# Election Assistance Commission

## Voting System Test Summary Report

# Summary of test Report for testing through 10/22/08 for Election Systems & Software (ES&S), Unity 4.0 Voting System

**Report Number 07-V-ESS-035-CTP-01, Rev 0.3**

**July 15, 2009**

Prepared for:

| | |
|---|---|
| **Vendor Name** | Election Systems & Software (ES&S) |
| **Vendor System** | Election Systems and Software (ES&S)<br>Unity 4.0 Voting System |
| **EAC Application No.** | ESS0702 |
| **Vendor Address** | 11208 John Galt Boulevard<br>Omaha, NE 68137-2364 |

## Statement of use:

This document is a summary report for the testing that SysTest Labs had completed as of 10/22/08. The document was compiled and edited by the EAC with the information provided by SysTest Labs.

Due to the suspension of SysTest's EAC VSTL accreditation, the ES&S voting system was transferred to iBeta for continued testing and certification. iBeta was allowed to re-use portions of the testing completed by SysTest. Please refer to the letters of correspondences between the EAC and iBeta, which can be found on the EAC's website at www.eac.gov. This document is to be used as a reference for the testing completed by SysTest and used by iBeta. It is **NOT** to be used in place of the approved certification test report from iBeta.

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- Model 100 Precinct Scanner (M100) is a trademark of Election Systems & Software.
- intElect DS200 Precinct/Central Count Scanner (DS200) is a trademark of Election Systems & Software.
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**Opinions and Interpretations**

EAC interpretations were applied to this VSTL test effort. Interpretations are listed in the relevant section.

## Other Labs Performing Hardware Testing

SysTest Labs is responsible for all core voting system tests as identified in NIST NVLAP Handbook 150-22 (2005). The labs listed below performed non-core hardware testing for this certification test campaign.

| Laboratory | Address | Test(s) | Date(s) |
|---|---|---|---|
| SysTest Labs | 216 16th St., Suite 700<br>Denver, CO, 80202 | | |
| | | | |

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# List of Tables

# Introduction

SysTest Labs Incorporated is submitted this report as a summary of the certification testing efforts for Election Systems & Software (ES&S) Unity 4.0, for testing completed through 10/22/08. The purpose of this document is to provide an overview of the certification testing effort and the findings of the testing effort up to that date.

This effort included documentation review of the Technical Data Package, source code review, and testing of Unity 4.0. Testing consisted of the development of a test plan, managing system configurations, executing functional test cases based on the project test requirements, system level tests prepared by SysTest Labs and analysis of results. The review and testing was performed at SysTest Labs' Denver, Colorado facility and at ES&S's facility in Omaha, Nebraska.

SysTest Labs is a full service third party testing facility, founded in May 1996, from a software test-consulting firm. The specific system testing services offered include:

- Test Planning and Test Management
- eBusiness, Client-Server and Stand-alone Application Functional, Compatibility and Regression Testing
- eBusiness and Client-Server Load and Performance Testing
- Automated Regression Test Development, Consulting, Scripting and Execution
- Complex, Integrated Test Solutions And Automated Test Harnesses
- Independent Verification and Validation
- EAC approved Voting System Test Laboratory

SysTest Labs maintains partnerships with software test tool vendor companies Segue Software, Mercury Interactive, Rational Software, Borland, and Compuware.

## 1.1 References


1. Federal Election Commission Voting System Standards (FEC VSS), April 2002. *Volume I Performance Standards:* Section 1 Introduction 1.6.1; Section 2 Functional Capabilities; Section 3 Hardware Standards; Section 7 Quality Assurance 7.1, 7.4, 7.6, and 7.7; Section 8 Configuration Management 8.1; Section 9 Overview of Qualification Tests 9.2, 9.4.1, 9.4.1.1, 9.4.2, 9.5, 9.5.2, 9.5.2.1, 9.5.2.2, 9.6, and 9.6.1.2. *Volume II Test Standards:* Section 1 Introduction 1.3 and 1.4; Section 2 Technical Data Package; Section 3 Functionality Testing 3.2.1, 3.2.2, 3.2.3, and 3.2.4; Section 6 System Level Integration Testing 6.6 and 6.7; Section 7 Examination of Vendor Practices for Configuration Management and Quality Assurance 7.5 and 7.5.1; Appendix A Qualification Test Plan A.2 and A.3.
2. NIST NVLAP Handbook 150: 2006.
3. NIST NVLAP Handbook 150-22: 2005.
4. EAC Testing and Certification Program Manual, United States Election Assistance Commission, 2006
5. IEEE Standard for Software Quality Assurance Plans IEEE Std 730-1998, October 20th, 1998.
6. IEEE Standard for Software Configuration Management Plans IEEE Std 828-1998, June 25th, 1998.
7. IEEE Standard for Software Test Documentation IEEE Std 829-1998, December 16th, 1998.

8. IEEE Recommended Practice for Software Requirements Specifications IEEE Std 830-1998, October 20th, 1998.
9. IEEE Standard for Software Unit Testing IEEE Std 1008-1987, December 29th, 1986.
10. IEEE Standard for Software Verification and Validation IEEE Std 1012-1998, July 20th, 1998.
11. SysTest Labs Quality System Manual, Revision Rev. 1.5, prepared by SysTest Labs, dated December, 05, 2008.

## 1.2 Document Overview

This document contains:

- The Introduction discusses the application tested/reviewed.
- The Certification Test Background discusses the testing process.
- The System Identification identifies hardware and software for the Unity 4.0.
- The System Overview discusses the functionality of Unity 4.0 software and firmware.
- The Certification Test Results Summary contains a summary of the testing effort.
- The Recommendations section contains the analysis of the testing effort conducted so far.
- The Appendices contain Test Operations, Findings and Data Analysis. They also contain the EAC Certification information after the system has been qualified.
    - Appendix A: Trusted Build
    - Appendix B: Index of Attachments

# Certification Test Background

## 1.3 PCA - Document and Source Code Reviews

The Physical Configuration Audit (PCA) review of ES&S Unity 4.0 voting system documentation submitted in the Technical Data Package (TDP) was executed in order to verify conformance with Federal Election Commission Voting System Standards (FEC VSS) April 2002. Source Code was reviewed for Unity 4.0.

All reviews were conduced in accordance with Volume 2, Sections 2.2 through 2.13 and Volume 2, Section 6.6 of the FEC VSS April 2002, to demonstrate that the system meets or exceeds the requirements of the FEC VSS. Results of the source code review were recorded on Excel spreadsheets for each submitted application. Results of the PCA documentation review can be found in Attachment B of this Certification Report. Results of the source code review can be found in Attachment C.

Inconsistency or errors in documentation were identified to ES&S in a Discrepancy Report for resolution or comment. This Discrepancy Report can be found in Attachment D.

## 1.4 FCA - Functional & System Testing and Sampling

The Functional Configuration Audit (FCA) review of the test documentation submitted by ES&S in the TDP was executed in order to verify testing of the voting system requirements defined in *Volume 1 Sections 2, 3, 4, 5, 6,* and *Volume 2, Section 6.7* of the FEC VSS April 2002.

SysTest Labs' standard System Level Test Cases were customized for ES&S and conducted in accordance with *Volume 2 Section 6*, in conjunction with the functional testing. Simulations of elections were conducted to demonstrate a beginning-to-end business use case process for Unity 4.0. SysTest Labs selected a subset of the Unity 4.0 voting system functionality for functional test execution based on high-risk areas, such as Security, Audit log, Tabulating, Transmitting, and Accuracy. Any test issues found during the project were identified to ES&S in a Discrepancy Report for resolution or comment. ES&S resolved all discrepancies that did not comply with the April 2002 FEC VSS requirements, which were verified as acceptable after regression testing by SysTest Labs.

Status Reports were emailed to ES&S. These reports reflected the daily and/or weekly test activities including project task status, issues found, and schedule/project management information. All results of our FCA testing can be found in Attachment A of this Certification Report.

**Table 1 – Summary of Unity 4.0 Voting System Components**

| Software/Firmware | Hardware |
|---|---|
| Election Management System (EMS)<br>• Audit Manager<br>• Election Data Manager<br>• AutoMARK Information Management System (AIMS)<br>• ES&S Ballot Image Manager<br>• Ballot on Demand | • Compact Flash Multi-Card Reader/Writer<br>• Automatic Bar Code Reader<br>• Hand held bar code scanner<br>• iVotronic DRE with a 4-inch Real-Time Audit Log printer<br>• iVotronic DRE with a 9.5-inch Real-Time Audit Log printer |

| Software/Firmware | Hardware |
|---|---|
| • iVotronic Image Manager<br>• Hardware Programming Manager<br>• Data Acquisition Manager<br>• Election Reporting Manager | • iVotronic DRE with stand-alone printer<br>• iVotronic DRE with the communication pack<br>• AutoMARK Voter Assist Terminal<br>• Model 100 precinct scanner with steel ballot box<br>• intElect DS200 precinct scanner with steel & plastic ballot box<br>• Model 650 central count scanner |

## 1.5 Terms, Abbreviations, and Definitions

The following terms and abbreviations will be used throughout this document:

**Table 2 – Matrix of Terms and Abbreviations provided by the vendor.**

| Term | Abbreviation | Definition |
|---|---|---|
| Audit Manager | AM | Audit Manager is ES&S' tracking program for the Unity software suite. AM tracks user activity in AM, EDM and ESSIM. |
| Automatic Bar Code Reader | ABCR | The ABCR is a device that audits and recounts the printout generated by the iVotronic RTAL printer. The ABCR device interfaces with ABCR software installed on a PC to generate reports based upon the scanned barcodes from the RTAL printout. |
| AutoMARK Information Management System | AIMS | Software that facilitates creation of the election database, or conversion of a 3rd party election database, for installation on the VAT. |
| AutoMARK Voter Assist Terminal | VAT | Optical paper ballot marking device for disabled voters and alternative languages |
| Ballot On Demand | BOD | Election officials use Ballot on Demand to print test ballots, early voting ballots and ballots for polling places that run short of ballots on Election Day. |
| Binary Logic Input Device | | Alternative accessible appliance that is connected to the AutoMARK Voter Assist Terminal through a stereo jack, enabling the voter to issue either a yes or no command. These devices may include foot pedals and Sip/Puff tubes. |

| Term | Abbreviation | Definition |
|---|---|---|
| Data Acquisition Manager | DAM | The ES&S Data Acquisition Manager software is used to transmit election results over a network connection from ES&S ballot counting equipment to a central count location. |
| Delkin USB | | A USB flash drive to store the scanner's election definition, audit log and other election-specific information. |
| Election Data Manager | EDM | Election Data Manager is a database system that stores all of a jurisdiction's precinct, office, and candidate information. It is used in conjunction with other Unity software to format and print ballots, program ballot scanning equipment, and produce Election Day reports. |
| Election Reporting Manager | ERM | The Election Reporting Manager is an election results reporting program, used to generate paper and electronic reports for poll workers, candidates, and the media. ERM can display updated election totals on a monitor as ballot data is tabulated and can send result reports directly to media outlets over the Internet. ERM is designed to support a wide range of ES&S ballot scanning equipment and can produce reports for both central count systems and precinct count systems. |
| ES&S Ballot Image Manager | ESSIM | ES&S Ballot Image Manager is a publishing tool used to design and print ballots with the election information stored in EDM. |
| Flash Memory Card | FMC | The FMC supplies ballot content information to the VAT. |
| iVotronic | | The iVotronic is a DRE (direct recording electronic) touch screen that displays ballots and records votes. The iVotronic addresses accessibility requirements through the use of voice files, font type and size, and color combinations. There are two sizes of iVotronics. One is the 12 inch with 3 key ADA buttons the other is a 15 inch that have a 3, 4 or 6 key ADA buttons. There are also non-ADA iVotronics. The iVotronic 6 key allows the use of the sip and puff. |
| iVotronic Image Manager | iVIM | The iVotronic Image Manager enables the user to create and format graphic ballot screens for the iVotronic voting device. |
| Hardware Programming Manager | HPM | Hardware Programming Manager enables the user to import, format, and convert the election definition files for ballot scanning equipment and DREs. |
| intElect DS200 | DS200 | The intElect DS200 precinct ballot scanner is part of a jurisdiction-wide election tabulating system. Voters make selections and then insert their ballots directly into the Model 100 at the polling place. The scanner tabulates votes and sorts a ballot as soon as a voter inserts it and then feeds the ballot into the attached ballot storage bin accepting ballots inserted in any direction and reads both sides of the ballot simultaneously. |
| Model 100 | M100 | The Model 100 precinct ballot scanner is part of a jurisdiction-wide election tabulating system. Voters make selections and then insert their ballots directly into the Model 100 at the polling place. The scanner tabulates votes and sorts a ballot as soon as a voter inserts it and then feeds the ballot into the attached ballot storage bin accepting ballots inserted in any direction and reads both sides of the ballot simultaneously. |
| Model 650 | M650 | The Model 650 is an optical scan central count counter that is used to scan ballots at a central count location. The M650 scan up to 350 ballots per minute, counts different sizes (11, 14, 17, 19) of ballots and can read voting marks on the right or left of the ballot column. The M650 prints results reports and saves results to a zip disk. |

| Term | Abbreviation | Definition |
|---|---|---|
| PCMCIA | | PCMCIA card contains the M100 election definition that exactly mirrors the ballot contents and issues as defined by election officials. |
| Personalized Electronic Ballots | PEB | An electronic ballot that a jurisdiction defines for use with the iVotronic to open polls, load ballots and collect votes from each terminal at the end of an election day. |
| Real-Time Audit Log Printer | RTAL | The Real-Time Audit Log Printer records each voter's actions on a paper audit log in real time, including all selections and de-selections for the iVotronic. The paper audit log can be viewed but not touched by the voter as the paper is behind a clear plastic cover. Prior to casting a vote. Under-voted contests and a two-dimension bar code of the votes are appended to the audit entries and the paper advances out of the view window in either a 9-inch or 4.5-inch window. |
| Unity Release | N/A | The system configuration(s) of ES&S hardware and software voting system(s). |

# System Identification

Unity 4.0 was submitted for certification testing with the hardware and software listed below. No other ES&S product was included in this test effort.

The TDP User/Owner manuals that would be part of the certified system delivered to a purchaser of the system are as follows:

**System Maintenance Procedures:**

- ES&S DS200 System Maintenance Manual, Hardware Version 1.2.0.0, Firmware Version 1.2.0.0, November 2, 2007
- ES&S iVotronic System Maintenance Manual, Hardware Revision iV1.26.15asp, Firmware Version 9.2.0.0, August 3, 2007
- ES&S M100 System maintenance Manual, Version Release 5.4.0.0, Hardware Version, 1.3, November, 16, 2007
- ES&S Model 650 System Maintenance Manual, Firmware Version 2.2.1.0, Hardware Version 1.1, November 16, 2007

**System Operation Procedures:**

- ES&S Model 650 System Operations Procedures, Firmware Version 2.2.1.0, Hardware Version 1.1, November 16, 2007
- ES&S Model 100 System Operations Procedures, Firmware Version 5.4.0.0, Hardware Version 1.3, November 16, 2007
- ES&S iVotronic System Operations Procedures, Firmware Version 9.2.0.0, Hardware Version 1V1.26.15asp, November 7, 2007
- ES&S iVotronic Image Manager System Operations Procedures, Version Release 3.1.0.0, October 19, 2007
- ES&S Hardware Programming Manager System Operations Procedures, Version Release 5.6.0.0, August 17, 2007

- ES&S Image Manager System Operations Procedures, Version Release 7.7.0.0, October 15, 2007
- ES&S Election Reporting Manager System Operations Procedures, Version Release 7.4.0.0, November 16, 2007
- ES&S Election Data Manager System Operations Procedures, Version Release 7.8.0.0, November 16, 2007
- ES&S DS200 System Operations Procedures, Firmware Version 1.2.0.0, Hardware Version 1.2.0.0, November 8, 2007
- ES&S Data Acquisition Manager System Operations Procedures, Version Release 6.1.1.0, November 16, 2007
- ES&S Audit Manager System Operations Procedures, Version Release 7.5.0.0, November 12, 2007
- ES&S Automated Barcode Reader System Operations Procedures, Firmware Version 29, Hardware Version Rev B, Software Version 1.3.0.0, HIDCom Version 1.0.0.0, November 16, 2007

**System Overview:**

- System Overview, Election Systems and Software, Version Number 4.0.0.0, November 15, 2007

## 1.6 Software and Firmware

Items identified in the table reflect all software and firmware used to perform hardware, software, telecommunications, security and integrated system tests. Not all items listed below were required to run the Unity 4.0 voting system. However, all items listed were part of the certification test effort.

**Table 3 – Matrix of Required Software and Firmware**

| Application(s) | Manufacturer | Version | Description |
|---|---|---|---|
| Audit Manager | ES&S | 7.5.0.0 | Audit Manager provides security and user tracking for itself, Election Data Manager and Ballot Image Manager. Audit Manager runs in the background of the other Unity programs and provides password security and a real-time audit log of all user inputs and system outputs. Jurisdiction Officials use Audit Manager to set Unity system passwords and track user activity. |
| Election Data Manager | ES&S | 7.8.0.0 | Election Data Manager is a single-entry database that stores all of a jurisdiction's precinct, office, and candidate information. Election Data Manager is used in conjunction with other Unity software to format and print ballots, program ballot scanning equipment, and produce Election Day reports. |
| ES&S Ballot Image Manager | ES&S | 7.7.0.0 | ESSIM is a desktop publishing tool that is used to design and print ES&S paper ballots. ESSIM uses ballot |

| Application(s) | Manufacturer | Version | Description |
|---|---|---|---|
| (with Ballot on Demand) | | | style information created by Unity Election Data Manager to display the WYSIWYG ballots.<br><br>Ballot On Demand (BOD) is an accessory program that you can use to print individual, Election Day ballots directly from ESSIM. |
| iVotronic Image Manager | ES&S | 3.2.0.0 | iVotronic Image Manager (iVIM) is a desktop publishing tool that is used to design and generate graphic ballots for the iVotronic precinct voting system. iVIM uses ballot style information created by Unity Election Data Manager to display the WYSIWYG ballots. iVotronic Image Manager also allows the user to view the ballot in different languages, and create multiple displays for the same ballot. Ballots generated by iVotronic Image Manager comply with ADA (Americans with Disabilities Act) requirements using voice files, specific font type and size, and color combinations. |
| Hardware Programming Manager | ES&S | 5.7.0.0 | Hardware Programming Manager (HPM) is a complete election package that enables the user to import, format, and convert the election file; define districts; specify election contests and candidates; create election definitions for ballot scanning equipment; burn M100 PCMCIA Cards, DS200 USB memory sticks, M650 zip disks, or PEBs; and create the Data Acquisition Manager Precinct List. The Hardware Programming Manager is primarily used for converting the election IFC file for use with the Election Reporting Manager and for creating and loading election parameters; however, it may also be used for coding the election. The Unity Hardware Programming Manager seamlessly programs the ES&S election tabulation hardware with election-specific information retrieved from the Unity Election Data Manager (EDM).<br><br>**NOTE: Creating an election definition from scratch in HPM is not supported in the Unity 4.0 certification.** |
| Data Acquisition Manager | ES&S | 6.1.3.0 | The Unity Data Acquisition Manager (DAM) is a client-server application that collects election data from ES&S voting systems and transmits the data directly from the polls or regional sites via modem transmission to the host election server for the purpose of results accumulation, reporting, and display.<br><br>The Data Acquisition Manager allows users to transfer election results from remote polling sites to a jurisdiction's election headquarters. Data Acquisition Manager has two software configurations: Data Acquisition Manager Remote and Acquisition Manager Host. Poll workers use the remote configuration to transfer election results to the central collection location. Officials at the central site use the host configuration to receive election data from polling places. Workers at the central location load collected results into Election Reporting Manager™ to format, print, and display final |

| Application(s) | Manufacturer | Version | Description |
|---|---|---|---|
| | | | election reports. |
| Election Reporting Manager | ES&S | 7.5.2.0 | Election Reporting Manager (ERM) is ES&S' election results reporting program. ERM generates paper and electronic reports for election workers, candidates, and the media. ERM can also display updated election totals on a monitor as ballot data is tabulated, and it can send results reports directly to media outlets. Election Reporting Manager is designed to support a wide range of ES&S ballot scanning equipment and can produce reports for both central-count systems and precinct-count systems. |
| AIMS | ES&S | 1.3.57 | The AutoMARK Management Information System (AIMS) is software that manages all of the information required by the AutoMARK Voter Assist Terminal (VAT) for an election. The AIMS process starts with a printed optical scan ballot. In addition to the printed ballot, files produced by ES&S Unity Systems may be imported into AIMS, for ease in loading data into the AutoMARK AIMS election database. In lieu of the import procedure, election specific data may be manually entered into AIMS. AIMS writes the election database to a compact flash memory card (FMC). This FMC supplies ballot content information to the VAT. |

**Table 4 – Matrix of Required COTS Software/Firmware**

| COTS Application(s) | Manufacturer | Version | Description |
|---|---|---|---|
| **Required COTS software for the Unity 4.0 voting system** | | | |
| Windows XP Professional | Microsoft Corporation | 2002 Service Pack 2 | COTS software for all Applications listed above. |
| RM COBOL RUNTIME System | RM/COBOL | 11.01 | COTS software for the ERM, HPM |
| Adobe Type Manager<br><br>(includes Adobe Type Basics and Adobe Type Manager Light) | Adobe | 4.1 | COTS software for ESSIM, BOD |
| OmniDrive USB Professional | Omni | No version | COTS software for the HPM, ERM |
| PEB Reader | Pivot/ES&S | 1.1.0.0 | COTS software for HPM, ERM |
| **Non-required COTS software for the Unity 4.0 voting system** | | | |
| Broadcom Gigabit Integrated Controller | Broadcom | 9.02.06 | COTS software Voyager Hand scanner, and Desktop PCs. |

| COTS Application(s) | Manufacturer | Version | Description |
|---|---|---|---|
| C-Major Audio | SigmaTel | 42.xx | COTS software Voyager Hand scanner, and Desktop PCs. |
| Conexant D110 MDC | Unknown | 92 Modem | COTS software Voyager Hand scanner |
| Graphics Media Accelerator Driver for Mobile | Intel | No version | COTS software Voyager Hand scanner |
| MS Office Professional Edition 2003<br><br>(MS Word and Excel installed in the setup) | Microsoft Corporation | 11.0.7969.0 | COTS software Voyager Hand scanner |
| O2Micro Smartcard Driver | O2Micro | 2.26.0000 | COTS software Voyager Hand scanner, and Desktop PCs. |
| ATI Display Driver | ATI | No version | COTS software for the Server |
| Dell OpenManage Array Manager | Dell | No version | COTS software for the Server |
| DirectX Hotfix – KB839643 | Microsoft Corporation | No version | COTS software for the Server |
| HP Laser Jet 2300 Uninstaller | HP | No version | COTS software for the Server |
| Intel® PRO Intelligent Installer<br><br>Intel® PRO Network Adapters and Drivers | Intel | 2.01.1000 | COTS software for the Server |
| Internet Explorer Q867801 | Microsoft Corporation | No version | COTS software for the Server |
| LiveUpdate | Symantec Corporation | 1.7 | COTS software for the Server |
| Symantec AntiVirus Client | Symantec Corporation | 8.0.0.374 | COTS software for the Server |
| Outlook Express Q823353 | Microsoft Corporation | No version | COTS software for the Server |
| Windows 2000 | Microsoft Corporation | Service Pack 4 | COTS software for the Server |
| Windows 2000 Administration Tools | Microsoft Corporation | 5.0.0.0000 | COTS software for the Server |
| Microsoft Health Monitor 2.1 | Microsoft Corporation | 2.10.1850.0000 | COTS software for the Server |
| Microsoft Internet Security and Acceleration Server | Microsoft Corporation | 3.0.1200 | COTS software for the Server |
| Microsoft Shared Fax | Microsoft Corporation | 1.0000 | COTS software for the Server |

| COTS Application(s) | Manufacturer | Version | Description |
|---|---|---|---|
| Microsoft Small Business | Microsoft Corporation | Server 2000 | COTS software for the Server |
| Microsoft Data Access Components KB870669 | Microsoft Corporation | No version | COTS software for the Server |
| Microsoft.NET Framework | Microsoft Corporation | 1.1.4322 | COTS software for the Server |
| Windows 2000 Hotfix:<br>- KB819696,<br>- KB820888,<br>- KB822831,<br>- KB823182,<br>- KB823559,<br>- KB82410,<br>- KB824141,<br>- KB824146,<br>- KB825119,<br>- KB826232,<br>- KB828028,<br>- KB828035,<br>- KB828741,<br>- KB828749,<br>- KB835732,<br>- KB837001<br>- KB839643,<br>- KB839645,<br>- KB840315,<br>- KB841872,<br>- KB841873,<br>- KB842526, | Microsoft Corporation | <br>- 20030703.183130<br>- 20030604.152521<br>- 20030611.114034<br>- 20030618.121409<br>- 20030627.135515<br>- 20030716.151320<br>- 20030805.151423<br>- 20030823.144456<br>- 20030827.151123<br>- 20031007.160553<br>- 20040122.114409<br>- 20031023.142138<br>- 20040311.130332<br>- 20031023.124056<br>- 20040323.171849<br>-<br>- 20040506.120130<br>- 0040519.160457<br>- 20040622.153749<br>- 20040520.90850<br>- 20040610.95344<br>- 20040521.202909 | COTS software for the Server |
| Intel ProEthernet Adapter and Software | Intel | No version | COTS Software on the Desktop PCs |
| SeaCOM | Unknown | No version | COTS Software on the Desktop PCs |
| SoundMAX | Unknown | No version | COTS Software on the Desktop PCs |
| ATI Software Uninstall Utility | ATI | 6.14.10.10.14 | COTS Software on the Desktop PCs |

| COTS Application(s) | Manufacturer | Version | Description |
|---|---|---|---|
| ATI Control Panel | ATI | 6.14.10.5173 | COTS Software on the Desktop PCs |
| ATI Display Driver | ATI | 8.20-051110A1-028793C-Dell | COTS Software on the Desktop PCs |
| Conexant D480mdc | Unknown | 92 modem | COTS Software on the Desktop PCs |

## 1.7 Equipment (Hardware)

Equipment identified in the table reflects all hardware used to perform hardware, software, security and integrated system tests. Not all items listed below were required to run the Unity 4.0 voting system. However, all items listed were part of this certification test effort. All equipment was provided by ES&S. SysTest Labs staff uploaded all executables and installs on the equipment, and the equipment and Trusted Build executable and installs were under the control of SysTest Labs.

**Table 5 – Matrix of Required Hardware**

| Item | Manufacturer | Model # | Version/Rev | Description |
|---|---|---|---|---|
| intElect DS200 (Scanner) | ES&S | DS200 | Hardware v. 1.2.0 & 1.2.1<br><br>DS200 Firmware 1.3.7.0<br><br>Power Management Firmware 1.2.0.0<br><br>Scanner Firmware 2.11.0.0 | A precinct/central count ballot scanner. The scanner accepts ballots, tabulates votes, and sorts the ballots (if attached to a ballot box containing a diverter). |
| Steel ballot box without diverter | ES&S | N/A | N/A | A storage receptacle to store scanned ballots. (Used with M100 and DS200). |
| Model 100 (Scanner) – | ES&S | M100 | Hardware v. 1.3.0<br><br>Firmware v. 5.4.0.0 | A precinct ballot scanner. The scanner accepts ballots, tabulates votes, and sorts the ballots (if attached to a ballot box containing a diverter). |
| Model 100 | ES&S | M100 | Hardware v. | A precinct ballot scanner. The scanner accepts ballots, tabulates |

| Item | Manufacturer | Model # | Version/Rev | Description |
|---|---|---|---|---|
| (Scanner) – | | | 1.3.0<br><br>Firmware v. 5.4.0.0 | votes, and sorts the ballots (if attached to a ballot box containing a diverter). |
| Steel ballot box w/ diverter) | ES&S | N/A | N/A | A storage receptacle to sort and store scanned ballots. (Used with M100 and DS200). |
| Plastic ballot box | ES&S | N/A | N/A | A storage receptacle to sort and store scanned ballots. (Used with M100 and DS200). |
| Model 650 – Red – Left (Scanner) | ES&S | M650 | Hardware v. 1.2<br><br>Firmware v. 2.2.1.0 | An optical scan central counter that is used to scan ballots at a central count location. The M650 prints results reports and saves results to a zip disk. |
| Model 650 – Green – Right (Scanner) | ES&S | M650 | Hardware v. 1.1<br><br>Firmware v. 2.2.1.0 | An optical scan counter that is used to scan ballots at a central count location. The M650 prints results reports and saves results to a zip disk. |
| Model 650 – Green – Left (Scanner) | ES&S | M650 | Hardware v. 1.2<br><br>Firmware v. 2.2.1.0 | An optical scan central counter that is used to scan ballots at a central count location. The M650 prints results reports and saves results to a zip disk. |
| 12inch, 3 key iVotronic (DRE) – | ES&S | 0105-096-90659 | Hardware v. 1.1<br><br>Firmware v. 9.2.3.0 | A DRE (direct recording electronic) touch screen that displays ballots and records votes. This is 12 inches with 3 keys ADA buttons. |
| 12inch, Non-ADA iVotronic (DRE) – | ES&S | 0105-096-90659 | Hardware v. 1.1<br><br>Firmware v. 9.2.3.0 | A DRE (direct recording electronic) touch screen that displays ballots and records votes. This is 12 inches with no ADA buttons. |
| 15inch, 3 key iVotronic (DRE) | ES&S | 9VDC 2770mA | Hardware v. 1.1<br><br>Firmware v. 9.2.3.0 | A DRE (direct recording electronic) touch screen that displays ballots and records votes. This is 15 inches with 3 keys ADA buttons. |

| Item | Manufacturer | Model # | Version/Rev | Description |
|---|---|---|---|---|
| 15inch, 4 Key iVotronic (DRE) – | ES&S | 9VDC 2770mA | Hardware v. 1.1<br><br>Firmware v. 9.2.3.0 | A DRE (direct recording electronic) touch screen that displays ballots and records votes. This is 15 inches with 4 keys ADA buttons. |
| 15inch, 6 key iVotronic (DRE) – | ES&S | 15” 9VDC 2770mA | Hardware v. 1.1<br><br>Firmware v. 9.2.3.0 | A DRE (direct recording electronic) touch screen that displays ballots and records votes. This is a 15 inches with 6 key ADA buttons. The iVotronic 6 key allows the use of the sip and puff. |
| 15 inch, Non-ADA iVotronic (DRE) – | ES&S | 0105-096-90659 | Hardware v. 1.1<br><br>Firmware v. 9.2.3.0 | A DRE (direct recording electronic) touch screen that displays ballots and records votes. This is 15 inches with no ADA buttons. |
| 15 inch Supervisor iVotronic (RED) – | ES&S | 9VDC 2770mA<br><br>0150-096-90659 | Hardware v. 1.1<br><br>Firmware v. 9.2.3.0 | Poll workers use supervisor equipment to open polls, load ballots onto voter PEBs or voting terminals, close the polls, and print results for the polling place. |
| iVotronic RTAL Booth 4.5 inch window | Booth: Pivot, Printer: Xten | N/A | Hardware v. N/A<br><br>Firmware v. V012 | The Real-Time Audit Log Printer records each voter’s actions on a paper audit log in real time on a 4.5-inch window. This printer is attached to a private voting booth. |
| iVotronic RTAL Booth 9 inch window | Booth: Pivot, Printer: Xten | N/A | Hardware v. N/A<br><br>Firmware v. V012 | The Real-Time Audit Log Printer records each voter’s actions on a paper audit log in real time on a 9-inch window. This printer is attached to a private voting booth. |
| ABCR (Automatic Bar Code Reader) – | JADAK | N/A | Hardware v. B<br><br>Firmware v. 29 | The ABCR is a device that audits and recounts the barcode printout generated by the iVotronic RTAL printer. |
| Supervisor PEB – | Pivot | N/A | Hardware v. N/A<br><br>Firmware v. 1.7.1.0 | A portable cartridge fitted with an infrared communications window and a flash memory chip. Supervisor PEBs contain specific ballot data for each election. They open the polls, load the ballot onto a voter terminal and enable |

| Item | Manufacturer | Model # | Version/Rev | Description |
|---|---|---|---|---|
| | | | | the service mode for administrative functions. |
| Election SecurityKey PEB | ES&S | N/A | Hardware v. N/A<br><br>Firmware v. 1.7.1.0 | The iVotronic utilizes a “Key” PEB which requires that a key be passed to each iVotronic during set up in order to validate that the EQC (election qualification code) is correct for the election being conducted. This “Key” also requires that the correct election key be resident on each terminal before the election data is allowed to be unencrypted. |
| Voter Activated PEB – **3** | Pivot | N/A | Hardware v. N/A<br><br>Firmware v. 1.7.1.0 | The Voter Activated PEB allows the voter to activate a ballot on the terminal in complete privacy. |
| Communication Pack<br><br>with Seiko printer | Pivot<br><br>Seiko | N/A<br><br>DPU 3445 | Hardware v. 1.1 | A case that contains special communications hardware, a serial thermal printer, and an optional modem for the iVotronic. The printer generates paper results, and the modem is used to transfer results to a central count location. |
| Printer (standalone for iVotronic) | Seiko | DPU-3445 | N/A | Standalone printer for the iVotronic. |
| BOD Printer | OkiData | 9600 | | Printer used to print ballots. |
| Printer (M650 Red Left Printer) (2) | 520 OkiData | GE5258 A | N/A | Printer for audit logs and reports for the M650. |
| Printer (M650 Green Right Printer) – 2 | 520 OkiData | GE5258 A | N/A | Printer for audit logs and reports for the M650. |
| Printer (M650 Green Left Printer) – 2 | Epson Model # LQ-590 | P363A | N/A | Printer for audit logs and reports for the M650. |
| LaserJet Printer | HP | 2300N | N/A | Printer for reports created within Unity. |
| Router | Dlink | 1 @ DSH-16, 1 with no identificat | 1 @ V. B2, 1 with no identification | Directs and controls the flow of data. |

| Item | Manufacturer | Model # | Version/Rev | Description |
|---|---|---|---|---|
| | | ion | | |
| Modem | US Robotics | 56K Sportster | N/A | A device that allows computer information to be sent over a telephone line. |
| Multi-Modem Adapters<br>(Used in DAM PC)<br>**(1 each)** | Equinox | N/A | N/A | 4 and 8 port |
| Multi-Modem Adapters<br>(Used in DAM PC) | Digi | N/A | N/A | 4 and 8 Port |
| Multi-Modem Adapters<br>(Used in DAM PC) | Perle | N/A | N/A | 4 and 8 Port |
| Multi-Port Adapter<br>(Used in DAM PC) | SeaLevel | N/A | N/A | 7801 & 7803 – 8 Port<br>7406 – 4 Port |
| USB PEB Reader/Writer | Pivot | M1706 | Hardware v. 1.1 | A device with a USB connection used to upload election results from a PEB to a PC. |
| Hand Bar Code Reader | Voyager | MS9544 | N/A | A device that reads the barcode printout generated by the iVotronic RTAL printer. |
| Omni Drive | Omni | D707-94 | Rev. C1<br>USB 1.1 | A device used to read/write data to the PCMCIA card. |
| Omni Drive Professional USB2 | Omni | D707-94 | Rev. A<br>USB 2.0 | A device used to read/write data to the PCMCIA card. |
| SanDisk Reader | SanDisk | SDDR-91 | N/A | Used to read data off of a SanDisk. |
| SanDisk ImageMate CF Reader | SanDisk | SDDR-92 | N/A | Used to read data off of a SanDisk. |
| Zip Disk<br>**1 Received** | iOmega | Z250US BPCMBP | N/A | Used to store data. |
| Headphones | ADID -(ESS) N/A -(ES&S | N/A | N/A (ESS) | A pair of listening devices joined by a band across the top of the |

| Item | Manufacturer | Model # | Version/Rev | Description |
|---|---|---|---|---|
| | VAT) | | AKG-K-44 (ES&S VAT) | head and worn in or over the ears. |
| External Volume Control Button | ES&S | N/A | Hardware v. N/A | Used for controlling the volume on the 12 inch 3-Key and 15 inch 3-Key iVotronics. |
| Serial PEB Reader | Pivot | N/A | Hardware Rev. 1.1<br><br>Software: N/A | A device with a serial connection used to upload election results from a PEB to a PC. The reader can also connect to a M100 to combine results at the polling place. |
| UPS | Belkin | N/A | N/A | Backup uninterrupted power source for the M650 |
| Sip n Puff | Pivot | N/A | | Device used on the iVotronic 6-key by physically disabled voters |
| iVotronic booth | Pivot | N/A | N/A | A booth that holds an iVotronic terminal and optionally an RTAL printer, to ensure voter privacy. |
| Dell Laptop D600 Latitude | Dell | N/A | Windows XP Professional, SP2<br><br>Rev A00 | Intel® Pentium® M processor 1.60GHz 1.60 GHz, 1.00 GB of RAM (Laptop for Remote modeming only)<br><br>Post Voting<br><br>(DAM Client Regional Site remote only) |
| Dell PC Pentium® | Dell | N/A | Windows XP Professional, SP2 | 4 CPU 2.00GHz, 512MB of RAM<br><br>(PC System 1)<br>(Pre and Post Voting) |
| Dell PC Pentium® | Dell | N/A | Windows XP, SP2 | 4 CPU 2.80GHz, 2.79 GHz, 1.00 GB of RAM (PC System 2)<br>Pre and Post Voting |
| Dell PC Pentium® | Dell | N/A | Windows XP Professional, SP2 | 4 CPU 2.80GHz, 2.79 GHz, 5.12 MB of RAM (PC System 3)<br><br>(Post Voting DAM Host only) |
| Server (PC) PE600SC | Dell | N/A | | Intel Pentium 4 CPU 1.80 GHz<br><br>AT/AT compatible<br><br>523,763 KB RAM |
| Dell Laptop D610 Latitude | Dell | N/A | Windows XP Professional, SP2 | Intel® Pentium® M processor 1.73GHz 795MHz, 0.99GB of RAM, (Physical Address Extension - laptop)<br>(Hand Bar Code Reader and |

| Item | Manufacturer | Model # | Version/Rev | Description |
|---|---|---|---|---|
| | | | Rev A06 | ABCR) |
| Multi Compact Flash Reader/Writer (Gang Programmer PC) | Dell | N/A | Windows XP Professional, SP2<br><br>Rev A00 | Pentium 4 CPU<br>2.80GHz, 2.79 GHz, 512 MB of RAM<br>(Pre & Post voting) |
| VAT | ES&S | Model # A100 | Hardware v 1.0<br><br>Firmware v. 1.3.2904 | AutoMARK Voter Assist Terminal (VAT) is an electronic ballot marking device that allows voters to electronically mark a ballot, by using the touch screen Braille keypad or an AT (Assistive Technology (Sip and Puff) device. |
| VAT | ES&S | Model # A200 | Hardware v 1.0, and 1.1<br><br>Firmware v. 1.3.2904 | AutoMARK Voter Assist Terminal (VAT) is an electronic ballot marking device that allows voters to electronically mark a ballot, by using the touch screen Braille keypad or an AT (Assistive Technology (Sip and Puff) device. |

## 1.8 Test Materials

Items identified in the table reflect test materials required to perform hardware, software, telecommunications, security, accuracy and integrated system tests.

**Table 6 – Matrix of Test Materials**

| Item | Provided by | Details |
|---|---|---|
| Printer paper rolls | ES&S | RTAL, Communication Pack, M100, DS200 and Seiko Printer |
| Zip disks | ES&S | M650 program media |
| USB SanDisk (CF) | ES&S | Compact Flash card 128, 256 & 512MB |
| Blank paper ballot stock | ES&S | Inches/ballot positions: 11x36, 14x36, 14x48, 17x45, 17x60, 19x51, 19x68 |
| PCMCIA | ES&S | PC Cards M100 program media |
| USB Memory Stick | ES&S | DS200 |
| Head sets | ES&S | For the VAT and iVotronic |

## 1.9 TDP Documents Used to Support Testing

The vendor documents used to support Certification Testing are listed in Attachment A.

# System Overview

The Unity 4.0 Voting System is a configuration consisting of an election management system (EMS), three ES&S optical mark scan hardware platforms (**M100** precinct scanner, **DS200** precinct scanner, and **M650** central scanner), the iVotronic DRE hardware platform, and the AutoMark Voter Assist Terminal (VAT). The election management software includes the following applications: Audit Manager, Election Data Manager, AutoMARK Information Management System (AIMS), ES&S Ballot Image Manager, Ballot on Demand, iVotronic Image Manager, Hardware Programming Manager, Data Acquisition Manager, Automatic Bar Code Reader, and Election Reporting Manager. The EMS creates multiple ballot styles, generates election definition reports, and consolidates and distributes election results. The system is designed around the pre-election, election and post-election activities.

The ES&S Model 100 (M100) is a precinct-based, voter-activated paper ballot counter and vote tabulator. The M100 uses advanced Intelligent Mark Recognition (IMR) visible light scanning technology. The M100 has the ability to alert voters to overvoted races, undervoted races, or blank ballots. When so alerted, the ballot is returned to the voter providing the opportunity for private revisions and the opportunity to recast the ballot. The M100 accepts ballots inserted in any orientation – top first, face up; bottom first, face down; etc. Optical sensors simultaneously read both sides of the ballot, and accurately record voter selections, as the Counter passes the ballot to the integrated ballot box. The M100 also has a feature that provides the user the ability to print a combined zero report and a combined results report at a polling place using an iVotronic PEB from the same election. A Personalized Electronic Ballot (PEB) is used to activate the iVotronic, open polls, load ballots onto the iVotronic and collect all votes from each iVotronic terminal at the end of an election day. A PEB reader can be connected to the M100 and combine the iVotronic results with those of the M100. All write-in names voted on the iVotronic DRE will display on the combined report, as well as the combined totals. The report will display the iVotronic totals separate from the M100 totals. If combining the iVotronic results with the M100, the user can transmit results via a landline modem. However, transmitting will only send the M100 results; therefore, the PEB must be taken to central count for tallying.

The intElect DS200 is an optical scan paper ballot tabulator designed to be used at the polling place level, but can be used in multiple environments, such as a central count device in small jurisdictions only. After the voter makes their selections on their paper ballot with an indelible marker, or a device that was designed to assist with the marking process, their ballot is inserted into the unit for immediate tabulation. Both sides of the ballot are scanned at the same time using a high-resolution image-scanning device that produces ballot images that are decoded by a proprietary recognition engine. The system includes a large touch screen display to provide clear feedback to the voter on the disposition of their ballot. Once the ballot is tabulated and the system updates the vote counters, the ballot is dropped into a secure ballot box. The DS200 includes an internal thermal printer for the printing of zero reports, log reports, and polling place totals upon the official closing of the polls. Like the M100, the DS200 has the ability to alert voters to overvoted races, undervoted races, or blank ballots. When so alerted, the ballot is returned to the voter providing the opportunity for private revisions and the opportunity to recast the ballot. The DS200 also accepts ballots inserted in any orientation – top first, face up; bottom first, face down; etc. Optical sensors simultaneously read both sides of the ballot, and accurately record voter selections, as the Counter passes the ballot to the integrated ballot box.

The Model 650 is also an optical scan central ballot counter. Jurisdiction workers program the scanner for a specific election with an election definition from a Zip disk. After the polls close, poll workers transport ballots to a central count location where election officials scan the ballots. The Model 650 prints a continuous audit log to a dedicated audit log printer and can print results reports directly from the scanner to a second connected printer. The scanner saves results to a Zip disk that officials can use to format and print results from a PC running Election Reporting Manager. The Model 650 uses an OKI compatible dot matrix printer with a standard parallel input to print reports. In addition to the report printer, the M650 supports an additional audit printer. The scanner stops if either printer fails. If one printer fails, the audit log automatically switches to the working printer.

The iVotronic DRE is a touch screen terminal that will display different ballot styles and record votes. The iVotronic can display many different ballot styles and has an optional 4-position volume control on the main panel and audio button functionality. The iVotronic is available with a 12-inch, 3-key terminal or a 15-inch 3-key, 4-key, and 6-key terminal. The 3-key terminal contains the Select and Scroll buttons; the 4-key terminal contains the Select, Scroll, and Volume Control buttons; and the 6-key terminal contains the Scroll buttons, Select button, Volume Control Button, Repeat Button, and Info Button; however, in the Unity. 4.0 release, the Repeat and Info buttons are not supported. The 15-inch iVotronic supports nine languages and the 12-inch iVotronic terminal supports eight languages; however, only Spanish was supported in the Unity 4.0 certification. The iVotronic is capable of presenting the ballot to voters in alternative languages—in the case of Unity 4.0, Spanish. A Personalized Electronic Ballot (PEB) is used to activate the iVotronic, open polls, load ballots onto the iVotronic and collect all votes from each terminal at the end of an election day. The iVotronic is also capable of presenting a combination audio/visual ballot to the voter. This presentation displays the ballot on the iVotronic electronic display and when screen objects are selected (race/proposition titles, candidate name etc.), that selected screen object is read to the voter, in an audio format, through the use of headphones. Selections are then made through the use of the select button on the iVotronic tactile button array. This capability allows use of the terminal for voters who may be illiterate or whose native language has no written form. The Real-Time Audit Log (RTAL) Printer may be attached to an ES&S Unity 4.0 Voting System iVotronic configuration. It records each voter's actions on a paper audit log in real time. This includes all selections and de-selections. The paper audit log is viewed, but not touched by the voter. After a review of the paper audit entries and review screen on the iVotronic, a voter casts a vote. Undervoted contests and a two-dimension bar code of the votes are appended to the audit entries and the paper advances out of the view window.

Audit Manager (AM) is ES&S' tracking program for the Unity software suite. AM tracks user activity in AM, EDM and ESSIM.

Election Data Manager (EDM) is a database system that stores all of a jurisdiction's precinct, office, and candidate information. It is used in conjunction with other Unity software to format and print ballots, program ballot scanning equipment, and produce Election Day reports.

ES&S Ballot Image Manager (ESSIM) is a publishing tool used to design and print ballots with the election information stored in EDM.

Election officials use Ballot on Demand (BOD) to print test ballots, early voting ballots and ballots for polling places that run short of ballot stock on Election Day.

The iVotronic Image Manager enables the user to create and format graphic ballot screens for the iVotronic voting device.

Hardware Programming Manager enables the user to import, format, and convert the election definition files for ballot scanning equipment and DREs.

The ES&S Data Acquisition Manager software is used to transmit election results over a network connection from ES&S ballot counting equipment to a central count location.

The ABCR is a device that audits and recounts the printout generated by the iVotronic RTAL printer. The ABCR device interfaces with ABCR software installed on a PC to generate reports based upon the scanned barcodes from the RTAL printout.

The Election Reporting Manager is an election results reporting program, used to generate paper and electronic reports for poll workers, candidates, and the media. ERM can display updated election totals on a monitor as ballot data is tabulated and can send result reports directly to media outlets over the Internet. ERM is designed to support a wide range of ES&S ballot scanning equipment and can produce reports for both central count systems and precinct count systems.

The Compact Flash Multi-Card Reader/Writer (Gangburner) can be used to copy election data to multiple Compact Flash disks and also to read audit data files from multiple compact flash cards to a central directory location.

The ES&S Unity 4.0 Voting System software is designed and developed to:

- Define election databases for paper or electronic ballots;
- Install election specific data on appropriate election hardware media (optical scanner or DRE);
- Cast electronic or paper ballots;
- Provide a voter verifiable paper audit tape for electronic ballots;
- View and/or print audit reports;
- Report election totals in the precinct;
- Transmit results from precinct tabulators and remote regional sites;
- Tabulate ballots at a central counting site;
- Send central count vote data via a network (LAN for M650) and landline modem for the M100, DS200, and iVotronic) to the Election Reporting Manager (ERM)
- Report and consolidate votes at a central location.

Testing was done in conjunction with the ES&S AutoMARK Voting System. Following is a description of the AutoMARK systems:

AIMS is designed and developed to:

- Import election definition files from ES&S Unity 4.0;
- Manually enter election definition information;
- Maintain election specific information including precincts, splits, races and candidates;
- Preview and verify all election data;
- Write the election database to a secure compact flash memory card (FMC);
- Record, review, and print real time audit logs.

The FMC is used to supply ballot content information to the VAT.

The VAT is an ADA compliant paper ballot-marking component of the ES&S AutoMARK Voting System. It enables a user to:

- Install an election database that corresponds to the printed paper ballot via an FMC;
- Independently insert a blank paper ballot for either visual or audio display;
- Independently select candidate and contest options from a visual or audio ballot via a touch screen, tactile buttons or an alternative entry binary logic stereo jack input device;
- Cast a ballot, resulting in the marking and ejection of the paper ballot;
- Mark a paper ballot such that a Unity 4.0 tabulator programmed with the corresponding election database, can read and tabulate it.

Functionality was tested, as identified in the Test Methodology table below. The following functional areas exist for ES&S and Unity 4.0.

**Table 7 – Matrix of System Functional Testing**

| Function | Test Methodology |
|---|---|
| **Ballot Preparation Functions** | |
| *a.* Ballot preparation subsystem | Verify the election is defined for election day, and one more precinct/polling place can be defined. |
| **Before, During & After Processing of Ballots** | |
| *b.1.* Logic Test – Interpretation of Ballot Styles & recognition of precincts | Verify in Functional Tests:<br>Verify voting variation functionality identified by ES&S for the ES&S Unity 4.0 voting system (Vol. 1. Section 2.2.8.2). |
| *b.2.* Accuracy Tests- Ballot recording/reading accuracy | Verify with the processing of 1,549,703 consecutive ballot positions with no errors, or 3,126,404 with one error (Vol. 2 Section 4.7.1.1). |
| *b.3.* Status Tests- Equipment statement &memory contents | Verify in Functional Tests:<br>Equipment statement & memory contents at the corresponding intervals outlined in user documentation for the functions a. b.4, c 1-7 and d. 1-8 |
| *b.4.* Report Generation – Produce test output data | Verify in Functional Tests:<br>Clearing Election Totals<br>Manual data entry<br>Generating a Zero Report<br>Testing an Election<br>Creating Test Reports<br>Clearing Totals for Election Day |

| Function | Test Methodology |
|---|---|
| | Selecting Reporting Groups<br>Loading Scanner Totals<br>Producing Election Reports<br>Displaying Election Information<br>ERM Election Results |
| *b 5.* Report Generation- Produce audit data | Verify in Functional Tests:<br>System audit reports voting |
| **Polling Place Functions** | |
| *c.1.* Opening the polls, accepting & counting ballots | Verify in Functional Tests:<br>Zero Reports<br>Scan paper ballots<br>Alerts for over votes and under votes |
| *c.2.* Monitoring equipment status | Verify in Functional Tests:<br>Equipment status as identified in user documentation |
| *c.3.* Equipment response to commands | Verify in Functional Tests:<br>Equipment response to all voter and poll worker commands as identified in user documentation |
| *c.4.* Generating real-time audit messages | Verify Verified in Functional Tests:<br>Print audit log<br>Each audit message contains a timestamp.<br>Election name, software, and firmware are listed at the beginning of each audit log.<br>Count of ballots processed is included in log of uploaded results.<br>Error messages.<br>Precinct ID is identified for all results pertaining to insertions, additions, and deletions. |
| *c.5:* Closing polls and disabling ballot acceptance | Verify in Functional Tests:<br>Inability to cast additional ballots<br>Close of polls<br>Inability to scan additional ballots |
| *c.6.* Generating election data reports. | Verify in Functional Tests:<br>Generation of precinct reports |
| *c.7.* Transfer ballot count to central counting location | Verify in Functional Tests:<br>Reading the USB from the ERM<br>Telecommunication |
| *c.8.* Electronic transmission of election data to central count locations | Verify in Functional Tests:<br>Confirming transmission, receipt, and validity of data interactively and with reports |
| **Central Count Functions** | |
| *d.1.*Process ballot deck for > 2 precincts with 3 split precincts per precinct for a total of 6 ballot styles | Verify in Functional Tests:<br>Process of ballot decks on the |
| *d.2.* Monitoring equipment status | Verify in Functional Tests:<br>Equipment status as identified in user documentation |
| *d.3.* Equipment response to commands | Verify in Functional Tests:<br>Equipment responds to all voter and poll worker commands as identified in user documentation<br>(Messages generated by the equipment that require an action by the voter or poll worker before operation continues--as in blank ballots, overvotes, undervotes as defined in election setup) |
| *.4.* Integration with peripherals equipment or other | See b.3 |

| Function | Test Methodology |
|---|---|
| data processing systems | |
| *d.5.* Generating real-time audit messages. | See b.4 |
| *d.6.* Generating precinct-level election data reports | See b.3 |
| *d.7.* Generating summary election data reports | See b.3 |
| *d.8.* Transfer of detachable memory module to the processing equipment | See b.3 |
| *d.9.* Electronic transmission of data to other processing equipment | Verify in Functional Tests:<br>Confirming transmission, receipt, and validity of data interactively and with reports |
| *d.10.* Producing output data for interrogation by external display devices | Verify in Functional Tests:<br>Confirming transmission, receipt, and validity of data interactively and with reports where possible |

**Table 8 - Matrix of System Level and Other Functional Testing**

| Other Functional Testing | Test Methodology |
|---|---|
| **Volume Test** | |
| System's response to processing more than the expected number of ballots/voters per precinct, to processing more than the expected number of precincts, or to any other similar conditions that tend to overload the system's capacity to process, store, and report data. | Accuracy Test Case (described previously in this section) |
| **Stress Tests** | |
| System's responses to transient overload conditions. Subject polling place devices to ballot processing at the high volume rates, evaluate software response to hardware-generated interrupts and wait states. | Hardware is tested to limits outside the range of 'normal' but within specifications for the units. |
| **Usability Tests** | |
| Responses to input, text syntax, error message content, and audit message input | All System-Level Test Cases |
| **Accessibility Test** | |
| Exercises system capabilities of voters with disability features | System-Level Test Case GEN 03 |
| **Security Test** | |
| Exercises systems security provisions, unauthorized access, deletion or modification of data, audit trail data, and modification or elimination of security mechanisms. | Security Test case for each component (described previously in this section) |
| **Telecommunications Test** | |

| Other Functional Testing | Test Methodology |
|---|---|
| Exercises telecommunications, maintaining data integrity, protection against external threats, monitoring and responding to external threats, shared operating environment, incomplete election returns, and use of public communications networks. | Telecommunications Test case for each component |
| **Performance Tests** | |
| Tests accuracy, processing rate, ballot format, handling capability and other performance attributes claimed by Premier | All System Test Cases |
| **Recovery Tests** | |
| Exercise system's ability to recover from hardware and data errors. | Security Test Case |

## Table 9 – Matrix of Additional Testing

| Test Case | Execution |
|---|---|
| Hi Capacity Ballot Test, 11X36 ballot | Using an all fill ballot definition (all left and right ballot positions utilized) vote the first and last ballot position in all contests on the 11X36 ballot (6 contest w/ 35 candidates). Scan the ballot on the scanners (M100, DS200, M650). Utilizing random orientations to test all orientations (M100 & DS200). |
| Hi Capacity Ballot Test, 14X36 ballot | Using an all fill ballot definition (all left and right ballot positions utilized) vote the first and last ballot position in all contests on the 14X36 ballot (6 contest w/ 35 candidates). Scan the ballot on the scanners (M100, DS200, M650). Utilizing random orientations to test all orientations (M100 & DS200). |
| Hi Capacity Ballot Test, 14X48 ballot | Using an all fill ballot definition (all left and right ballot positions utilized) vote the first and last ballot position in all contests on the 14X48 ballot (6 contest w/ 47 candidates). Scan the ballot on the scanners (M100, DS200, M650). Utilizing random orientations to test all orientations (M100 & DS200). |
| Hi Capacity Ballot Test, 17X45 ballot | Using an all fill ballot definition (all left and right ballot positions utilized) vote the first and last ballot position in all contests on the 17X45 ballot (6 contest w/ 44 candidates). Scan the ballot on the scanners (M100, DS200, M650). Utilizing random orientations to test all orientations (M100 & DS200). |
| Hi Capacity Ballot Test, 17X60 ballot | Using an all fill ballot definition (all left and right ballot positions utilized) vote the first and last ballot position in all contests on the 17X60 ballot (6 contest w/ 59 candidates). Scan the ballot on the scanners (M100, DS200, M650). Utilizing random orientations to test all orientations (M100 & DS200). |
| Hi Capacity Ballot Test, 19X51 ballot | Using an all fill ballot definition (all left and right ballot positions utilized) vote the first and last ballot position in all contests on the 19X51 ballot (6 contest w/ 50 candidates). Scan the ballot on the scanners (M100, DS200, M650). Utilizing random orientations to test all orientations (M100 & DS200). |
| Hi Capacity Ballot Test, 19X68 ballot | Using an all fill ballot definition (all left and right ballot positions utilized) vote the first and last ballot position in all contests on the 19X68 ballot (6 contest w/ 67 candidates). Scan the ballot on the scanners (M100, DS200, M650). Utilizing random orientations to test all orientations (M100 & DS200). |

| Test Case | Execution |
|---|---|
| Expanded Precincts (M100) | Using M100 firmware, create PCMCIA card for early voting containing 494 precincts on one card. Verify the card can be created and read into ERM. |
| Expanded Precincts (DS200) | Using DS200 firmware, create DS200 USB drive for early voting containing 494 precincts on one USB drive. Verify the card can be created and read into ERM. |
| Auto Recovery | Using the iVotronic Auto Recovery procedure v 9.1.0.0, vote an election and recover the results from the U2-D chip. (U2-D chip is a SanDisk). Manual provided and steps were completed, as only a trained ES&S technician completes this procedure. |
| Maximum Candidates | In ERM load election database "02PNELAN" with more than 1000 candidates in a precinct. ERM limits 1000 counters in a single precinct. Verify that an attempt to load over 1000 counters gives an error messages stating "Aborted-over 1000 candidate in precinct: 211 ERM create results database failed. Connect election definition HPM and then retry." |
| L&A Vote Selected Ballot Test | Using ES&S test case "L&A Vote Selected Ballot Test" to verify the logic and accuracy vote selected ballot test. The voter selects a particular ballot to vote and that vote logic is applied to a select number of ballots designated for the voter to cast. |
| L&A Multi-Vote Test | Using ES&S test case "L&A Vote Multi-Vote Test" to verify the logic and accuracy of the multi vote test. Votes for each candidate will increase from one to the next, as in 1, 2, 3, 4, 5, etc. |
| L&A Vote for One Test | Using ES&S test case "L&A Vote For One Test" to verify the logic and accuracy of the vote for one test. Each candidate within a contest will receive one vote. There will be an additional undervote assigned in each contest. |
| View Log | Using an existing election (GEN01), select a user and verify Audit Manager has captured all activity(ies) carried out in all applicable applications (EDM, AM, and ESSIM). |
| Opening the Polls Functions | Use this test case to determine if the DS200 can open polls with an election definition that has more than one precinct. The HPM Report Level option must be 'Precinct'. |
| M100 with Older Model of Plastic Ballot Box | Using ES&S test case "Model 100 with Plastic Ballot Box" to verify that the M100 can process ballots accurately when seated in the plastic ballot box. Note: Testing was completed with the Plastic Ballot Box; however, it cannot be certified as a part of the Unity 4.0 Suite, as it has not gone through Hardware Testing. |

# Certification Test Results Summary

## 1.10 Code Review Summary

SysTest Labs has reviewed the ES&S software source code for Unity 4.0 to determine the source code's compliance with the FEC VSS for source code according to the FEC VSS April 2002, *Volume 1 Section 4, 8 and Volume 2 Section 2.2.5.2* and for compliance with ES&S's internally developed coding standards as referenced in Section 1.9 of this document. All results of the source code review were documented in Excel spreadsheets. The source code that was delivered to SysTest Labs was in the form of:

- Assembly
- C/C++
- C#
- VB
- Cobol
- Java

The review was conducted for:

- **Software Integrity:** The module contains no self-modifying code. Software remains unchanged and retains its integrity. The module has defined array dimensions, which are positive constant integers (Pointer variables, dynamic memory allocation and management are not applicable to Visual Basic.)
- **Modularity:** The module has a specific testable function; performs a single function; is uniquely named; follows a standard format, has a single entry point; has a single exit point (or deviates in an acceptable manner); has error handling; and acceptable module size
- **Control Constructs:** Logic flow utilizes standard constructs of the development language used; constructs are used consistently throughout the code; logic structure is not overly complex, and acceptable use of error handlers.
- **Naming Conventions:** Variable and Function names that clearly define the purpose of the variable or function. Use of standard notation for variables by type. Use of names that are unique for both global and local variables. Use of names that are unique for functions (except where it deviates in an accepted manner).
- **Coding Conventions:** Use of a standard methodology for the construction of a code module. This includes uniform calling sequences, parameter validation, a single executable statement per line, and status or error messages.
- **Comments Conventions:** Comment Header blocks for the module / function follows a standard format in its layout and content. In code comments are clearly delineated and readable.

**Attachment C details specific information on the source code review. This information was submitted to ES&S for their review and resolution, if necessary, during the course of the review.**

**Evaluation of Source Code**

The source code was reviewed for compliance per the guidelines defined in FEC VSS 2002 *Volume 2, Section 5.4*. Overall, the source code written in [languages] was written adequately in terms of the FEC VSS April 2002. The code is generally modular and there is sufficient error handling. Readability is good and supports maintainability.

The reviewer's assessment is based on the following observations:

- Software Integrity
    - There were no unbounded arrays. This follows the April 2002 FEC VSS requirements for software integrity.

- No instances of self-modifying or dynamically loaded code were observed.

- Modularity
  - The code is very modular and self-contained.
  - Modules perform only the specified functionality.
  - The requirement of single entry and exit points has been complied with.
  - Modules are small enough to facilitate ease of reading and understanding.

- Control Constructs
  - Control Constructs used are in accordance with those allowed by the VSS.
  - Most loop control constructs have been appropriately chosen for the logical tasks to be accomplished. There are, however, instances of loop constructs written to include early termination logic other than by the normal loop exit condition specification. The interpretation of the currently written VSS requirement is that this early loop termination logic is not disallowed by the VSS but it is a variation of the construct other than that described by the standard and was accepted. As the code is currently written there will be no problems caused by those loop controls however, future changes to the code should be performed with some caution to ensure that the system state is stable.
  - Modules have fewer than 6 levels of indented scope.
  - Array boundaries are checked.

- Naming Conventions
  - Function and variable names are in accordance with the requirements of the VSS.
  - Names differed by more than a single character and have been chosen as to enhance the readability of the code.
  - There were no instances of language keywords being used as a name for procedures or variables.

- Coding Conventions
  - Coding conventions employed are in compliance with the requirements of the VSS.
  - Code was well structured and it was clear that it was written with the standards in mind.

- Comments
  - Module headers are in compliance with the requirements of the VSS.
  - In-line comments are sufficient in number and placement to facilitate a good understanding of the code.
  - Variables have comments at the point of declaration.

- On the Application level, no more than 50% of the modules can exceed 60 lines, no more than 5% can exceed 120 lines, and none can exceed 240 lines without justification.
  - Most of the functions/modules were within the FEC VSS tolerances;

- 93.4% of the modules had less than 60 lines of code;
- 5.4% had between 61 and 120 lines of code;
- 1.2% had between 121 and 240 lines of code; and
- 0.0% had more than 240 lines of code.

The source code was reviewed for compliance per the guidelines defined in FEC VSS 2002, *Appendix E, sections E.2.1* through *E.2.6*.

The following line counts for each of the reviewed products were assessed:

**Table 10 – Source Code Review Assessment**

| Language | Less than 60 | Between 60 & 120 | Between 120& 240 | > 240 | Total |
|---|---|---|---|---|---|
| **Assembly** | **99.4%** | **0.6%** | **0.0%** | **0.0%** | **100.0%** |
| **C/C++** | **91.2%** | **7.3%** | **1.5%** | **0.0%** | **100.0%** |
| **C#** | **100.0%** | **0.0%** | **0.0%** | **0.0%** | **100.0%** |
| **VB** | **93.1%** | **5.8%** | **1.1%** | **0.0%** | **100.0%** |
| **Cobol** | **96.2%** | **3.0%** | **0.8%** | **0.0%** | **100.0%** |
| **Java** | **95.8%** | **3.5%** | **0.7%** | **0.0%** | **100.0%** |
| **Total %** | **93.4%** | **5.4%** | **1.2%** | **0.0%** | **100.0%** |

## 1.11 Technical Data Package Review Summary

SysTest Labs has reviewed the vendor's TDP for Unity 4.0 for compliance with the FEC VSS April 2002 according to *Volume 2 Section 2*. The specific documents are listed in Section 1.9 of this document.

The review was conducted for the required content and format of the:

- **System Overview:** System description and performance
- **System Functionality Description:** System functional processing capabilities, encompassing capabilities required by the Standards and any additional capabilities provided by the system, including a simple description of each capability.
- **System Hardware Specification:** System Hardware Characteristics, Design and Construction

- **Software Design and Specification:** Purpose and scope, applicable documents, software overview, software standards and conventions, software operating environment, software functional specification, programming specifications, system database, interfaces and appendices.
- **System Security Specification:** Access control policy and measures, equipment and data security, software installation, telecommunications and data transmission security, elements of an effective security program.
- **System Test and Verification Specifications:** Development and certification test specifications
- **System Operations Procedures:** Operation environment, system installation and test specifications, operational features, operating procedures, operations support.
- **System maintenance Procedures:** Preventative and corrective maintenance procedures, maintenance equipment, facilities and support.
- **Personnel Deployment and Training Requirements**
- **Configuration Management:** Configuration management policy, configuration identification, procedures for baseline, promotion, demotion and configuration control, release process, configuration audits and management resources,
- **Quality Assurance Program:** Quality assurance policy, parts and materials special testing and examination, quality conformance inspections
- **System Change Notes:** Changes to the system if it was previously qualified

**Evaluation of TDP**

The Technical Data Package for Unity 4.0 was found to comply with the April 2002 FEC VSS. Attachment B details specific information on the TDP review. This information was submitted to ES&S for their review during the course of the project.

## 1.12 Application Functional Test Summary

SysTest Labs executed validation of the ES&S Unity 4.0 Voting System using the standard system level test cases where possible. Functional Test scripts for ES&S Unity 4.0 Voting System were also executed and testing was conducted on the equipment provided by ES&S, listed in Table 1 – Summary of Unity 4.0 Voting System Components. The ES&S Unity 4.0 Voting System was tested for Security, Audit Log capabilities, Tabulating, Transmitting, and Accuracy. A listing of the Functional Tests completed by SysTest Labs is included Table 9 – Matrix of Additional Testing.

**Evaluation of Functional Testing**

The ES&S Unity 4.0 Voting System Functional Test scripts were found to comply with the April 2002 FEC VSS. Any critical issues found were reported, resolved and re-tested. Table 9 – Matrix of additional Testing details specific information on the functional tests.

SysTest Labs executed functional tests as listed below. Issues identified during testing were reported to ES&S in the Unity 4.0 Discrepancy Report. Resolutions were submitted to SysTest Labs, and retested to validate acceptable resolution.

**Summary of Functional Tests:**

**Test Case Name:** Readiness Test
**Passed/Failed:** Passed
**Summary:** Readiness is a functional test case used to validate the entire voting system is ready for testing. Readiness testing is used to verify the voting system functions properly, to confirm that the equipment has been properly integrated, to obtain equipment status reports, to make sure all voting system equipment is properly prepared for an election, and to collect data that verifies equipment readiness. The Readiness test case is also used to verify that status and data reports from each set of equipment can be obtained, ensure correct installation/interface of all system equipment, verify that hardware and software function correctly, and check that consolidated data reports at the polling place and higher jurisdictional levels can be generated.

The Readiness test is executed on initial testing and each time the system is powered down and restarted.

The pass/fail criteria for this test case reflected the system meeting the expected results from the test case, and validated the VSS requirements identified in the test case and the Test Plan.

**Test Case Name:** Functional Operation Status Test
**Passed/Failed:** Passed
**Summary:** The Operational test is a comprehensive end-to-end test case(s) verifying the machines' functions are behaving correctly, and operating in the correct modes. SysTest Labs performs the operational status check (provided by the vendor) once upon acceptance of the equipment and once after all other testing. During this process, all equipment should operate in environmental conditions that simulate election use to verify the functional status of the system. Prior to the conduct of each of the environmental hardware tests, a supplemental test determines that the operational state of the equipment is within acceptable performance limits.

Summary of instructions for this test case: Turn on power, and allow the system to reach recommended operating temperature. Operate the equipment in all modes; demonstrate all functions and features that would be used during election operations. Verify all system functions have been correctly executed.

The following vendor provided documentation was utilized: DS200 Precinct Scanner, Pre-Election Day Checklist, v 1.x, Release date: 04/2007, Revision date: 04/2007; iVotronic™ Voting System Pre-Election Day Operations Checklist, Poll Worker Activated, v 9.2.x, Revision date: 06/2007; Model 100 Precinct Scanner, Pre-Election Day Checklist, v 5.x (includes v 5.4), Revision date: 06/2007; Model 650 Central Scanner, Pre-Election Day Checklist, v 2.x, Revision date: 01/2007; Model 650 Pre-Election Day Setup-Handout A, Firmware Version 2.2.1.0, Hardware Version 1.1, June 2007.

All information used in processing the test case was captured. This includes inputs, outputs, deviations and any other item that may impact the validation of the test case. Any failure of the test against the EAC guidelines is reported and implies failure of the system. Failures are reported as defect issues in the discrepancy report and are provided to the manufacturer. Before the final Certification Test Report is issued, manufacturers are given the opportunity to correct all discrepancies. If the manufacturer submits corrections, retests are performed.

The first iteration, Rev01, was executed and passed.

**Test Case Name:** 40HTEST1
**Passed/Failed:** Passed
**Summary:** 40HTEST1 is a system level test that uses the 2002 Voting System Standards (VSS) guidelines to validate required functionality and performance. Testing includes accuracy, ballot format handling capability, reporting, and usability of the hardware, software, and procedures in the Unity 4.0 voting system, which includes the following: Election Data Manager (EDM); iVotronic Image Manager (iVim); Hardware Programming Manager (HPM); Audit Manager (AM); Election Reporting Manager (ERM); ES&S Ballot Image Manager (ESSIM); Model 100 Ballot Scanner (M100); intElect DS200 Ballot Scanner (DS200); iVotronic DRE; and the Model 650 Optical Scan central Count Counter (M650).

40HTEST1 contained 20 contests and a wide variety of races and candidate positions including: US Senator, 2 candidates; Secretary of State, 3 candidates; Auditor of State, 2 candidates; Treasurer of State, 2 candidates; US Representative in Congress, 2 candidates; State Representative, 1 candidate; Judge of Circuit Court, 1 candidate; Prosecuting Attorney, 2 candidates; County Auditor, 1 candidate; County Treasurer, 2 candidates; County Sheriff, 1 candidate; County Assessor 1 candidate; County Commissioner, 1 candidate; County Council Member, 5 candidates; Township Trustee, 22 candidates; Township Board Member, 59 candidates; Justice of the Indian Supreme Court (Recall/Retain) Y/N; Judge Court of Appeals, 2nd District (Recall/Retain) Y/N; Judge Court of Appeals, 4th District (Recall/Retain) Y/N.

40HTEST1 ballots were voted and report tapes tallied with 100% accuracy; no functional discrepancies occurred. The test consisted of Rev01 and passed on the first iteration.

**Test Case Name:** 40HTEST3
**Passed/Failed:** Passed
**Summary:** 40HTEST3 is a functional test case that uses the 2002 Voting System Standards (VSS) guidelines to validate required functionality and performance. The object of this test case is to verify the on-screen message changes (overvote message is suppressed in the state of Florida) when the two different election definitions are utilized containing two different state codes. Testing includes accuracy, ballot format handling capability, and usability of the hardware, software, and procedures in the following areas of the voting system: Election Data Manager (EDM) v. 7.8.0.0; Hardware Programming Manager (HPM) 5.7.0.0; Audit Manager (AM) 7.5.0.0; ES&S Ballot Image Manager (ESSIM) 7.7.0.0; Model 100 Ballot Scanner (M100) 5.4.0.0; and intElect DS200 Ballot Scanner (DS200) v. 1.3.7.0.

40HTEST3 consisted of Rev01 and passed on the first iteration.

**Test Case Name:** 40HTEST4
**Passed/Failed:** Passed
**Summary:** 40HTEST4 is a functional test case that uses the 2002 Voting System Standards (VSS) guidelines to validate required functionality and performance. The object of this test case is to create a subset election in HPM (from an existing election), ensure media can be burned, an election loaded on an M650, and a ballot can be accepted. Testing includes accuracy, ballot format handling capability, and usability of the hardware, software, and procedures in the following areas of the voting system: Election Data Manager (EDM) v. 7.8.0.0; Hardware Programming Manager (HPM)

5.7.0.0; Audit Manager (AM) 7.5.0.0; and the Model 650 Optical Scan central Count Counter (M650) v. 2.2.1.0.

40HTEST4 consisted of Rev01 and passed on the first iteration.

**Test Case Name:** 40HTEST5
**Passed/Failed:** Passed
**Summary:** 40HTEST5 is a functional test case that uses the 2002 Voting System Standards (VSS) guidelines to validate required functionality and performance. The object of this test case is to verify HPM can accept an Open Primary election with greater than nine Party Preference contests and 100 precincts. Testing includes accuracy, ballot format handling capability, and usability of the hardware, software, and procedures in the following areas of the voting system: Election Data Manager (EDM) v. 7.8.0.0; Hardware Programming Manager (HPM) v. 5.7.0.0; and Audit Manager (AM) 7.5.0.0

40HTEST5 consisted of Rev01 and passed on the first iteration.

**Test Case Name:** 3000 PCTS
**Passed/Failed:** Passed
**Summary:** 3000 PCTS is a functional test case that uses the 2002 Voting System Standards (VSS) guidelines to validate required functionality and performance. The object of this test case is to verify media can be burned for the iVotronic, a ballot can be loaded, voted, cancelled, and the polls can be closed. The election was a General with Straight Party containing more than 150 contests and greater than 1300 precincts.

Testing included ballot format handling capability, usability of the hardware, software, and procedures in the following areas of the voting system: Election Data Manager (EDM) v. 7.8.0.0; Hardware Programming Manager (HPM) v. 5.7.0.0; Audit Manager (AM) v. 7.5.0.0; ES&S Ballot Image Manager (ESSIM) v 7.7.0.0; iVotronic Image Manager (iVim) v. 3.2.0.0; and the iVotronic DRE v. 9.2.3.0.

3000 PCTS consisted of Rev01 and passed on the first iteration.

**Test Case Name:** Hi Capacity Ballot Test, 11X36 ballot
**Passed/Fail:** Passed
**Summary:** SysTest Labs conducted functional system testing on the Unity 4.0 software. The system tests were conducted to verify that all the components operate as designed, that the system operates as expected in a user environment and other programs associated with Unity 4.0 work correctly. Using an all fill ballot definition (all left and right ballot positions utilized) we voted the first and last ballot position in all contests on the 11X36 ballot (6 contests w/ 35 candidates). We scanned the ballot on the scanners (M100, DS200, M650). Two orientations were run for the M100 and DS200. No issues were found in running the 11X36 Hi Capacity Ballot Test.

**Test Case Name:** Hi Capacity Ballot Test, 14X36 ballot
**Passed/Fail:** Passed
**Summary:** SysTest Labs conducted functional system testing on the Unity 4.0 software. The system tests were conducted to verify that all the components operate as designed, that the system operates

as expected in a user environment and other programs associated with Unity 4.0 work correctly. Using an all fill ballot definition (all left and right ballot positions utilized) we voted the first and last ballot position in all contests on the 14X36 ballot (6 contests w/ 35 candidates). We scanned the ballot on the scanners (M100, DS200, M650). Two orientations were run for the M100 and DS200. No issues were found in running the 14X36 Hi Capacity Ballot Test.

**Test Case Name:** Hi Capacity Ballot Test, 14X48 ballot
**Passed/Fail:** Passed
**Summary:** SysTest Labs conducted functional system testing on the Unity 4.0 software. The system tests were conducted to verify that all the components operate as designed, that the system operates as expected in a user environment and other programs associated with Unity 4.0 work correctly. Using an all fill ballot definition (all left and right ballot positions utilized) we voted the first and last ballot position in all contests on the 14X48 ballot (6 contests w/ 47 candidates). We scanned the ballot on the scanners (M100, DS200, M650). Four orientations were run for the M100 and DS200. No issues were found in running the 14X48 Hi Capacity Ballot Test.

**Test Case Name:** Hi Capacity Ballot Test, 17X41 ballot
**Passed/Fail:** Passed
**Summary:** SysTest Labs conducted functional system testing on the Unity 4.0 software. The system tests were conducted to verify that all the components operate as designed, that the system operates as expected in a user environment and other programs associated with Unity 4.0 work correctly. Using an all fill ballot definition (all left and right ballot positions utilized) we voted the first and last ballot position in all contests on the 17X41 ballot (6 contests w/ 44 candidates). We scanned the ballot on the scanners (M100, DS200, M650). Four orientations were run for the M100 and DS200. No issues were found in running the 17X41 Hi Capacity Ballot Test.

**Test Case Name:** Hi Capacity Ballot Test, 17X45 ballot
**Passed/Fail:** Passed
**Summary:** SysTest Labs conducted functional system testing on the Unity 4.0 software. The system tests were conducted to verify that all the components operate as designed, that the system operates as expected in a user environment and other programs associated with Unity 4.0 work correctly. Using an all fill ballot definition (all left and right ballot positions utilized) we voted the first and last ballot position in all contests on the 17X45 ballot (6 contests w/ 44 candidates). We scanned the ballot on the scanners (M100, DS200, M650). Two orientations were run for the M100 and DS200. No issues were found in running the 17X45 Hi Capacity Ballot Test.

**Test Case Name:** Hi Capacity Ballot Test, 17X60 ballot
**Passed/Fail:** Passed
**Summary:** SysTest Labs conducted functional system testing on the Unity 4.0 software. The system tests were conducted to verify that all the components operate as designed, that the system operates as expected in a user environment and other programs associated with Unity 4.0 work correctly. Using an all fill ballot definition (all left and right ballot positions utilized) we voted the first and last ballot position in all contests on the 17X60 ballot (6 contests w/ 59 candidates). We scanned the

ballot on the scanners (M100, DS200, M650). Four orientations were run for the M100 and DS200. No issues were found in running the 17X60 Hi Capacity Ballot Test.

**Test Case Name:** Hi Capacity Ballot Test, 19X51 ballot
**Passed/Fail:** Passed
**Summary:** SysTest Labs conducted functional system testing on the Unity 4.0 software. The system tests were conducted to verify that all the components operate as designed, that the system operates as expected in a user environment and other programs associated with Unity 4.0 work correctly. Using an all fill ballot definition (all left and right ballot positions utilized) we voted the first and last ballot position in all contests on the 19X51 ballot (6 contests w/ 50 candidates). We scanned the ballot on the scanners (M100, DS200, M650). Four orientations were run for the M100 and DS200. No issues were found in running the 19X51 Hi Capacity Ballot Test.

**Test Case Name:** Hi Capacity Ballot Test, 19X68 ballot
**Passed/Fail:** Passed
**Summary:** SysTest Labs conducted functional system testing on the Unity 4.0 software. The system tests were conducted to verify that all the components operate as designed, that the system operates as expected in a user environment and other programs associated with Unity 4.0 work correctly. Using an all fill ballot definition (all left and right ballot positions utilized) we voted the first and last ballot position in all contests on the 19X68 ballot (6 contests w/ 67 candidates). We scanned the ballot on the scanners (M100, DS200, M650). Four orientations were run for the M100 and DS200. No issues were found in running the 19X68 Hi Capacity Ballot Test.

## 1.13 System Level (Integration) Test Description

System level testing consisted of a set of standard system level regression tests customized for each system configuration. This incorporated end-to-end election scenarios testing the functionality supported, as identified in the System Overview.

SysTest Labs executed System Level Integration Tests for the multiple system configurations of ES&S Unity 4.0. The tests validated all supported voting variation functionality and languages in mock elections. Testing included validation of the voter facing messages for both audio and visual format for all supported languages. Issues identified during testing were reported to ES&S in the Discrepancy Report. Resolutions were submitted to SysTest Labs, and retested to validate acceptable resolutions.

**Summary of System-Level Test Cases:**

**Test Case Name:** GEN01
**Passed/Fail:** Passed
**Summary:** GEN01 is a system-level general election test case that includes core and optional functionality and features (as defined in the Test Plan). Accuracy in defining an election through tallying results at central count, ballot format handling capability, reporting, and usability of the hardware, software and procedures in the entire voting system are verified in this test case.

The election consisted of two precincts with three splits per precinct, 11 contests containing non-partisan, partisan, recall types A and B, and a proposition/question. A "standard" rotation was applied to one of the contests.

The AM application, which runs in the background and keeps an audit log of all actions performed in EDM and ESSIM, was started prior to any test step execution. The election was coded in EDM, ballot layout was designed in ESSIM (for paper ballots) and iVIM (for the DRE ballot), and the media was created in HPM. Electronic ballots were voted on the iVotronic DRE. Paper ballots were scanned on the DS200, M100, and M650 scanners. The results from the DS200, M100, and iVotronic were modemed utilizing DAM (Precinct) modem to DAM Host into ERM. The M650 results were networked to ERM on a LAN via TCP/IP.

Testing consisted of verifying versions of Software and Firmware, executing the test steps that were defined using the System Operations Manuals for all applications and devices, validating various reports available from the applications and devices, voting the election using 11 voters for the M100, DS200, M650, and 14 voters for the iVotronic, in a predefined and repeatable pattern to simulate various voters' choices, verifying the totals of all reports generated from the individual scanner tapes and ERM to a predicted result in the test case, and verification of the VSS requirements as defined in the Test Plan.

Special features that were tested in this election for the M650 include 1) Volatile Flush Header, which is used to zero the totals in the volatile memory. Users would utilize this option on the M650 if they inadvertently counted absentee ballots in a duplicate set of precincts to "flush" or clear both the Election Day and absentee ballot counts in that precinct. 2) Creation of 10 node folders, which are traditionally used in a network M650 environment. Each M650 is assigned a scanner ID. When the M650 operator saves the results, the results are automatically transferred to the election server and stored in a node folder with the same number as the scanner ID. 3) M650 early voting group. This group is created in the Add/Change Groups of the ERM. Early voting ballots are processed on the M650 and then read into the ERM group called Early Voting. For the iVotronic, we defined an on screen vote button, which places a vote button display on the iVotronic touch screen. Coded ballot functionality was also verified on the iVotronic by ensuring that the 'Provisional' prompt appeared and separate totals were generated. A coded ballot is given to a voter whose eligibility to vote is in question. The iVotronic stores ballot codes in the terminal's audit data. Election Officials can review the coded ballot for eligibility after the polls close. We also verified the "Ballot Control" option in HPM for the M100 and DS200. For this election, we set this option to "Reject" the voter for any overvoted, cross-voted, blank, or unreadable marks on the ballot(s).

The pass/fail criteria for this test case were dependent on they system meeting the expected results from the test case, and validated the VSS requirements identified in the test case and the Test Plan.

There were three iterations of the test case, due to discrepancies encountered. Rev 01 failed during creation of the media in HPM (see discrepancy # 177). Rev 02 failed utilizing DAM to modem iVotronic results into ERM (see discrepancy 240), and while creating reports in ERM (see discrepancies 278 and 279). Rev 03 was executed and passed after all of the above discrepancies had been resolved, and a new trusted build of DAM was installed and testing successfully executed.

**Test Case Name:** GEN02 – Straight Party
**Passed/Fail:** Failed – Please refer to iBeta's Test Report
**Summary:** GEN02 is a system level, straight party test case that includes core and optional functionality and features (as defined in the Test Plan). The test case is designed to test accuracy in

defining an election, creating election ballots, voting, and tallying results, for a General Election with straight party. Ballot format handling capability, reporting, and usability of the hardware, software and procedures in the entire voting system are also verified in GEN02.

The election consisted of a two-page ballot, 7 precincts, and crossover voting, Recalls Type A, B, and C, a proposition, questions, and the precinct rotation type.

The AM application, which runs in the background and keeps an audit log of all actions performed in EDM and ESSIM, was started prior to any test step execution. The election was coded in EDM, ballot layout was designed in ESSIM (for paper ballots) and iVIM (for the DRE ballots), and the media was created in HPM. The electronic ballots were voted on the iVotronic DRE using Seiko printer. Paper ballots were scanned on the DS200, M100 and M650 scanners. The results from the M100 were read directly into ERM using the PCMCIA card. The results from the DS200 were read directly into ERM using the USB flash drive and iVotronic results were read directly into ERM using the PEB. The M650 results were networked into ERM using a LAN via TCP/IP (Central).

Testing consisted of verifying versions of Software and Firmware, executing the test steps that were defined using the System Operations Manuals for all applications and devices, validating various reports available from the applications and devices, voting the election using 28 voters for the M100, DS200, M650, and 24 voters for the iVotronic, in a predefined, repeatable pattern to simulate various voters' choices, and verification of the VSS requirements as defined in the Test Plan.

Special features that were tested in this election include preventing or disabling the resetting of the counter by any person other than authorized persons at authorized points, and verifying the ballot count is only visible to designated election officials.

Coded ballot functionality was also verified on the iVotronic by ensuring that the 'Provisional' prompt appeared and separate totals were generated. A coded ballot is given to a voter whose eligibility to vote is in question. The iVotronic stores ballot codes in the terminal's audit data. Election Officials can review the coded ballot for eligibility after the polls close.

The pass/fail criteria for this test case were dependent on the system meeting the expected results from the test case, and validated the VSS requirements identified in the test case and the Test Plan.

There have been three iterations of this test case and this test case has not yet passed.

The first two iterations failed due to discrepancies #177 (any referendum must be set up in the same column on the ballot in HPM, or it will not tabulate correctly on the M650) and #239 (Statistical Counters did not function correctly on the M650 Grand Totals and Precinct by Precinct reports). These discrepancies have since been closed.

The third iteration was due to discrepancy #297 (the District Canvass report totals were not matching our vote data tab). The vendor has responded that documentation needs to be updated. Once this documentation can be reviewed and verified, the discrepancy can be closed and the test case is expected to pass.

**Test Case Name:** GEN02- PA Straight Party
**Passed/Fail:** Passed

**Summary:** GEN02PA is a system-level general election test case with a Pennsylvania straight party option. This test case is designed to test accuracy in defining an election, creating election ballots, voting, and tallying results for a General Election with Pennsylvania straight party functionality. Ballot format handling capability, reporting, and usability of the hardware, software and procedures in the entire voting system are also verified in GEN02PA.

The election consisted of seven precincts with no split precincts; 12 contests containing non-partisan, partisan, recall types A, B, and C, and a proposition/question. A "Votronic Auto" rotation was applied to certain contests.

The AM application, which runs in the background and keeps an audit log of all actions performed in EDM and ESSIM, was started prior to any test step execution. The election was coded in EDM, ballot layout was designed in ESSIM (for paper ballots) and iVIM (for the DRE ballots), and the media was created in HPM. The electronic ballots were voted on the iVotronic DRE. Paper ballots were scanned on the M100 and M650 scanners. The results from the M100 and iVotronic were modemed utilizing DAM (Precinct) modem to DAM Host into ERM. The M650 results were read directly into ERM using the zip disk.

Testing consisted of verifying versions of Software and Firmware, executing the test steps defined using the System Operations Manuals for all applications and devices, validating various reports available from the applications and devices, voting the election using 24 voters for the M100, M650, and 23 voters for the iVotronic, in a predefined, random, repeatable pattern to simulate various voters' choices, verifying the totals of all reports generated from the individual scanner tapes and ERM to a predicted result in the test case, and verification of the VSS requirements as defined in the Test Plan.

Special features tested in this election include 1) Two-page ballot election per voter and 2) Straight party (multi-member board).

The pass/fail criteria for this test case were dependent on the system meeting the expected results from the test case, and validated the VSS requirements identified in the test case and the Test Plan.

GEN02PA consisted of two iterations and three discrepancies were discovered during testing. Upon further research, it was discovered that two of the three discrepancies were due to tester error and the discrepancies were closed. The third discrepancy was #177 (any referendum must be set up in the same column, on the ballot in HPM, or it will not tabulate correctly on the M650). This discrepancy consisted of inaccurate instructions of the HPM System Operations document. The vendor corrected this document and the added information into the ESSIM Systems Operations document, which were reviewed and verified. Upon verification, the discrepancy was closed and the test case passed.

**Test Case Name:** GEN03 – Add Languages
**Passed/Failed:** Failed– Please refer to iBeta's Test Report
**Summary:** GEN03 is a system-level general election test case that includes core and optional functionality and features (as defined in the Test Plan) and Accessibility. Accuracy in defining an election through tallying results at central count, ballot format handling capability, reporting, error messages, languages (Spanish), usability, and accessibility of the hardware, software and procedures in the entire voting system are verified in this test cast.

The election consisted of 1 precinct with provisional/challenged ballots; 10 contests containing Non-Partisan contests (Vote for 1 of M-Sheriff; Proposition/Question-Proposition X), Partisan contests

(Multi-member board, “Vote for 3 of M” race with declared candidates with a voting position defined for write-in: City Council), Type D, and Type C.

Accessibility was tested using the visual, audio, and a sip & puff terminal. The testers simulated the disability to test these functions. Audio, Combo (Audio & Visual), and Sip & Puff were meticulously tested for correct functionality, usability, and accuracy and all applicable VSS requirements. Measurements of the terminal were taken to validate the requirements for Accessibility listed in VSS Volume 1 section 2.2.7.

The secondary language tested during testing was Spanish. It was verified that the electronic display did reflect Spanish. Also, it was validated that the appropriate WAV files were played. Accessibility was tested in Spanish as well.

The AM application, which runs in the background and keeps an audit log of all actions performed in EDM and ESSIM, was started prior to any test step execution in any of the other applications comprising the Unity 4.0 suite. The election was coded in EDM, ballot layout was designed in iVIM for the DRE ballot, and the media was created in HPM. The election was voted on the iVotronic DRE. Printed reports were collected from the iVotronic terminals and ERM.

Testing consisted of verifying versions of Software and Firmware, executing the test steps that were defined using the System Operations Manuals for all applications and devices, validating various reports available from the applications and devices, voting the election using 63 voters (4.0 Testing), 77 voters (4.0 Heavy Rev. 1), 62 voters (4.0 Heavy Rev. 2) and 29 voters (4.0 Heavy Rev. 3) for the iVotronic, in a predefined, random, but repeatable pattern to simulate various voters’ choices, verifying the totals of all reports generated from the individual scanner tapes and ERM to a predicted result in the test case, and verification of the VSS requirements as defined in the Test Plan. Poll worker and Voter facing system messages were also verified against documentation and audit logs.

Special features that were tested in this election include 1) Multi-language ballots (English and Spanish), 2) Audio/Visual/Combo ballots, 3) 15” iVotronic with 3-key, 4-Key, 6-Key (6-Key supports sip and puff), 4) 12” iVotronic 3-Key, 5) VVPAT printer (Real Time Audit Log- RTAL), 6) Error Messages and Recovery. The VVPAT printer was tested to verify accuracy of ballots cast and verify cancellation of ballots due to any disturbance of the printer. User error messages were validated by attempting to cast undervotes, overvotes, blank ballots, type C ballots where the question is not answered, attempting to cast ballot prior to reviewing summary, inactivity of terminal, and disconnecting the printer cable.

The pass/fail criteria for this test case were dependent on the system meeting the expected results from the test case, and validated the VSS requirements identified in the test case and the Test Plan.

There were four iterations of the test case executed, due to discrepancies encountered.

4.0 (Firmware 9.2.0.0) failed during Election Day voting on the DRE. Discrepancies discovered in 4.0 testing were:

- #190 Automatically accepting a write-in after a maximum number of characters entered
- #191 Audio volume level does not stay at the set volume during a combo ballot
- #193 Inability to return to the ballot after the vote button was pushed on an incomplete ballot
- #194 to #197 Incorrect audio instructions

- #198 Volume button restarts the instruction and increases volume during summary mode
- #224 Inability to cast a blank ballot
- #226 Lack of instruction for the "purple button"
- #227 Audio stopped playing
- #235 Instructions Combo screen is not fully displayed on Spanish Ballots
- #236 Incorrect message when the RTAL printer was unplugged
- #237 Not all characters displayed on the contest screen in zoom mode
- #238 The write-in display does not reflect text size selected
- #245 Incorrect message when the RTAL printer was unplugged
- #246 Duplicate of #237
- #247 Incorrect audio message
- #248 Arrow keys do not work in a combo ballot

4.0 Heavy Rev 01 (Firmware 9.2.1.0) failed during Election Day voting on the DRE and Printing of Reports. During this revision the following discrepancies were corrected and closed: 193, 194, 197, 224, 226, 227, 245, 246, 247, and 248. The major issue found during 4.0 Heavy Rev. 01 was the discovery that the voter could continue to cast a ballot even when the RTAL printer was disconnected during the process. Discrepancies discovered during 4.0 Heavy Rev 01 were:

- #434 Error message was received when inserting a new compact flash and PEB
- #441 Further instructions for the voter needed for Combo (Audio/Visual) ballot
- #442 Audio issue
- #443 Warning message received during the opening polls process
- #445 Option on "Configure Terminal" menu was not available
- #448 On a Spanish audio ballot, incorrect instructions were given
- #449 Votes casted after the RTAL Printer malfunction
- #450 Incorrect messages received when RTAL printer paper was low
- #451 Terminal did not behave has the instructions provided.
- #458 Spanish instructions are not provided while the voter selects ballot type.
- #464 On a multiple contest, the summary did not display the multiple candidates selected
- #465 Incorrect audio instructions
- #466 Incorrect audio instructions
- #467 Inconsistent instruction during initial navigation instruction
- #468 Incorrect ballot totals
- #469 Incorrect time/date provided by ERM compared to the audit log provided by the iVotronic.

<u>ERM Functional discrepancies found:</u>

- #472 Issue with audit data total
- #473 Incorrect vote data totals

4.0 Heavy Rev. 02 (Firmware 9.2.2.0) failed during Election Day voting on the DRE and Printing of Reports (No new discrepancies were found or closed). The 12" iVotronic terminal could not be tested as the vendor was researching discrepancies. As such, discrepancies could not be closed as

they needed validation on the 12" iVotronic terminal. It was discovered at this iteration that #472 & #473 were documentation issues.

4.0 Heavy Rev 03 (Firmware 9.2.3.0) failed during Election Day voting on the DRE and Printing of Reports (No new discrepancies were found). The following discrepancies were corrected and closed: 443, 448, 449, and 465. At the end of this test cycle, a total of 16 functional discrepancies remain open.

Discrepancies #194, #196, #227, #245, #247 and #248 found in the 4.0 testing, are applicable to the accessibility test done concurrently with the GEN03 testing. During GEN03 Heavy Rev 01, the following discrepancies were closed for accessibility: #194, #227, #247, and #248. Discrepancies #441, #466, and #467 were discovered during these iterations and were applicable to the accessibility test. The accessibility test failed with 6 outstanding discrepancies.

**Test Case Name:** PRI01 – Open Primary
**Passed/Failed:** Passed
**Summary:** PRI01 is a system-level primary election test case that includes core and optional functionality and features (as defined in the Test Plan) for an Open Primary. The test case is designed to test accuracy in defining an election, creating election ballots, voting, and tallying results for an Open Primary. Ballot format handling capability, reporting, and usability of the hardware, software and procedures in the entire voting system are also verified in PRI01.

The election consisted of five precincts, 6 contests containing non-partisan, partisan, and a primary presidential nomination of candidates. A "Districts by Registered Voters Non-Partisan" rotation was applied to one of the contests.

The AM application, which runs in the background and keeps an audit log of all actions performed in EDM and ESSIM, was started prior to any test step execution in any of the other applications comprising the Unity 4.0 suite. The election was coded in EDM, ballot layout was designed in ESSIM (for paper ballots) and iVIM (for the DRE ballot), and the media was created in HPM. The election was voted on paper and the iVotronic DRE. Paper ballots were scanned on the M100 and M650 scanners. The results from the M100, and iVotronic were modemed utilizing DAM (Precinct) modem to DAM Host into ERM. Results from the M650 were imported from a Zip Disk to ERM.

Testing consisted of verifying versions of Software and Firmware, executing the test steps that were defined using the System Operations Manuals for all applications and devices, validating various reports available from the applications and devices, voting the election using 15 voters for the M650, 16 voters for the M100 (due to ballot being scanned twice), and 15 voters for the iVotronic, in a predefined and repeatable pattern to simulate various voters' choices, verifying the totals of all reports generated from the individual scanner tapes and ERM to a predicted result in the test case, and verification of the VSS requirements as defined in the Test Plan.

The pass/fail criteria for this test case were dependent on the system meeting the expected results from the test case, and validated the VSS requirements identified in the test case and the Test Plan.

Only one discrepancy, #177 (any referendum must be set up in the same column on the ballot in HPM, or it will not tabulate correctly on the M650), existed in this test case. This discrepancy consisted of inaccurate instructions of the HPM System Operations document. The vendor corrected this document and added information to the ESSIM Systems Operations document, which was reviewed and verified. Upon verification, the discrepancy was closed and the test case passed.

**Test Case Name:** PRI01 – Pick-a-Party
**Passed/Failed:** Failed – Please see iBeta's Test Report
**Summary:** PRI01PP is a system-level primary election test case that includes core and optional functionality and features (as defined in the Test Plan) for an Open Primary with Pick-a-Party (aka Party Preference). The test case is designed to test accuracy in defining an election, creating election ballots, voting, and tallying results for an Open Primary with Pick-a-Party. Ballot format handling capability, reporting, and usability of the hardware, software and procedures in the entire voting system are also verified in PRI01PP.

The election consisted of five precincts, 6 contests containing non-partisan, partisan, and a primary presidential nomination of candidates. A "Standard (Candidate > Vote for)" rotation was applied to one of the contests.

Testing consisted of verifying versions of Software and Firmware, executing the test steps that were defined using the System Operations Manuals for all applications and devices, validating various reports available from the applications and devices, voting the election using 55 voters for the M650, 55 voters for the M100, and 50 voters for the iVotronic, in a predefined, random, but repeatable pattern to simulate various voters' choices, verifying the totals of all reports generated from the individual scanner tapes and ERM to a predicted result in the test case, and verification of the VSS requirements as defined in the Test Plan for the first iteration of testing.

The AM application, which runs in the background and keeps an audit log of all actions performed in EDM and ESSIM, was started prior to any test step execution in any of the other applications comprising the Unity 4.0 suite. The election was coded in EDM, ballot layout was designed in ESSIM (for paper ballots) and iVIM (for the DRE ballot), and the media was created in HPM. The election was voted on paper and the iVotronic DRE. Paper ballots were scanned on the M100 and M650 scanners. The results from the M100, and iVotronic were modemed utilizing DAM (Precinct) modem to DAM Host into ERM. Results from the M650 were imported from a Zip Disk into ERM.

The pass/fail criteria for this test case were dependent on the system meeting the expected results from the test case, and validated the VSS requirements identified in the test case and the Test Plan.

Rev01 failed, as the ERM report totals were not matching our vote data totals (Discrepancies #293-295). During the second iteration discrepancies #293 & #294 were closed after the iVotronic was re-voted and totals were read into ERM. Further validation was needed for discrepancy #295. Rev03 passed after receiving clarification, from the vendor, on how to validate the report referenced in discrepancy #295 and a new discrepancy (#492) stating there is little to no information provided in the documentation to assist in validating the reports.

**Test Case Name:** PRI02 – Closed Primary
**Passed/Failed:** Passed
**Summary:** PRI02 is a system-level test case that includes core and optional functionality and features (as defined in the Test Plan) for a Closed Primary Election. The test case is designed to test accuracy in defining an election, creating election ballots, voting, and tallying results for a Closed Primary. Ballot format handling capability, reporting, and usability of the hardware, software and procedures in the entire voting system are also verified in PRI02.

The election consisted of seven precincts, eight contests containing non-partisan, partisan, and recall type D. A "District by Registered Voters" rotation was applied to one of the contests.

The AM application, which runs in the background and keeps an audit log of all actions performed in EDM and ESSIM, was started prior to any test step execution in any of the other applications comprising the Unity 4.0 suite. The election was coded in EDM, ballot layout was designed in ESSIM (for paper ballots) and iVIM (for the DRE ballot), and the media was created in HPM. The election was voted on paper and the iVotronic DRE. Paper ballots were scanned on the DS200, and M100, and M650 scanners. The results from the DS200, M100, and iVotronic were modemed utilizing DAM (Precinct) modem to DAM Host into ERM. The M650 results were transferred to the ERM via zip disk.

Testing consisted of verifying versions of Software and Firmware, executing the test steps that were defined using the System Operations Manuals for all applications and devices, validating various reports available from the applications and devices, voting the election using 28 voters for the M100, DS200, M650, and 28 voters for the iVotronic, in a predefined and repeatable pattern to simulate various voters' choices, verifying the totals of all reports generated from the individual scanner tapes and ERM to a predicted result in the test case, and verification of the VSS requirements as defined in the Test Plan.

The pass/fail criteria for this test case were dependent on the system meeting the expected results from the test case, and validated the VSS requirements identified in the test case and the Test Plan.

There were four iterations of the test case executed, due to discrepancies encountered. Rev01 failed due to discrepancy #177, which was corrected through documentation. Rev02 failed due to discrepancy #176 (crossover voting not accepted), which was rectified by re-coding the election and omitting the type of crossover voting we were attempting. In Rev03 we encountered an error message that was received as a result of the iVIM application, version 3.1.0.0, being left open for the weekend (discrepancy # 249) and due to incorrect vote total on a District Canvassing Report (discrepancy #297). In Rev04 we tested a new version of iVIM (3.2.0.0) and were able to correctly validate all the totals; therefore, all discrepancies were closed and test case passed.

## 1.14 Environmental Hardware Test Summary

Based upon an examination of the ES&S equipment listed in the vendor's hardware submitted for testing listed in Table 4 – Matrix of Required COTS Software/Firmware and vendor's Hardware Specification, SysTest Labs concluded that the hardware, listed and marked as (COTS) in table 4, was COTS (Commercial Off the Shelf). As such it is not subject to Environmental Hardware Testing.

SysTest Labs executed Environmental Hardware testing on the non-COTS hardware listed in Table 5 – Matrix of Required Hardware. The testing methods and results are located in Attachment H

**Evaluation of Environmental Hardware Testing**

Any critical issues found were reported, resolved and re-tested. Attachment H contains the hardware environmental reports from SysTest Labs' EAC approved Hardware Environmental Test Subcontractor, Percept Technology Labs. These reports detail specific information on the environmental hardware testing.

**Test Case Name:** Environmental Hardware Test
**Passed/Failed:** Passed
**Summary**: Based upon an examination of the ES&S equipment listed in the vendor's hardware submitted for testing listed in Table 4 – Matrix of Required COTS Software/Firmware and vendor's

Hardware Specification, SysTest Labs concluded that the hardware, listed and marked as (COTS) in table 4, was COTS (Commercial Off the Shelf). As such it is not subject to Environmental Hardware Testing.

Test reports from previous hardware testing performed by accredited NVLAP or A2LA laboratories were analyzed to determine if the results would be accepted for certification. The EAC provided additional input on required tests in their Notice of Clarification (NOC) 08-001 as follows:

- For hardware not tested by an accredited laboratory after January 1, 2005, all testing is required in this certification effort.
- All hardware was required to undergo Electrostatic Disruption (ESD) testing.

Please see the Hardware Test Matrix, ESS retest matrix v1.16.pdf, in attachment H to ascertain which tests were accepted from previous hardware test efforts and which tests were performed by SysTest Labs in this certification effort.

Maintainability testing and Accessibility and Human Engineering Evaluation testing was performed at SysTest Labs in Denver.

All tested equipment successfully passed each of the environmental tests to which the equipment was subjected. Please see the pertinent test reports as outlined in attachment H.

**Other Labs Performing Hardware Testing**

SysTest Labs is responsible for all core voting system tests as identified in NIST NVLAP Handbook 150-22 (2005). The labs listed below performed non-core hardware testing for this certification test campaign.

- Environmental Testing was done at SUN APT Laboratories in Longmont, Colorado and Percept Technology Laboratories in Boulder, Colorado.
- EMC Testing was performed at Criterion Laboratories in Rollinsville, Colorado, EMC Integrity Laboratories in Longmont Colorado, and NCEE Laboratories in Lincoln, Nebraska.
- Safety Testing was performed at Compliance Integrity Services (CIS) Laboratories in Longmont, Colorado and Components Reliability & Safety, Inc. (CRS) Laboratories in Broomfield, Colorado.

**Hardware Environmental Testing Assessment**

The acceptance and use of previous hardware environmental testing and certification performed by accredited NVLAP or A2LA facilities is based on the following criteria:

- The configuration of the equipment being presented for testing is substantially identical to the equipment that was previously tested and certified and that all changes made to the hardware configuration of the equipment being presented for testing, from the hardware that was previously tested and certified were confirmed to be de minimis changes.
- The standards and associated requirements under which the previous testing and certification was performed are equal to or more demanding than the current requirements.
- There have been no significant changes to the test methods.

The labs that completed the hardware environmental testing and certification meet the EAC's requirements for accreditation as defined in NIST Handbook 150-22: 2005 and NIST Handbook 150-22: 2007.

**Opinions and Interpretations**
EAC Notice of Clarification 08-001 was applied to this VSTL test effort, with the result that all hardware equipment was subjected to Electrostatic Disruption testing.

## 1.15 Security/Telecommunications Test Summary

Not applicable for this test summary document.

## 1.16 Sampling of Vendor Testing Results

SysTest Labs executed 11 sample test cases provided by ES&S in the TDP. The tests, test dates, and SysTest Labs' test results are listed below.

**Test Case Name:** Expanded Precincts (M100)
**Passed/Failed:** Passed
**Summary** The Process 100 Cards/200 Memory Sticks is a functional test case that includes core features (as defined in the Test Plan). The purpose of this test is to process more than the expected number of ballots/voters per precincts, more that the expected number of precincts, and any other similar conditions that tend to overload the system's capacity to process, store and report data.

As this election was a sample test case, provided by the vendor, SysTest labs was given the media and blank ballots. We then hand marked two sets of 195 ballots. One set was scanned on the M100 and the other set was scanned on DS200. Once voted, all totals were pulled into ERM.

Testing consisted of verifying versions of Software and Firmware, executing the test steps defined using the System Operations Manuals, voting the election using 494 precincts, and validating various reports available from the applications and devices.

The pass/fail criteria for this test case were dependent on the system meeting the expected results from the test case, and validated the VSS requirements identified in the test case and the Test Plan.

**Test Case Name:** Auto Recovery (iVotronic)
**Passed/Failed:** Passed
**Summary:** Using the iVotronic Auto Recovery procedure v 9.1.0.0, we voted an election and recovered the results from the U2-D chip. (U2-D chip is a SanDisk). The manual was provided and steps were completed; however, only a trained ES&S technician should complete this procedure. No issues were found in running the Auto Recovery.

**Test Case Name:** Maximum Candidates
**Passed/Failed:** Passed
**Summary:** Load ERM election database "02PNELAN" with more than 1000 candidates in a precinct. ERM limits 1000 counters in a single precinct. Verify that an attempt to load over 1000 counters gives an error messages stating "Aborted-over 1000 candidate in precinct: 211 ERM create results database failed. Connect election definition HPM and then retry." The initial attempt to load

the election did not produce the error. In researching the election definition, we found we were provided the incorrect election. Once given the correct election definition, the error message was received as indicated above.

**Test Case Name:** L&A Vote Selected Ballot Test
**Passed/Failed:** Passed
**Summary:** Using ES&S test case "L&A Vote Selected Ballot Test" to verify the logic and accuracy vote selected ballot test. The voter selects a particular ballot to vote and that vote logic is applied to a select number of ballots (11,803) designated for the voter to cast. No issues were found in running the L&A Vote Selected Ballot Test.

**Test Case Name:** L&A Multi-Vote Test
**Passed/Failed:** Passed
**Summary:** Using ES&S test case "L&A Vote Multi-Vote Test" to verify the logic and accuracy of the multi vote test. Votes for each candidate will increase from one to the next, as in 1, 2, 3, 4, 5, etc. No issues were found in running the L&A Multi-Vote Test.

**Test Case Name:** L&A Vote for One Test
**Passed/Failed:** Passed
**Summary:** Using ES&S test case "L&A Vote For One Test" to verify the logic and accuracy of the vote for one test. Each candidate within a contest will receive one vote. There will be an additional undervote assigned in each contest. No issues were found in running the L&A Vote for One Test.

**Test Case Name:** View Log
**Passed/Failed:** Passed
**Summary:** Using an existing election (GEN01), select a user and verify Audit Manager has captured all activity(ies) carried out in all applicable applications (EDM, AM, and ESSIM). No issues were found in running the View Log test case.

**Test Case Name:** Opening the Polls Functions
**Passed/Failed:** Passed
**Summary:** Use this test case to determine if the DS200 can open polls with an election definition that has more than one precinct. The HPM Report Level option must be ‘Precinct’. No issues were found in running the Opening the Polls Functions test case.

**Test Case Name:** M100 with Plastic Ballot Box (Note: Testing was completed with the Plastic Ballot Box; however, it cannot be certified as a part of the Unity 4.0 Suite, as it has not gone through Hardware Testing.)

**Passed/Failed:** Passed
**Summary:** Using ES&S test case "Model 100 with Plastic Ballot Box" to verify that the M100 can process ballots accurately when seated in the plastic ballot box. No issues were found in running the M100 with Plastic Ballot Box test case.

**No critical issues were found in running any sample test cases and all sample test cases passed.**

## 1.17 Maintainability Test Results

**Test Case Name:** Maintainability Test
**Passed/Failed:** Passed
**Summary**: Maintainability is a test case designed to verify the performance of maintenance activities, as identified in the System Maintenance Procedures, can be performed by the jurisdiction without significant impediment or difficulties.

System Maintenance Procedures were received for the following hardware: DS200, M650, M100, iVotronic DRE, and ABCR (Automatic Bar Code Reader).

Testing consisted of verifying procedures to include determination of operation status, service of the components, repair or replacement of parts, restoration to operation status, confirmation of presence of labels and the identification of test points, provision of built-in test, diagnostic circuitry or physical indicators of conditions, presence of labels, alarms related to failure, and presence of features that allow non-technicians to perform routine maintenance tasks. Also tested was the assessment for ease of detecting equipment failure by non-technician, ease of diagnosing problems by a technician, rate of false alarms, ease of access to component for replacement, ease of performance of adjustment or alignment, ease with which databases updated can be performed by a non-technicians and adjustments, alignment, and service of components.

The testing procedures consisted of using processes described in the Maintenance Manuals to review the maintenance procedure(s) for the corresponding product, an examination of the physical attributes for reliability and any significant impediment for the performance of the maintenance activities to be performed by the jurisdiction, an examination of the additional attributes to assess system maintainability, and performance of the activities designated as maintenance activities to the corresponding product.

The pass/fail criteria for this test case were dependent on the system meeting the expected results from the test case, and validated the VSS requirements identified in the test case and the Test Plan.

During testing one issue was encountered. The DS200 System Maintenance Manual (SMM) did not advise mechanical checks are only supposed to be completed by a trained technician (discrepancy #5). Since then, the vendor has included this issue to the DS200 SMM and the discrepancy was closed. The maintainability test passed with no unresolved discrepancies.

## 1.18 Accuracy Test Results

**Summary:** The Accuracy Test Case is a system level general election with a straight party option. This test case verified the iVotronic can accurately and reliably record and store into memory ballots incorporating a minimum of consecutive ballot positions and can be counted without error. This test was performed in two phases.

Testing consisted of verifying versions of Software and Firmware, executing the test steps that were defined using the System Operations Manuals for all applications and devices, and validating various reports available from the applications and devices.

The AM application, which runs in the background and keeps an audit log of all actions performed in EDM was started prior to any test step execution in any of the other applications comprising the Unity 4.0 suite. The election was coded in EDM, ballot layout was designed in iVIM (for the DRE ballot), and the media was created in HPM. The election was voted on the iVotronic (DRE) and the results were verified by modeming data from two of the machines using the PEB and ERM. Two of the machines utilized the DAM Remote Pack Reader to transmit election results, and the last machine used the communication pack to transmit results into ERM. The reports were printed and verified.

The election consisted of 8 contests with 14 parties and 98 candidates, 7 in each party. The object of Phase 1 was to verify the iVotronic can accurately and reliably print ballots incorporating a minimum of 26,997 ballot positions (including voted and non-voted positions) and that these ballots can be mechanically/electronically tabulated without error. The object of Phase 2 was to verify iVotronic can accurately and reliably print ballots incorporating a minimum of 1,549,703 ballot positions (including voted and non-voted positions) and that these ballots can be mechanically/electronically tabulated without error. The ballot positions completed in the Phase 1 test carried over to and become part of this phase 2 test. The pass/fail criteria for this test case were dependent on the system meeting the expected results from the test case, and validated the VSS requirements identified in the test case and the Test Plan

Each component successfully completed component level accuracy testing. Additionally, the ES&S ABCR and Voyager optical scanners successfully scanned all tapes and reports were validated. One documentation discrepancy was written in response to this Test Case due to a printer busy message received while printing out the final results; the tester tried to verify documentation and couldn't locate the error message in the documentation. There was no impact on the system and discrepancy number 478 was written.

| Ballot Information | | | |
|---|---|---|---|
| | **Contest** | **Contestants** | **Ballot Positions** |
| **Straight Party** | 1 | 14 | **14** |
| **Partisan** | 8 | 98 | **784** |
| **Non-Partisan** | 1 | 2 | **2** |
| **Total** | **10** | **114** | **800** |

| | **Totals** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Phase 1** | **Phase 2** | | | | | | |
| | **Batch 1** | **Batch 2** | **Batch 3** | **Batch 4** | **Batch 5** | **Batch 6** | **Batch 7** | **Total** |
| **TOTALS** | | | | | | | | |
| Ballots Planned | 48 | 350 | 350 | 350 | 350 | 350 | 140 | 1938 |
| Ballot Position Planned | 38400 | 280000 | 280000 | 280000 | 280000 | 280000 | 112000 | 1550400 |
| Ballots Actual | 48 | 350 | 350 | 350 | 350 | 350 | 140 | 1938 |
| Ballot Position Actual | 38400 | 280000 | 280000 | 280000 | 280000 | 280000 | 112000 | 1550400 |

| | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Phase 1** | | | | | | | |
| | **Batch 1** | **Batch 2** | **Batch 3** | **Batch 4** | **Batch 5** | **Batch 6** | **Batch 7** | **Total** |
| **Machine 1 - Precinct 1** iVotronic SN V5105369-C | | | | | | | | |
| Ballots Planned | 48 | 70 | 70 | 70 | 70 | 70 | 31 | 429 |
| Ballot Position Planned | 38400 | 56000 | 56000 | 56000 | 56000 | 56000 | 24800 | 343200 |
| Ballots Actual | 48 | 70 | 70 | 70 | 70 | 70 | 31 | 429 |
| Ballot Position Actual | 38400 | 56000 | 56000 | 56000 | 56000 | 56000 | 24800 | 343200 |

| | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Phase 1** | | | | | | | |
| | **Batch 1** | **Batch 2** | **Batch 3** | **Batch 4** | **Batch 5** | **Batch 6** | **Batch 7** | **Total** |
| **Machine 2 - Precinct 2** iVotronic SN V5149331 | | | | | | | | |
| Ballots Planned | | 70 | 70 | 70 | 70 | 70 | 31 | 381 |
| Ballot Position | 0 | 56000 | 56000 | 56000 | 56000 | 56000 | 24800 | 304800 |
| Ballots Actual | | 70 | 70 | 70 | 70 | 70 | 31 | 381 |
| Ballot Position Actual | 0 | 56000 | 56000 | 56000 | 56000 | 56000 | 24800 | 304800 |

| | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Phase 1** | | | | | | | |
| | **Batch 1** | Batch 2 | Batch 3 | Batch 4 | Batch 5 | Batch 6 | Batch 7 | Total |
| **Machine 3 - Precinct 3** iVotronic SN V5187814 | | | | | | | | |
| Ballots Planned | | 70 | 70 | 70 | 70 | 70 | 31 | 381 |
| Ballot Position | 0 | 56000 | 56000 | 56000 | 56000 | 56000 | 24800 | 304800 |
| Ballots Actual | | 70 | 70 | 70 | 70 | 70 | 31 | 381 |
| Ballot Position Actual | 0 | 56000 | 56000 | 56000 | 56000 | 56000 | 24800 | 304800 |

| | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Phase 1** | | | | | | | |
| | **Batch 1** | **Batch 2** | **Batch** | **Batch** | **Batch 5** | **Batch 6** | **Batch 7** | **Total** |

| | | | 3 | 4 | | | | |
|---|---|---|---|---|---|---|---|---|
| **Machine 4 - Precinct 4** iVotronic SN V5118248 | | | | | | | | |
| Ballots Planned | | 70 | 70 | 70 | 70 | 70 | 31 | 381 |
| Ballot Position | 0 | 56000 | 56000 | 56000 | 56000 | 56000 | 24800 | 304800 |
| Ballots Actual | | 70 | 70 | 70 | 70 | 70 | 31 | 381 |
| Ballot Position Actual | 0 | 56000 | 56000 | 56000 | 56000 | 56000 | 24800 | 304800 |

| | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Phase 1** | | | | | | | |
| | **Batch 1** | **Batch 2** | **Batch 3** | **Batch 4** | **Batch 5** | **Batch 6** | **Batch 7** | **Total** |
| **Machine 5 - Precinct 5** iVotronic SN V5178132 | | | | | | | | |
| Ballots Planned | | 70 | 70 | 70 | 70 | 70 | 16 | 366 |
| Ballot Position | 0 | 56000 | 56000 | 56000 | 56000 | 56000 | 12800 | 292800 |
| Ballots Actual | | 70 | 70 | 70 | 70 | 70 | 16 | 366 |
| Ballot Position Actual | 0 | 56000 | 56000 | 56000 | 56000 | 56000 | 12800 | 292800 |

The DS200 Accuracy Test Case is a system level general election. This test case verified the DS200 can accurately and reliably scan and store into memory a minimum of consecutive ballot positions and can be counted without error. This test was performed in two phases.

Testing consisted of verifying versions of Software and Firmware, executing the test steps that were defined using the System Operations Manuals for all applications and devices, and validating various reports available from the applications and devices.

The AM application, which runs in the background and keeps an audit log of all actions performed in EDM was started prior to any test step execution in any of the other applications comprising the Unity 4.0 suite. The election was coded in EDM, ballot layout was designed in ESSIM for the DS200 and the media was created in HPM. This test was created to run in two phases.

Greater than 100 ballots were scanned when an error occurred on machine 2. Per vendor documentation the error “#124 "Ballot Dragged/Turn Ballot Over and Try Again"” gave instructions to contact an ES&S technician/representative. After the service technician began troubleshooting it was determined the cause of the error was due to a miniscule mark in the timing mark area on the ballot on orientations 2 and 4 that caused the ballot to drag. Testing was halted. (See Disc #465). These ballots with this mark on them were replaced and a second iteration of the test took place (Rev 02).

During Phase 1 of the second iteration the DS200 accurately and reliably scanned ballots incorporating a minimum of 26,997 ballot positions (including voted and non-voted positions) and it was confirmed that these ballots can be mechanically/electronically tabulated without error.

During Phase 2, the DS200 accurately and reliably scanned ballots incorporating a minimum of 1,549,703 ballot positions (including voted and non-voted positions) and it was confirmed that these ballots can be mechanically/electronically tabulated without error. The ballot positions completed in the Phase 1 test carried over to and became part of this phase 2 test. The pass/fail criteria for this test case were dependent on the system meeting the expected results from the test case, and validated the VSS requirements identified in the test case and the Test Plan.

The totals from Machine 1 were modemed directly from the machine into DAM Host and the totals from Machine 2 were read into ERM via media. The totals from Machine 1 were printed and validated. The reports from ERM totals were printed and validated accurately.

| Actual (reflects using complete batches of 320 ballots each. Batch 1 split between Phase 1 and Phase 2) | | | | | | |
|---|---|---|---|---|---|---|
| | Requirement | Target (>= Requirement) | Target Machine 1 | Target Machine 2 | Target Machine 3 (N.A.) | Target Machine 4 (N.A.) |
| Phase 1 | | | | | | |
| Ballots | N.A. | 104 | 52 | 52 | 0 | 0 |
| ballot positions | 26,997 | 27,456 | 13,728 | 13,728 | 0 | 0 |
| | | | | | | |
| Phase 2 - 19 batches | | | 10 batches | 9 batches | | |
| ballots from phase 1 | N.A. | 104 | N.A. | N.A. | N.A. | N.A. |
| ballot positions from phase 1 | N.A. | 27,456 | N.A. | N.A. | N.A. | N.A. |
| Ballots | N.A. | 6,080 | 3,148 | 2,828 | 0 | 0 |
| ballot positions | 1,549,703 | 1,605,120 | 831,072 | 746,592 | 0 | 0 |

The M100 Accuracy Test Case is a system level general election. This test case verified the M100 accurately and reliably recorded and stored into memory ballots incorporating a minimum of consecutive ballot positions and counted the ballots without error. This test case was conducted in two phases.

Testing consisted of verifying versions of Software and Firmware, executing the test steps that were defined using the System Operations Manuals for all applications and devices, and validating various reports available from the applications and devices.

The AM application, which runs in the background and keeps an audit log of all actions performed in EDM was started prior to any test step execution in any of the other applications comprising the Unity 4.0 suite. The election was coded in EDM, ballot layout was designed in ESSIM for the M100 and the media was created in HPM. This test was created to run in two phases.

During phase 1 the M100 accurately and reliably scanned ballots incorporating a minimum of 26,997 ballot positions (including voted and non-voted positions) which allowed the continuation onto phase 2.

Phase 2 testing verified the M100 accurately and reliably scanned ballots incorporating a minimum of 1,549,703 ballot positions (including voted and non-voted positions). The ballot positions completed in phase 1 test carried over and became part of phase 2 testing. The pass/fail criteria for this test case were dependent on the system meeting the expected results from the test case, and validated the VSS requirements identified in the test case and the Test Plan.

The totals from Machine 1 were transmitted directly from the unit to the DAM Host and the totals were printed and validated. The totals from Machine 2 were read into DAM Remote Pack Reader and transmitted, and the totals for Machine 3 were read directly into ERM. These ballots were mechanically/electronically tabulated without error and the reports from ERM totals were printed and validated accurately.

There were no problems found during the testing of the M100 and Functional Discrepancy #259 has been closed.

| | Requirement | Target (>= Requirement) | Target Machine 1 | Target Machine 2 | Target Machine 3 |
|---|---|---|---|---|---|
| Phase 1 | | | | | |
| ballots | N.A. | 103 | 35 | 34 | 34 |
| ballot positions | 26,997 | 27,192 | 9,240 | 8,976 | 8,976 |

| Phase 2 | | | | | |
|---|---|---|---|---|---|
| ballots from phase 1 | N.A. | 103 | N.A. | N.A. | N.A. |
| ballot positions from phase 1 | N.A. | 27,192 | N.A. | N.A. | N.A. |
| ballots | N.A. | 5,871 | 1,923 | 1,923 | 1,922 |
| ballot positions | 1,549,703 | 1,549,944 | 507,672 | 507,672 | 507,408 |

| Phase 3 (optional) | | | | | |
|---|---|---|---|---|---|
| ballots | N.A. | 5,972 | 1,991 | 1,991 | 1,990 |
| excess ballot positions from phase 2 | N.A. | 241 | N.A. | N.A. | N.A. |
| ballot positions | 1,576,701 | 1,576,849 | 525,624 | 525,624 | 525,360 |

The M650 Accuracy Test Case is a system level general election. This test case verified the M650 accurately and reliably scanned and stored into memory ballots incorporating a minimum of consecutive ballot positions and the ballots could be counted without error. This test case was conducted in two phases.

Testing consisted of verifying versions of Software and Firmware, executing the test steps that were defined using the System Operations Manuals for all applications and devices, and validating various reports available from the applications and devices.

The AM application, which runs in the background and keeps an audit log of all actions performed in EDM was started prior to any test step execution in any of the other applications comprising the Unity 4.0 suite. The election was coded in EDM, ballot layout was designed in ESSIM for the M650 and the media was created in HPM. This test was created to run in two phases.

This test was performed in two phases. The object of Phase 1 was to verify that the M650 could accurately and reliably scan ballots incorporating a minimum of 26,997 ballot positions (including voted and non-voted positions) and that these ballots could be mechanically/electronically tabulated without error.

The object of Phase 2 was to verify that the M650 could accurately and reliably scan ballots incorporating a minimum of 1,549,703 ballot positions (including voted and non-voted positions) and that these ballots could be mechanically/electronically tabulated without error. The ballot positions completed in the Phase 1 test carried over to and became part of this phase 2 test. The pass/fail criteria for this test case were dependent on the system meeting the expected results from the test case, and validated the VSS requirements identified in the test case and the Test Plan.

The totals from Machine 1 were then read into ERM via media and the totals from Machine 2 were saved over a LAN directly to a shared network folder for subsequent reading by ERM. The totals from Machine 2 were printed and validated. The reports from ERM totals were printed and validated accurately.

One torn ballot produced an error. SysTest replaced the ballot from a set of extra ballots and testing proceeded. The ERM Networked laptop went into sleep mode and the connection was lost. The laptop was configured to refrain from sleep mode and testing proceeded. No discrepancy was written. Discrepancy #262 was closed.

| Actual (reflects using complete batches of 320 ballots each. Batch 1 split between Phase 1 and Phase 2) | | | | | | |
|---|---|---|---|---|---|---|
| | Requirement | Target (>= Requirement) | Target Machine 1 | Target Machine 2 | Target Machine 3 (N.A.) | Target Machine 4 (N.A.) |
| Phase 1 | | | | | | |
| ballots | N.A. | 104 | 52 | 52 | 0 | 0 |
| ballot positions | 26,997 | 27,456 | 13,728 | 13,728 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Phase 2 - 19 batches | | | 10 batches | 9 batches | | |
| ballots from phase 1 | N.A. | 104 | N.A. | N.A. | N.A. | N.A. |
| ballot positions from phase 1 | N.A. | 27,456 | N.A. | N.A. | N.A. | N.A. |
| ballots | N.A. | 6,080 | 3,148 | 2,828 | 0 | 0 |
| Ballot positions | 1,549,703 | 1,605,120 | 831,072 | 746,592 | 0 | 0 |

SysTest Labs executed telecommunications tests on all software and hardware components of the Unity 4.0 voting system that incorporate either modem or IP connections. Transmission testing includes intentional interruption of the communications link to verify recoverability, error reporting, and user notification (per the vendor documentation). After the interruption, the data was retransmitted successfully and verified. The tests were designed to verify Unity 4.0 meets all applicable EAC VSS 2002 telecommunications requirements.

Election Systems and Software's Data Acquisition Manager (DAM) allows users to transfer election results from remote polling sites to a jurisdiction's election headquarters. Data Acquisition Manager has two software configurations: DAM Remote and DAM Host.

Officials at the central site use the DAM Host configuration to receive election data from polling places. The DAM Host requires the setting of several configuration options before a voting device or Remote DAM can transmit election results to Election Central. The primary configuration elements are: election name, tabulator or DRE device types, shared network folder name for the election results, data encryption option, and setting the Precinct Status file. After configuring and starting the DAM Host module, the Precinct tabulators or DREs, or DAM Remotes, can then transmit election results to Election Central.

Poll workers use the DAM Remote configuration to transfer election results via Pack Reader and Pack Sender to the central collection DAM Host location. The Precincts and polling places have three options for getting their collective election results to Election Central. The options are: hand carrying of the voting device media for reading at Election Central, reading the tabulator and DRE election results media on a Remote DAM for transmission to Election Central, or transmitting the election results directly from a tabulator or DRE to the DAM Host at Election Central. All three results delivery options were tested during the Accuracy testing. The DAM Remote has several configuration parameters including election name, tabulator or DRE type, and the DAM Host password.

All components of the ES&S Unity 4.0 voting system passed relevant telecommunications testing. The telecommunications testing includes assessment of the hardware and software performance, the design and maintenance characteristics, and the simplicity and flexibility of the components. Any critical issues found were reported, resolved and re-tested.

# Appendix A –Trusted Build

Appendix A is not a requirement to this document.

# Appendix B – Index of Attachments

Attachment A - FCA - Functional & System Testing and Sampling

Attachment B - PCA Document Review

Attachment C – Source Code Review

Attachment H - Environmental Hardware Test Summary