES&S CM requirements. 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 ES&S EVS 5.0.0.0 Voting System is a paper- based precinct counting system. Therefore, all EAC 2005 VVSG requirements intended for DRE were excluded from this test campaign, as well as the following:

- 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 5.0.0.0 Voting System to the requirements contained in the indicated sections of the EAC 2005 VVSG is described in Table 3-1.

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3.0 TEST BACKGROUND (Continued)

3.2 Testing Scope (Continued)

Table 3-1 Not Applicable Requirements

EAC 2005 VVSG Volume I Section	Rationale for 'Not Applicable'
6, 7.5.2-7.5.4	These requirements are written for use on public networks. The ES&S EVS 5.0.0.0 Voting System does not use public networks.
7.6	This section pertains to "Voting systems that transmit data over public telecommunications…" The ES&S EVS 5.0.0.0 Voting System as configured for this certification does not permit transmission over public networks.
7.7	No wireless technology is present in ES&S EVS 5.0.0.0 Voting System.
7.9	The ES&S EVS 5.0.0.0 Voting System is a paper based system.

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

This subsection defines all terms and abbreviations applicable to the development of the Test Plan.

Table 3-2 Terms and Abbreviations

Term	Abbreviation	Definition
Americans with Disabilities Act of 1990	ADA	ADA is a wide-ranging civil rights law that prohibits, under certain circumstances, discrimination based on disability.
Configuration Management	CM	---
Commercial Off the Shelf	COTS	Commercial, readily available hardware or software
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 Logging Service	ELS	---
Election Management System	EMS	Within the EVS 5.0.0.0 Voting System, the EMS is comprised of five components: ElectionWare, ERM, ES&S Event Logging Service, and VAT Previewer.
Election Reporting Manager	ERM	EVS EMS reporting component.
Election Systems and Software	ES&S	---
Equipment Under Test	EUT	Refers to the individual system component or multiple piece of the same component.
ES&S Voting System	EVS	---
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.
Intelligent Mark Recognition	IMR	Visible light scanning technology to detect completed ballot targets.

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3.0 TEST BACKGROUND (Continued)

3.5 Terms and Abbreviations (Continued)

Table 3-2 Terms and Abbreviations (Continued)

Term	Abbreviation	Definition
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	--
Regression Testing	n/a	The process of examining and testing to verify that all functional and firmware modifications made during the test campaign did not introduce new errors or non-conformities into the voting system.
System Under Test	SUT	Refers to the system as a whole (all components).
Secure File Transfer Protocol	SFTP	A network protocol that provides file access, files transfer, and file management functionality over any reliable data stream.
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	---
Voter Assist Terminal	VAT	The electronic ballot marking device component is the ES&S AutoMARK™.
Voluntary Voting System Guidelines	EAC 2005 VVSG	Published by the EAC, the third iteration of national level voting system standards.
Wyle Laboratories, Inc.	Wyle	---
Wyle Operating Procedure	WoP	Wyle Test Method or Test Procedure.
Voting System Test Laboratory	VSTL	Wyle Labs.
Voluntary Voting System Guidelines	VVSG	EAC Voluntary Voting System Guidelines V. 1.0.

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4.0 TEST FINDINGS AND RECOMMENDATIONS

The ES&S EVS 5.0.0.0 Voting System, as identified in Section 2 of this report, was subjected to the tests as summarized in the following paragraphs.

4.1 Source Code Review

As part of the testing activities, the ES&S EVS 5.0.0.0 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

Other than the coding standards noted in the technical summary reports, no other deficiencies or significant problems were found during the source code review. A technical summary report of all identified standards violations was sent to ES&S for resolution. ES&S then corrected all standards violations and re-submitted the source code for re-review. The Source Code Review Report that summarizes the discrepancies noted is included in Appendix A.8 of this report. The Notice of Anomaly (NOA No. 18) documenting that source code discrepancies were found is included in Appendix A.1 of this report.

4.2 Witnessed Build

A Witnessed Build of the software was created using ES&S trusted build documents. The “Trusted Build” was 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 disk image of the build environment
- Load the compliant source code into the build environment
- Create a disk image of the pre-build environment
- Create a digital signature of the pre build environment
- Build executable code
- Create a disk image of the post-build environment
- Create a digital signature of executable code
- Build installation media

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4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.2 Witnessed Build (Continued)

- Create a digital signature of the installation media
- Install executable code onto the system and validate the software/firmware
- Deliver source code with digital signature, disk image of pre-build environment with digital signatures, disk image of post-build environment with digital signatures, executable code with digital signatures, and installation media to the EAC Repository.

The "Trusted Build" for the ES&S EVS 5.0.0.0 includes source code, data, and script files, in clear text form. The build also includes COTS software on commercially available media, COTS software downloaded by the VSTL, COTS software verified by 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 spot on the hard drive, so the drive is cleared of existing data. The Microsoft Windows XP Professional 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 performed a Witnessed Build for each software component of the ES&S EVS 5.0.0.0 on March 3-8, 2013. ES&S Technical Representative for the Witnessed Build was Dave Herrera. The products from the Witness Build shall be supplied to the EAC as part of the certification effort. The detailed steps followed during the performance of the Witnessed Build are presented in Appendix C.

4.3 Technical Data Package Review

The ES&S EVS 5.0.0.0 Voting System Technical Data Package (TDP) was reviewed to the VVSG. This review was performed as part of the pre-testing activities. The documents included in the TDP review are listed in Section 2.5 of this document.

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.

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4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.3 Technical Data Package Review (Continued)

Summary Findings

The review results were recorded in a worksheet that provided the pass/fail compliance to each applicable VVSG requirement. ES&S corrected nonconformance observations and resubmitted the associated documents for review. This process continued until the TDP complied with TDP Standards.

A summary of the TDP issues encountered is provided below.

- Documents that were not included in the submitted TDP package were referenced for information.
- Some descriptive information included was inconsistent with descriptions in other TDP documents.
- Placeholders within some of the documents indicated information was not yet inserted.
- Not all VVSG requirements were initially addressed in some of the documents.
- Some of the individual user guides included information which conflicted with the actual information encountered when verified during the testing process.

All noted TDP issues were resolved prior to the conclusion of the review process. The Technical Data Package Review Report that summarizes the discrepancies noted is included in Appendix A.7 of this report. The Notice of Anomaly (NOA No. 17) documenting that TDP discrepancies were found is included in Appendix A.1 of this report.

4.4 QA and CM System Review

The ES&S QA Plan and CM Plan were reviewed to determine compliance with EAC 2005 VVSG Volume I Sections 8 and 9 and Volume II Sections 2 and 7 requirements, and with the requirements of the internal ES&S documentation. Also, the ES&S Technical Data Package was reviewed to determine if the ES&S QA Plan and the CM Plan were being followed.

Summary Findings

Wyle conducted a remote audit of ES&S QA Program, during which Wyle requested artifacts from ES&S' documented QA Program. Wyle provided ES&S an artifact checklist targeting the following areas:

• Pre-Product Development

• Product Change Management

• Fielded Products and Manufacturing

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4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.4 QA and CM System Review (Continued)

Summary Findings (Continued)

ES&S was allowed an 8-hour business day to provide the requested artifacts. Wyle reviewed the received artifacts against the ES&S documented procedures. Wyle accepted all of the artifacts received during this audit as meeting the stated process and procedures in the ES&S QA & CM Plan.

4.5 Hardware Testing

Hardware testing included: the inspection and evaluation of voting system documentation; tests of voting system under conditions simulating the intended storage, operation, transportation, and maintenance environments; and operational tests verifying system performance and function under normal and abnormal conditions. Hardware testing was limited to the EVS 5.0.0.0 Voting System.

Table 4-1 VVSG Test Requirements

REPORT SECTION	VVSG VOL. I SECTION	VVSG VOL. II SECTION	TEST DESCRIPTION
4.3		2.1	Technical Data Package Review
4.6.1		4.6.4	Low Temperature Test
4.6.1		4.6.5	High Temperature Test
4.6.1		4.6.3	Vibration Test
4.6.1		4.6.2	Bench Handling Test
4.6.1		4.6.6	Humidity Test
4.6.2		4.7.1	Temperature/Power Variation Test
4.6.2	3.2.2.2		Acoustic Noise Level Test
4.7.1	4.1.2.5	4.8A	Electrical Power Disturbance Test
4.7.2	4.1.2.9	4.8B	Electromagnetic Radiation Test
4.7.3	4.1.2.8	4.8C	Electrostatic Disruption Test
4.7.4	4.1.2.10	4.8D	Electromagnetic Susceptibility Test
4.7.5	4.1.2.6 (a)	4.8E	Electrical Fast Transient Test
4.7.6	4.1.2.7 (a) (b)	4.8F	Lightning Surge Test
4.7.7	4.1.2.11 (a)	4.8G	Conducted RF Immunity Test
4.7.8	4.1.2.12	4.8H	Magnetic Fields Immunity Test
4.7.9	4.3.8		Product Safety Review, UL60950-1*
4.7.10	4.1.2.4		Electrical Supply
4.7.11		4.7.2	Maintainability Test

*Safety testing was witnessed by Wyle at a third party laboratory

4.6 Environmental Tests

Environmental tests were performed to ensure that the EUT and associated machine resident firmware were in compliance with the VVSG.

During test performance, the EUT was configured as it would be for use in an election precinct.

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4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.6 Environmental Tests (Continued)

4.6.1 Non-Operating Environmental Tests (Continued)

The EUT was subjected to various Non-Operating Environmental Tests. Prior to and immediately following each test environment, the EUT was powered on and subjected to operability functional checks to verify continued proper operation. The EUT was not powered on during the performance of any of the non-operating tests.

Low Temperature Test

The EUT was subjected to a Low Temperature Test in accordance with section 4.6.4 of Volume II of the VVSG. The purpose of this test is to simulate stresses associated with the storage of voting machines and ballot counters. This test is equivalent to the procedure of MIL-STD-810D, Method 502.2, Procedure I-Storage, with a minimum temperature of -4°F.

Prior to test initiation, the EUT was subjected to a baseline operability checkout to verify system readiness. The EUT was then placed in an environmental test chamber and the chamber temperature was lowered to -4°F and allowed to stabilize. Upon temperature stabilization, the temperature was maintained for an additional four hours. The temperature was then returned to standard laboratory ambient conditions at a rate not exceeding 10°F per minute.

The EUT was removed from the chamber and inspected for any obvious signs of degradation and/or damage. None were observed. The EUT was successfully subjected to a post-test operability checkout.

The EUT successfully completed the requirements of the Low Temperature Test. The Low Temperature Test Chamber Circular Chart and Instrumentation Equipment Sheet are contained in the Hardware Test Report Appendix A.2.

High Temperature Test

The EUT was subjected to a High Temperature Test in accordance with section 4.6.5 of Volume II of the VVSG. The purpose of this test is to simulate stresses associated with the storage of voting machines and ballot counters. This test is equivalent to the procedure of MIL-STD-810D, Method 501.2, Procedure I-Storage, with a maximum temperature of 140°F.

Prior to test initiation, the EUT was subjected to a baseline operability checkout to verify system readiness. The EUT was then placed in an environmental test chamber and the chamber temperature was raised to 140°F and allowed to stabilize. Upon temperature stabilization, the temperature was maintained for an additional four hours. The temperature was then returned to standard laboratory ambient conditions at a rate not exceeding 10°F per minute.

The EUT was removed from the chamber and inspected for any obvious signs of degradation and/or damage. None were observed. The EUT was successfully subjected to a post-test operability checkout.

The EUT successfully completed the requirements of the High Temperature Test. The High Temperature Test Chamber Circular Chart and Instrumentation Equipment Sheet are contained in the Hardware Test Report Appendix A.2.

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.6 Environmental Tests (Continued)

4.6.1 Non-Operating Environmental Tests (Continued)

Vibration Test

The EUT was subjected to a Vibration Test in accordance with section 4.6.3 of Volume II of the VVSG. The purpose of this test is to simulate stresses faced during transport of voting machines and ballot counters between storage locations and polling places. This test is equivalent to the procedure of MIL-STD-810D, Method 514.3, Category 1- Basic Transportation, Common Carrier.

Prior to test initiation, the EUT was subjected to a baseline operability checkout to verify system readiness. Upon completion, the EUT was secured to an electro dynamics shaker. One control accelerometer was affixed to the shaker table. The EUT was subjected to the Basic Transportation, Common Carrier profile as depicted in Mil-Std-810D, Method 514.3, Category I, with a frequency range from 10 to 500 Hz and an overall rms level of 1.04, 0.74, and 0.20 G for duration of 30 minutes in each orthogonal axis.

The vibration test for the DS200 was repeated four times. Upon each test completion, the DS200 was inspected for any obvious signs of degradation and/or damage. Inspections after the first three runs revealed parts that had become loose or were freely moving. The DS200 successfully completed the requirements of the Vibration Test on the fourth attempt. Notices of Anomaly 1, 2, 3, and 4 can be found in Appendix A.1 of this test report. Additional details of each anomaly are in section 4.9 Anomalies and Resolutions. The Vibration Test Data Sheets and Instrumentation Equipment Sheet are contained in the Hardware Test Report Appendix A.2.

Bench Handling Test

The EUT was subjected to a Bench Handling Test in accordance with section 4.6.2 of Volume II of the VVSG. The purpose of this test is to simulate stresses faced during maintenance and repair of voting machines and ballot counters. This test is equivalent to the procedure of MIL-STD-810D, Method 516.3, Procedure VI.

Prior to performance of the test, the EUT was subjected to a baseline operability checkout. Following the checkout, each edge of the base of the machine was raised to a height of four inches above the surface and allowed to drop freely. This was performed six times per edge, for a total of 24 drops. Upon test completion, the EUT was inspected for any obvious signs of degradation and/or damage. None were observed. The EUT was subjected to a post-test operability checkout and continued operability verified.

The EUT successfully completed the requirements of the Bench Handling Test. The Bench Handling Data Sheet and Instrumentation Equipment Sheet are contained in the Hardware Test Report Appendix A.2.

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4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.6 Environmental Tests (Continued)

4.6.1 Non-Operating Environmental Tests (Continued)

Humidity Test

The EUT was subjected to a Humidity Test in accordance with section 4.6.6 of Volume II of the VVSG. The purpose of the test was to simulate stresses encountered during storage of voting machines and ballot counters. This test is similar to the procedure of MIL-STD-810D, Method 507.2, Procedure I-Natural Hot-Humid.

The EUT was subjected to a baseline operability checkout to verify system readiness. Upon completion, the EUT was placed in an environmental test chamber and was subjected to a 10-day humidity cycle in accordance with the 24-hour cycle values. For a full description of the Humidity Test Data see the Hardware Report in Appendix A.2.

Upon test completion, the EUT was inspected for any obvious signs of degradation and/or damage. It was discovered that the AutoMARK A100 failed to function properly during the Post Operating Status Check. On the second attempt the AutoMARK A100 successfully completed the requirements of the Humidity Test. Notices of Anomaly 5, 6, and 13 can be found in Appendix A.1 of this test report. Additional details of each anomaly are in section 4.9 Anomalies and Resolutions. The Chamber Circular Chart and Instrumentation Equipment Sheet for the test are presented in the Hardware Test Report Appendix A.2.

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4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.6 Environmental Tests (Continued)

4.6.2 Operating Environmental Tests

Temperature/Power Variation Test

The EUT was subjected to a Temperature and Power Variation Test in accordance with section 4.7.1 of Volume II of the VVSG. The purpose of this test was to evaluate system operation under various environmental conditions. The total cumulative duration of the test was at least 163 hours, with 48 hours in the environmental test chamber. For the remaining hours, the equipment was operated at room temperature. This test is similar to the low temperature and high temperature tests of MIL-STD-810-D, Method 502.2 and Method 501.2.

To perform the test, the EUTs were placed inside an environmental walk-in test chamber and connected to a variable voltage power source. Two DS200 units were configured to scan 100 ballots per hour, while two AutoMark units were configured to mark 1 ballot an hour. Additionally, two DS850 units were configured to scan 300 ballots per hour. The temperature inside the chamber and the voltage supplied to the hardware varied from 50°F to 95°F and from 105 VAC to 129 VAC (as depicted in Figures 2-3 through 2-6). During test performance, the operational functions were continuously exercised by the scanning of ballots and the marking of ballots via audio voting. At the conclusion of the Temperature and Power Variation Test all ballots produced via the AutoMARK during the test were then processed by casting the ballots through the DS200 and the DS850. All 170 ballots were tabulated and all results were verified and validated to be accurate.

Summary Findings

The Temperature/Power Variation Test was restarted a total of three times. Three anomalies were identified during this test and ES&S addressed these issues from the hardware prospective. Notices of Anomaly 11, 12, and 14 can be found in Appendix A.1 of this test report. Additional details of each anomaly are in section 4.9 Anomalies and Resolutions. At the conclusion of the successful run, operational status checks were performed resulting in the EUTs successfully completing the requirements of the Temperature/Power Variation, Data Accuracy, and Reliability Tests.

Hardware Test Report Appendix A.2 contains the Temperature/Power Variation data.

Acoustic Noise Level Test

The EUT was subjected to an Acoustic Noise Level Test to satisfy the following requirements of Section 3.2.2.2 (c) of Volume I of the 2005 VVSG:

Section 3.2.2.2 (c) of Volume I of the 2005 VVSG

v. The voting machine shall set the initial volume for each voter between 40 and 50 dB SPL.

vi. The voting machine shall provide a volume control with an adjustable volume from a minimum of 20 dB SPL up to a maximum of 100 dB SPL, in increments no greater than 10 dB.

vii. The audio system shall be able to reproduce frequencies over the audible speech range of 315 Hz to 10 KHz.

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.6 Environmental Tests (Continued)

4.6.2 Operating Environmental Tests (Continued)

Summary Findings

During the performance of this test two anomalies were identified. Both the A100 and A200 failed to reach the maximum 100 dB SPL and ES&S addressed these issues from a firmware prospective. Notices of Anomaly 9 and 10 can be found in Appendix A.1 of this test report. Additional details of each anomaly are in section 4.9 Anomalies and Resolutions. The test was repeated successfully for only the maximum dB SPL levels for both the A100 and A200.

Hardware Test Report Appendix A.2 contains the Acoustic Noise Level test data.

4.7 Electrical Tests

Electrical tests were performed to ensure that the EUT and associated machine resident firmware were in compliance with the VVSG.

During test performance, the EUT was configured as it would be for use in an election precinct.

The EUT was subjected to various electrical tests to ensure continued system operation and reliability in the presence of abnormal electrical events. The EUT was powered and actively counting ballots during all electrical tests. Prior to and immediately following each electrical test, an operational status check was performed. The electrical tests for the EVS 5.0.0.0 Voting System were performed during prior test campaigns. The test data is contained in the Hardware Test Report Appendix A.2.

4.7.1 Electrical Power Disturbance

Electrical Power Disturbance testing was performed in accordance with sections 4.1.2.5 of Volume I and 4.8 of Volume II of the VVSG. This testing was performed to ensure that the EUT was able to withstand electrical power line disturbances (dips/surges) without disruption of normal operation or loss of data.

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing, and subjected to the voltage dips and surges over periods ranging from 20ms to four hours.

The EUT successfully met the requirements of the Electrical Power Disturbance Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in the Hardware Test Report Appendix A.2.

4.7.2 Electromagnetic Radiation Test (FCC Part 15 Emissions)

Electromagnetic Radiation emissions measurements were performed in accordance with sections 4.1.2.9 of Volume I and 4.8 of Volume II of the VVSG. This testing was performed to ensure that emissions emanating from the unit do not exceed the limits of FCC Part 15, Class B emissions. The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing.

The EUT was found to comply with the required emissions limits. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in the Hardware Test Report Appendix A.2.

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.7 Electrical Tests (Continued)

4.7.3 Electrostatic Disruption

Electrostatic Disruption testing was performed in accordance with sections 4.1.2.8 of Volume I and 4.8 of Volume II of the VVSG to ensure that should an electrostatic discharge event occur during equipment setup and/or ballot counting, that the EUT would continue to operate normally. A momentary interruption is allowed so long as normal operation is resumed without human intervention or loss of data.

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing without operator intervention. The EUT was then subjected to electrostatic discharges of +/- 8 kV contact and +/- 15 kV air. Discharges were performed at areas typical of those which might be touched during normal operation, including the touch screen, user buttons, and other likely points of contact.

There was no loss of normal operation or loss of data as a result of the applied discharges.

The EUT successfully met the requirements of the Electrostatic Disruption Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in the Hardware Test Report Appendix A.2.

4.7.4 Electromagnetic Susceptibility

Electromagnetic Susceptibility testing was performed in accordance with sections 4.1.2.10 of Volume I and 4.8 of Volume II of the 2005 VVSG. This testing was performed to ensure that the EUT was able to withstand a moderate level of ambient electromagnetic fields without disruption of normal operation or loss of data.

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing without operator intervention. The EUT was then subjected to ambient electromagnetic fields at 10 V/m over a range of 80 MHz to 1000 MHz.

There was no loss of normal operation or loss of data as a result of the applied electromagnetic fields.

The EUT successfully met the requirements of the Electromagnetic Susceptibility Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in the Hardware Test Report Appendix A.2.

4.7.5 Electrical Fast Transients

Electrical Fast Transients (EFT) testing was performed in accordance with sections 4.1.2.6 (a) of Volume I and 4.8 of Volume II of the 2005 VVSG to ensure that, should an electrical fast transient event occur on a power line, the EUT would continue to operate without disruption of normal operation of loss of data. Section 4.1.2.6 (b) of Volume I is not applicable because there are no I/O lines greater than three meters.

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing without operator intervention. The EUT was then subjected to electrostatic fast transients of 2 kV applied to its AC power lines.

There was no loss of normal operation or loss of data as a result of the applied transients. The EUT successfully met the requirements of the Electrical Fast Transients Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in the Hardware Test Report Appendix A.2.

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.7 Electrical Tests (Continued)

4.7.6 Lightning Surge

Lightning Surge testing was performed in accordance with sections 4.1.2.7 (a), (b) of Volume I and 4.8 of Volume II of the 2005 VVSG to ensure that, should a surge event occur on a power line due to a lightning strike, the EUT will continue to operate without disruption of normal operation or loss of data. Sections 4.1.2.7 (c), (d), and (e) are not applicable because there are no DC lines greater than 10 meters and no I/O lines greater than 30 meters.

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing. The EUT power input lines were then subjected to lightning surge testing at a level of 2 kV applied to its AC power line.

The EUT successfully met the requirements of the Lightning Surge Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in the Hardware Test Report Appendix A.2.

4.7.7 Conducted RF Immunity

Conducted RF Immunity testing was performed in accordance with sections 4.1.2.11 (a) of Volume I and 4.8 of Volume II of the 2005 VVSG. Section 4.1.2.11 (b) of Volume I is not applicable because there are no signal/control lines greater than three meters. This testing was performed to ensure that the EUT was able to withstand conducted RF energy onto its power lines without disruption of normal operation or loss of data.

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing without operator intervention. The EUT was then subjected to conducted RF energy of 10 V rms applied to its power lines over a frequency range of 150 kHz to 80 MHz.

There was no loss of normal operation or loss of data as a result of the applied conducted RF energy. The EUT successfully met the requirements of the Conducted RF Immunity Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in the Hardware Test Report Appendix A.2.

4.7.8 Magnetic Fields Immunity

Magnetic Fields Immunity testing was performed in accordance with sections 4.1.2.12 of Volume I and 4.8 of Volume II of the 2005 VVSG. This testing was performed to ensure that the EUT was able to withstand AC magnetic fields without disruption of normal operation of loss of data.

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing. The EUT was then subjected to AC magnetic fields of 30 A/m at a 60 Hz power line frequency.

There was no loss of normal operation or loss of data as a result of the applied magnetic field.

The EUT successfully met the requirements of the Magnetic Fields Immunity Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in the Hardware Test Report Appendix A.2.

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4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.7 Electrical Tests (Continued)

4.7.9 Product Safety Review

The VVSG states that all voting systems shall meet the following requirements for safety:

All voting systems and their components shall be designed to eliminate hazards to personnel or to the equipment itself.

Defects in design and construction that can result in personal injury or equipment damage must be detected and corrected before voting systems and components are placed into service.

Equipment design for personnel safety shall be equal to or better than the appropriate requirements of the Occupational Safety and Health Act, Code of Federal Regulations, Title 29, Part 1910.

To satisfy these requirements, the voting system was subjected to a Product Safety Review in accordance with UL 60950-1, "Safety of Information Technology Equipment".

Hardware Test Report Appendix A.2 contains the Product Safety Review data.

4.7.10 Electrical Supply Testing

Components of voting systems that require an electrical supply shall meet the following standards:

Precinct count voting systems shall operate with the electrical supply ordinarily found in polling places (Nominal 120 Vac/60Hz/1 phase).

Central count voting systems shall operate with the electrical supply ordinarily found in central tabulation facilities or computer room facilities (Nominal 120 Vac/60Hz/1, nominal 208 Vac/60Hz/3 or nominal 240 Vac/60Hz/2).

All voting machines shall also be capable of operating for a period of at least 2 hours on backup power, such that no voting data is lost or corrupted nor normal operations interrupted. When backup power is exhausted the voting machine shall retain the contents of all memories intact.

The AutoMARK and DS850 successfully completed the requirements of the Electrical Supply Test. However, the DS200s did not meet the initial 2 hour minimum requirement. Two anomalies (1 per each DS200) were identified. Notices of Anomaly 7 and 8 can be found in Appendix A.1 of this test report. Additional details of each anomaly are in section 4.9 Anomalies and Resolutions. The test was repeated successfully on the DS200s after ES&S addressed these issues from a firmware prospective.

Hardware Test Report Appendix A.2 contains the Electrical Supply Test data.

4.7.11 Maintainability

All maintenance required actions listed in the TDP were performed by Wyle Laboratories personnel to determine the ability to perform the actions required.

The AutoMARK, DS200, and DS850 successfully completed the requirements of the Maintainability Test.

4.8 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: Volume and Stress Test, System Integration Test, Security Test, Usability and Accessibility Tests, Data Accuracy, as well as the Physical and Functional Configuration Audits.

As part of System Level Testing, the system limits that ES&S has stated to be supported by the EVS 5.0.0.0 Voting System as well as the tested values and the test performed to verify each limit are compiled in Table 4-2.

Table 4-2 EVS 5.0.0.0 System Limits

Limit (Maximum Number of)	Declared Value	Tested Value	Test Performed
Precincts in Election	9,900	9,900	Volume and Stress
Contests in Election	21,000	21,000	Volume and Stress
Candidates/Counters in Election	21,000	21,000	Volume and Stress
Candidates/Counters in Precinct	1,000	1,000	Volume and Stress
Candidates/Counters in Tabulator	65,500	65,500	Volume and Stress
Maximum Precinct Element	500,000	500,000	Volume and Stress
Ballot Styles in Election	9,900	9,900	Volume and Stress
Contests in a Ballot Style	200	200	Volume and Stress
Candidates in a Contests	175	175	Volume and Stress
Ballot Styles in a Precinct	40	40	Volume and Stress
Number of Parties	Gen-=75, Prim=20	Gen=75, Prim=20	Volume and Stress
Vote For in Contest	98	98	Volume and Stress
Supported Languages per Election	5*	Verified Possible	System Integration (3)

*** "Verified Possible" means that the limit was tested during the FCA, but could not be verified in an election environment because of dependencies in the ballot layout configuration. The stated limits in the "Test Performed" column were tested in an election environment.**

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.

4.8.1 Volume and Stress Test

The EVS 5.0.0.0 Voting System was subjected to a Volume and Stress Test in accordance with the requirements of Section 6.2.3 of Volume II of the VVSG. The purpose of the test was to investigate the system's response to conditions that tend to overload the system's capacity to process, store, and report data. The Volume Test parameters were dependent upon the maximum number of active voting positions and the maximum number of ballot styles that the TDP claims the system can support. Testing was performed by exercising election definitions developed specifically to test for volume and stress (Election Definitions: Elections A-F contained in Table 4-3 of this document).

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.8 System Level Testing (Continued)

4.8.1 Volume and Stress Test (Continued)

Table 4-3 EVS 5.0.0.0 Volume and Stress

Voting Pattern	"Test Decks" were created for each election definition: **Election A**: **LIMITS TESTED:** ▪ Maximum Precincts in an election (9900) ▪ Maximum Ballot Styles in an Election (9900) ❑ **DS200 Test Deck: 584 Ballots** ▪ Test deck consisted of first 500 precincts then every 100th ballot starting at precinct 600 and ending at 9900. Even precincts voted for candidate 1 and odd precincts voted for write in ❑ **DS850 Test Deck: 9900 Ballots** ▪ Test deck consisted of precincts 1 to 9900, even precincts voted for candidate 1 and odd precincts voted for write in ❑ **AutoMARK: First five precincts loaded in AutoMARK** ▪ Voted each contest on ballot **Election B:** **Limits Tested:** ▪ Maximum Precinct Elements Tabulator (65,500) ▪ Maximum Precinct Elements ERM (500,000) ▪ **Test Deck: All Fill Ballot with 6 contests that each consist of a Vote for 82** ▪ 1st oval in each contest is filled, all others are left blank ❑ **DS200 Test Deck: 1 ballot per pass** ▪ Run in Admin Mode ▪ 8 total passes: Passes 1-7, 809 times; Pass 8, 510 times ▪ Reports configured to include Over/Under reporting ▪ Passes 1-7 will increment UNDERVOTES for each contest by 65,529 on each pass (81 x 809 = 65,529) ▪ On pass 8, total UNDERVOTE value will reach 500,013 (65,529 x 7) + (81 x 510) = 500,013 ❑ **DS850 Test Deck: 100 ballots** ▪ Run the test deck eight times, twice in each orientation, and then one run of nine ballots from the test deck for a total of 809. ▪ Export to USB, clear results and repeat seven more times, (saving each run on separate USB) with the eighth run consisting of 510 ballots. ❑ **AutoMARK: Marked first candidate in each contest on a ballot**

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4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.8 System Level Testing (Continued)

4.8.1 Volume and Stress Test (Continued)

Table 4-3 EVS 5.0.0.0 Volume and Stress (Continued)

Voting Pattern	**Election C:** **Limits Tested:** ▪ Maximum candidate counters/election (21,000) ▪ Maximum contests allowed in an election (21,000) ▪ Maximum candidates/contest (175) ▪ Maximum "Vote for"/contest (98) ▪ Maximum number of parties in a General Election **(75)** ❑ **DS200 & DS850 Test Deck: 156 ballots (One ballot for each ballot style in election)** ▪ Every EVEN candidate POSITION of each contest was marked with the exception of contest ten in which the first 12 candidates, the last 10 candidates and every other candidate in between was marked to confirm a "vote for 98" ❑ **AutoMARK Test Deck: Marked 15 randomly selected ballots** **Election D:** **Limits Tested:** ▪ Maximum number of parties in a Primary Election (20 including nonpartisan party) ❑ **DS200 & DS850 Test Deck: 20 Ballots (One ballot for each party)** ▪ Each candidate was marked ▪ Test deck ran four times, once in each orientation ▪ All candidates received four votes ❑ **AutoMARK Test Deck: 20 ballots** ▪ Each candidate was marked **Election E:** **Limits Tested:** ▪ Maximum district types (20) ▪ Maximum district names (40) ❑ **DS200 & DS850 Test Deck: 40 ballots (One for each district name)** ▪ Each candidate was marked ▪ Test deck ran four times, once in each orientation ▪ All candidates received four votes ❑ **AutoMARK Test Deck: One ballot** ▪ Each candidate was marked

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4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.8 System Level Testing (Continued)

4.8.1 Volume and Stress Test (Continued)

Table 4-3 EVS 5.0.0.0 Volume and Stress (Continued)

Voting Pattern	**Election F:** **Limits Tested:** ▪ Maximum candidate\counters allowed per precinct (1,000) ▪ Maximum contests allowed per ballot style (200 or ballot positions) ❑ **DS200 & DS850 Test Deck: 1 ballot (200 contests)** ▪ Odd races voted for candidate 1 and even races voted for write in ▪ Test deck ran four times, once in each orientation ▪ Odd races candidate 1 receives four votes and even races write in receives four votes ❑ **AutoMARK Test Deck: One ballot** ▪ Candidate 1 marked on odd races, and write in marked on even races

Table 4-4 EVS 5.0.0.0 Volume and Stress Ballots Cast

Total Ballots Cast

System	Ballots Cast Per Election						Machines in Test	Total Ballots Cast
	A	B	C	D	E	F		
DS200	584	6173	156	80	160	4	1	7,157
DS850	9900	6173	156	80	160	4	1	16,473
AutoMARK	5	1	15	20	1	1	1	43
							Total	23,673

Summary Findings

At the conclusion of the Volume and Stress Test, the DS200, DS850, and AutoMARK units successfully exercised the stated system limits. There was one (1) each DS200, DS850, and AutoMARK component used for the duration of Volume and Stress performance. A total of 23,673 ballots were processed without issue upon the completion of the test. There were two anomalies noted during testing and the test was restarted from the beginning on each occurrence. Notices of Anomaly 15 and 16 can be found in Appendix A.1 of this test report. Additional details of each anomaly are in section 4.9 Anomalies and Resolutions.

4.8.2 System Integration 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 5.0.0.0 Voting System. To perform the System Integration Testing, Wyle developed specific procedures and test cases designed to test the system as a whole. These procedures demonstrated compliance of the EVS 5.0.0.0 Voting System to Sections 2, 3, 4, 5, and 6 of Volume I of the VVSG.

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.8 System Level Testing (Continued)

4.8.2 System Integration Test (Continued)

The six election definitions exercised during the System Integration Testing are listed below and are presented in Appendix A.6 for further reference:

- 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. No anomalies were noted during testing. The individual requirements can be traced to the Requirements Matrix contained in Appendix E.

4.8.3 Security Test

The EVS 5.0.0.0 was subjected to Security Testing in accordance with the requirements of Section 7 of Volume I and Section 6.4 of Volume II of the VVSG. The purpose of the Security Test was to verify that security technologies implemented in the EVS 5.0.0.0 to secure the hardware, software, and storage media during pre-voting, voting, and post-voting activities perform as documented in the ES&S-supplied technical documentation and that it meets the requirements of the VVSG.

The Security Test was performed by running a security test suite to provide verification of the access controls and the physical controls documented by ES&S and to gather the necessary information for analysis by Wyle's security professional who holds CEH, CISSP, and CHFI certifications.

Summary Findings

After the initial security test findings were reported to ES&S, they supplied Wyle with an updated System Security Specification document. Wyle reviewed the document and an analysis was performed on the EMS desktop configured as documented by ES&S. Attempts were made to access certain functions of the EMS by users that did not have permissions to access those functions. Those attempts were unsuccessful.

In addition, security tie straps and tamper evident seals were provided and documented for the DS200, DS850, and AutoMARK hardware. The security tie straps/tamper evident seals and their documented installation were analyzed and found to be adequate. The test procedures followed during the Security Test are documented in the Security Test Case Procedure Specification presented in Appendix A.4 of this report. Wyle has determined EVS 5.0.0.0 to be compliant with the security requirements of the EAC 2005 VVSG. The security assessment report can be found in Appendix A.10 of this report.

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.8 System Level Testing (Continued)

4.8.4 Usability and Accessibility Test

The EVS 5.0.0.0 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 conformance to the usability and accessibility requirements in the EAC 2005 VVSG.

Conformance to these requirements should result in an improved quality of 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. Additional requirements for task performance are independence and privacy: the voter should normally be able to complete the voting task without assistance from others and the voter selections should be private.

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.

The requirements for physical, sensory, or cognitive disabilities shall be followed according to HAVA (a) (3) (B). Alternative languages shall be in accordance to HAVA (a) (4) and privacy mandated by HAVA (a) (1) (C). In addition Common Industry Format (CIF) shall be used for testing purposes according to ANSI/INCITS 354-2001 and in accordance with the VVSG. To help meet this requirement, ES&S submitted a summative usability test report to Wyle for review and is included in Appendix A.12 of this report.

Summary Findings

The EUT successfully met the requirements of the Usability and Accessibility Tests. The test cases performed and the procedures followed during the Usability and Accessibility Tests are documented in the Usability Test Case Procedure Specification presented in Appendix A.5 of this report. There were no notices of anomaly created as a result of these tests.

4.8.5 Data Accuracy Test

The EVS 5.0.0.0 Voting System was subjected to a Data Accuracy Test in accordance with the requirements of Section 4.7.1.1 of Volume II of the VVSG.

Per the EAC 2005 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.

Tables 4-6 to 4-8 show the breakdown of how many ballots of the different sizes were run during the accuracy test.

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.8 System Level Testing (Continued)

4.8.5 Data Accuracy Test (Continued)

Table 4-5 EVS 5.0.0.0 Accuracy DS200

Ballot Size	No. of Ballots	No. Vendor Marked	No. Hand Marked	No. Ballot Positions per Ballot	No. of Machines in Test	X Voted=	Total Ballot Positions	Total Ballots
11 inch	50	15	35	392	3	5	294,000	750
14 inch	50	15	35	512	3	5	384,000	750
17 inch	50	15	35	640	3	5	480,000	750
19 inch	50	15	35	720	3	4	432,000	600
Total	**200**	**60**	**140**	**N/A**	**N/A**	**19**	**1,590,000**	**2850**

Table 4-6 EVS 5.0.0.0 Accuracy DS850

Ballot Size	No. of Ballots	No. Vendor Marked	No. Hand Marked	No. Ballot Positions per Ballot	No. of Machines in Test	X Voted=	Total Ballot Positions	Total Ballots
11 inch	50	15	35	392	2	7	274,400	700
14 inch	50	15	35	512	2	7	358,400	700
17 inch	50	15	35	640	2	7	448,000	700
19 inch	50	15	35	720	2	7	504,000	700
Total	**200**	**60**	**140**	**N/A**	**N/A**	**28**	**1,584,800**	**2800**

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4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.8 System Level Testing (Continued)

4.8.5 Data Accuracy Test (Continued)

Table 4-7 EVS 5.0.0.0 Accuracy AutoMARK

Ballot Size	No. of Ballots	No. Vendor Marked	No. Hand Marked	No. Ballot Positions per Ballot	No. of Machines in Test	X Voted=	Total Ballot Positions	Total Ballots
11 inch	40	N/A	N/A	792	10	1	316,800	400
14 inch	40	N/A	N/A	774	10	1	309,600	400
17 inch	50	N/A	N/A	966	10	1	483,000	500
19 inch	50	N/A	N/A	900	10	1	450,000	500
Total	**180**	**N/A**	**N/A**	**N/A**	**N/A**	**4**	**1,559,400**	**1800**

Summary Findings

The EVS 5.0.0.0 Voting System successfully met the requirements of the Data Accuracy Test by scanning and processing at least 1,549,703 ballot positions.

4.8.6 Physical Configuration Audit

A Physical Configuration Audit (PCA) of the EVS 5.0.0.0 Voting System was performed as part of the pre-testing activities 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.

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.8 System Level Testing (Continued)

4.8.6 Physical Configuration Audit (Continued)

The PCA performed on the EVS 5.0.0.0 Voting System consisted of inspecting the following:

- The EVS Election Management System (EMS) software platform.
- DS200 Precinct Digital Scanner.
- DS850 Digital Scan Central Ballot Scanner.
- AutoMARK ADA Ballot Marking Device.
- All accessories, equipment, and documentation used with the EVS 5.0.0.0 Voting System.

Summary Findings

An initial baseline PCA was performed prior to commencement of the test campaign and is included in the Certification Test Plan contained in Appendix D. The initial PCA was revised during testing. The final PCA is presented in Appendix A.9 of this report. No discrepancies were noted during the PCA.

4.8.7 Functional Configuration Audit (FCA)

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 for the TDP. In addition to functioning according to the manufacturer's documentation, tests were conducted to insure all applicable EAC 2005 VVSG requirements are met.

A Functional Configuration Audit (FCA) of EVS 5.0.0.0 was performed in accordance with Section 6.7 of Volume II of the VVSG. The purpose of the FCA was to verify that EVS 5.0.0.0 performs as documented in the ES&S-supplied technical documentation during pre-voting, voting, and post-voting activities and validate that EVS 5.0.0.0 meets the requirements of the EAC 2005 VVSG. To perform the FCA, EVS 5.0.0.0 was subjected to a series of tests to simulate pre-voting, voting, and post-voting activities. These tests were performed to ensure compatibility of voting machine functions at the precinct level using the referenced firmware. During the FCA, both normal and abnormal data was input into the system to attempt to introduce errors and test for error recovery. The activities simulated were:

- Verification of hardware status via diagnostic reports prior to election;
- Performing procedures required to prepare hardware for election operations;
- Obtaining 'zero' machine report printouts on all contest fields;
- Performing procedures to open the polling place and enable ballot counting;
- Casting of ballots to demonstrate proper processing, error handling, and generation of audit data;
- Performing hardware operations required to disable ballot counting and closing the polls;

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.8 System Level Testing (Continued)

4.8.7 Functional Configuration Audit (FCA) (Continued)

- Obtaining machine reports and verifying correctness;
- Obtaining machine-generated audit logs and verifying correctness;

The FCA was divided into three phases: pre-voting, voting, and post-voting. The three phases are described in greater detail in the following paragraphs:

1. Pre-Voting

   Pre-Voting encompasses all activities performed to the point of loading the election data on a transport media. These activities include verifying roles, user administration, database administration, defining the political subdivisions, defining election types, defining voting variations, defining the ballot contents, audio ballot definition, election definition loading, auditing election creation process, producing pre- election reports, adding to existing elections, updating existing elections, modifying ballot styles, verifying alternative language translations, and loading an election on precinct count devices.

2. Voting

   Voting encompasses all activities performed by poll workers, voters, and warehouse maintenance technicians after an election has been loaded, through the processing of special votes such as absentee and provisional ballots. These activities include pre-election logic testing, diagnostic tests, opening the polls, activating ballots, voting and casting both normal and audio ballots, utilizing the usability and accessibility aspects of the accessible voting station, closing the polls, printing machine reports, performing post-election maintenance tasks, and executing special voting sessions such as the processing of absentee and provisional ballots.

3. Post-Voting

   Post-Voting encompasses all activities performed from verification of machine reports to the EMS post-election activities. These activities include verifying election results, tabulation of results, consolidating voted data, Election Media maintenance & cleaning, Election Media logs, concluding an election, backing up results, retaining election data for 22 months, deleting elections, and auditing voting machine log.

Summary Findings

There were deficiencies noted during this test. All deficiencies were documented during real-time test performance and were compiled into a report (presented in the Deficiency Report contained in Appendix A.11) for resolution tracking. The system successfully recovered from all abnormal and error conditions unless noted in the deficiency report. All deficiencies noted were corrected prior to the conclusion of the test campaign. The voting system successfully met the requirements of the FCA. The test cases performed and the procedures followed during the FCA are documented in the FCA Test Case Procedure Specification presented in Appendix A.3 of this report.

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.8 System Level Testing (Continued)

4.8.8 Availability

The voting system achieved at least 99 percent availability during normal operation for the applicable functions of the system.

4.9 Anomalies and Resolutions

Wyle performed compliance testing of the EVS 5.0.0.0 Voting System to the EAC 2005 VVSG. During the test campaign, all data from all "pre-testing", hardware testing, software testing, functional testing, security testing, volume testing, stress testing, usability testing, accessibility testing, and reliability testing activities were combined to ensure all applicable EAC 2005 VVSG requirements that are supported by the EVS 5.0.0.0 Voting System had been tested.

A total of eighteen (Include Source Code and TDP) 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 are presented in their entirety in Appendix A.1 of this report and are summarized below, along with their resolution.

Notice of Anomaly No. 1: Vibration Test: Following the vibration test performed on May 4, 2012, the DS200 was examined for anomalies that may have occurred during testing. It was discovered, upon opening the door that covers the USB ports and power switch that parts from the lock for the door had become loose and had fallen into the area surrounding the USB ports. An ES&S technician replaced the lock and all of its components. The test was restarted from the beginning.

Notice of Anomaly No. 2: Vibration Test: Following the vibration test performed on May 7, 2012, the DS200 was examined for anomalies that may have occurred during testing. It was discovered, upon opening the exterior cover, a screw with a captive washer had become loose and fallen into the bottom area adjacent to a large connector assembly on a metal tray. An ES&S technician inserted the screw back in its original location. The other screws in the area were also inspected and found to be acceptable. The test was restarted from the beginning.

Notice of Anomaly No. 3: Vibration Test: During the setup of the vibration test, the DS200 was dropped on its side causing the carrying case with the DS200 in it to come apart from the lower part of the ballot box. The DS200 and carrying case dropped from the vibration table to the concrete floor. The carrying case and the DS200 were damaged. The DS200 was examined by Wyle and ES&S which determined the damage was too great to continue. The unit was replaced and testing continued. This internal NOA was based on unit under test being dropped by Wyle personnel, and not a VVSG non-conformity.

Notice of Anomaly No. 4: Vibration Test: Following the vibration test performed on May 16, 2012, the DS200 was examined for anomalies that may have occurred during testing. Initially a component was heard to be loose inside the LCD case. It was discovered, upon opening the exterior cover of the LCD bezel, that a screw had become loose inside of the LCD case of the DS200. The like screw on the opposing side of the LCD bezel mount was found to be loose as well, but still attached. Photographs were taken of the anomaly and the remainder of the examination revealed some wear through 3 layers of material, exposing metal of the Li-ion Rechargeable Battery. An ES&S technician inserted the screws back in its original location. ES&S added additional steps in their DS200 checkout process to inspect the

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.9 Anomalies and Resolutions (Continued)

units for loose screws and nuts. The wear on the battery did not cause any issues with the functionally of the unit. The test was restarted from the beginning and completed successfully.

Notice of Anomaly No. 5: Humidity: During the AutoMARK A100 Humidity test being performed May 25, 2012 – June 04, 2012, the Humidity Chamber suffered a controller failure on May 29, 2012. When it was observed that the required environment could not be maintained, the test was halted and the units were removed from the failing chamber. A post-operational test was performed on all four EUTs that were being tested in the humidity chamber at the time of said failure. Testing was rescheduled to be performed June 01, 2012 – June 11, 2012 in an alternate humidity chamber. This internal NOA was based on chamber failure during test, and not a VVSG non-conformity.

Notice of Anomaly No. 6: Humidity: After being subjected to the Humidity test being performed June 01, 2012 – June 11, 2012, the AutoMARK A100 failed to function properly during the Post Operating Status Check. When it was observed that the unit could not successfully mark five consecutive ballots, it was at that time that the AutoMARK A100 portion of the Humidity test was identified as a failure. The reoccurring message during the failure was "Alert! A problem has occurred. Please notify an election official. There was an error while printing". After inspection, it was determined that the Contact Image Sensor (CIS) had stopped working properly. The ES&S technician replaced the CIS and the test was repeated successfully.

Notice of Anomaly No. 7: Electrical Supply: After being subjected to the Electrical Supply test being performed on June 19, 2012 the DS200's battery was depleted after only 1 hour, 37 minutes and 20 seconds. Since the DS200 shutdown prior to completing the 2 hour requirement, the Electrical Supply Test was identified as a failure. It was determined that the animation on the "Please Insert Your Ballot" screen caused the backup battery to be depleted before the required 2 hours. The firmware was updated to stop the animation when the DS200 is on the backup battery. The test was repeated successfully.

Notice of Anomaly No. 8: Electrical Supply: After being subjected to the Electrical Supply test being performed on June 19, 2012 the DS200's battery was depleted after only 1 hour, 43 minutes and 6 seconds. Since the DS200 shutdown prior to completing the 2 hour requirement, the Electrical Supply Test was identified as a failure. It was determined that the animation on the "Please Insert Your Ballot" screen caused the backup battery to be depleted before the required 2 hours. The firmware was updated to stop the animation when the DS200 is on the backup battery. The test was repeated successfully.

Notice of Anomaly No. 9: Acoustic Noise Level Test: After being subjected to the Acoustic Noise Level Test and Hearing Aid Compatibility as performed on June 19, 2012, it was observed that the AutoMARK A100 failed to achieve the required 100 dB SPL. The AutoMARK A100 portion of the Acoustic Noise Level Test and Hearing Aid Compatibility was identified as a failure. The highest volume produced by the AutoMARK A100 was 75 dB. It was determined that an update to the firmware of the AutoMARK A100 was needed to achieve the required 100 dB SPL. The firmware was updated and the test was repeated successfully.

Notice of Anomaly No. 10: Acoustic Noise Level Test: After being subjected to the Acoustic Noise Level Test and Hearing Aid Compatibility as performed on June 19, 2012, it was observed that the AutoMARK A200 failed to achieve the required 100 dB SPL. The AutoMARK A200 portion of the Acoustic Noise Level Test and Hearing Aid Compatibility was identified as a failure. The highest volume produced by the AutoMARK A200 was 75 dB. It was determined that an update to the firmware of the AutoMARK A200 was needed to achieve the required 100 dB SPL. The firmware was fixed and the test was repeated successfully.

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.9 Anomalies and Resolutions (Continued)

Notice of Anomaly No. 11: Temperature and Power Variation: After completing 18 hours of the scheduled 85 hours of testing, six ballot jams had occurred on one of the DS850 and the testing was halted due to the quantity and frequency of the ballot jams during the test. After inspection by ES&S technicians, it was determined that slight variations within the tolerance of parts on the DS850 can cause the ballot to slightly drift in the ballot path. The ballots are positioned 2mm from the main plate. If the ballots drift too close to the main plate, they can cause jams in the DS850. This anomaly was resolved by installing a 0.012 inch polycarbonate shim beneath the first roller's block at the top. ES&S has written a document for their technicians that detail the required steps to fix this issue. The test was restarted and Wyle did not observe any additional ballots jams from this DS850.

Notice of Anomaly No. 12: Temperature and Power Variation: After completing 18 hours of the scheduled 85 hours of testing, "Camera Interface Error" had occurred on the DS850. Following the System Operating Procedure, the DS850 was shut down and restarted. Upon logging into the DS850, it was observed that "Camera Interface Error" occurred again. It was at this time that testing was halted due to the inability to proceed with the DS850. It was determined that the DS850 suffered "degradation of performance such that the device is unable to perform its intended function for longer than 10 seconds" as identified in VVSG Volume 1, 4.3.3 Reliability. After inspection by ES&S technicians, it was determined that the PCI USB controller caused the error condition. The contacts on the USB controller were in a dull condition. The technician cleaned the contacts with a pencil eraser, and the DS850 did not have this error condition again. ES&S added a cleaning procedure on the PCI USB controller during the manufacturing process to mitigate this issue.

Notice of Anomaly No. 13: Humidity: During the AutoMARK A100 Humidity test performed Nov 16, 2012 – Nov 26, 2012, there was an air pocket affecting the water supply of the test chamber, which caused the test chamber not to reach the required humidity levels. This was found on Saturday Nov 17th. The chamber was inspected by Wyle and the issue was resolved. The test was extended one day to accommodate the delay. The test was completed without any issues. This internal NOA was based on chamber failure, and not a VVSG non-conformity.

Notice of Anomaly No. 14: Temperature and Power Variation: After completing 15 hours of the scheduled 85 hours of testing, switching from 50º F to 95º F and running for 3 hours (300 ballots every hour), the DS850 started out stacking all ballots to the top tray for "decision late". The unit was rebooted and ballots could be scanned normally. On the next hour of scanning 300 ballots again, all ballots were sent to the top tray for "decision late", and rebooting again allowed ballots to be scanned normally. The test was halted. After inspection by ES&S technicians, it was determined that the bottom camera was not working properly causing the error condition when the temperature changed from 50º F to 95º F. The camera was replaced, and the test was restarted and completed successfully. Further analysis of the camera revealed a cold solder joint on the internal board of the camera that caused the error condition when the EUT got hot.

Notice of Anomaly No. 15: Volume and Stress: During the Volume and Stress test on the DS200 an error was encountered during the EQC process. The EQC process failed and would not allow the unit to continue with the only option to shut down the unit. The volume and stress test was broken down into six elections A-F to execute the system limits. Elections A-D operated without issue and the error was encountered during the loading of the "E" election. The following error code was provided: "7101012: EQC data invalid or missing". After analysis by ES&S technicians, removing the USB stick prematurely is the most common cause of this error and was the method used to reproduce the issue. Other possible causes are: EQC media was not fully seated in the USB port causing an intermittent connection failure. A

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.9 Anomalies and Resolutions (Continued)

malfunction occurred in the USB controller that services the port. A malfunction in the USB related hardware on the main board. However, the other possible causes are extremely difficult to reproduce unless the hardware related issues are severe. After Wyle determined that it was not the Volume and Stress elections that caused the error condition, the test was restarted from the beginning, but failed to complete successfully producing NOA 16.

Notice of Anomaly No. 16: Volume and Stress: After the restart of the Volume & Stress test on the DS200 (the same unit that caused NOA 15), the unit would not power up after the execution of Election A. The Volume and Stress test was broken down into six elections A-F to execute the system limits. Election A operated without issue and the unit was powered down so election B could be loaded on the unit. Wyle attempted to power up the unit to load election B three times unsuccessfully. The test was halted and ES&S was notified of the issue. After analysis by ES&S technicians, it was determined from previous experience when the motherboard would not POST (power up), it is likely that the cause was the 5 or 12 volts supplied by the ATX power supply. The ATX power supply was replaced, and Wyle could not reproduce this anomaly. After two anomalies with the same DS200 during this test, this DS200 was removed from the test campaign in accordance with the vendor TDP. This test was restarted from the beginning on a backup DS200 unit and completed successfully with no issues.

Notice of Anomaly No. 17: Source Code Review: Review of the submitted source code comprising the EVS 5.0.0.0 Voting System revealed deviations from the 2005 VVSG as well as issues with the commenting. 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.

Notice of Anomaly No. 18: Technical Data Package (TDP) Review: Review of the submitted documentation revealed discrepancies between the TDP and the EAC 2005 VVSG requirements. Functional testing also identified text in the TDP that conflicted with the actual operation of the system. Each noted discrepancy was documented in detail in the Wyle-generated TDP review reports on file as raw data. All discrepancies were resolved by ES&S before the conclusion of the test campaign.

4.10 Deficiencies and Resolutions

During the test campaign, deficiencies were noted that were related to system functionality and usability. The deficiencies were discovered as part of the FCA, during hardware test performance, system integration testing, usability testing, volume and stress testing, or were noted during the general test campaign and not linked to a specific test or VVSG requirement. All deficiencies were documented during real-time test performance and were compiled into a report (presented in the Deficiency Report contained in Appendix A.11) for resolution tracking. All deficiencies noted were corrected prior to the conclusion of the test campaign.

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4.11 Recommendation for Certification

Wyle performed conformance/specification testing on the ES&S EVS 5.0.0.0 Voting System to the EAC 2005 VVSG (Version 1.0). During the test campaign, all data from pre-testing, hardware testing, software testing, functional testing, security testing, volume testing, stress testing, usability testing, accessibility testing, and reliability testing activities was combined to ensure all VVSG requirements that are supported by the EVS 5.0.0.0 Voting System had been tested. Wyle also used discretion as granted by the VVSG to design and exercise FCA Test Cases, perform source code reviews, and perform Security Tests.

Wyle concludes that EVS 5.0.0.0 Voting System, 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 all additional tests performed at Wyle's discretion. As such, Wyle recommends that the EAC grant the ES&S EVS 5.0.0.0 voting system, certification to the 2005 VVSG.

This report is valid only for the system identified in Section 2 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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APPENDIX A

ADDITIONAL FINDINGS

APPENDIX B

WARRANT OF ACCEPTING CHANGE CONTROL RESPONSIBILITY

ES&S WARRANT OF ACCEPTANCE CHANGE CONTROL

APPENDIX C

WITNESS BUILD

ES&S WITNESS BUILD PROCEDURE

APPENDIX D

WYLE LABORATORIES' CERTIFICATION TEST PLAN NO. T59087-01

ES&S EVS 5.0.0.0 AS RUN TEST PLAN

APPENDIX E

REQUIREMENTS MATRIX

EVS 5.0.0.0 REQUIREMENTS MATRIX

APPENDIX F

ES&S CONFORMITY STATEMENT

ES&S CONFORMITY STATEMENT

APPENDIX G

ES&S ATTESTATION OF DURABILITY

ES&S ATTESTATION OF DURABILITY