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Job No. T58506.01
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# CERTIFICATION TEST PLAN

Prepared for:

| | |
|---|---|
| **Manufacturer Name** | ES&S |
| **Manufacturer System** | Unity 3.2.0.0 |
| **EAC Application No.** | ESS1101 |
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| | | | **REVISION** A |
| | | | **REPORT NO.** Test Plan T58506.01-01, Rev. A |
| wyle laboratories | | | **DATE** May 10, 2011 |

| REV | DATE | PAGE OR PARAGRAPH AFFECTED | DESCRIPTION OF CHANGES |
|---|---|---|---|
| --- | 4-22-11 | Entire Document | Original Release |
| A | 5-5-11 | Sections 1.0 and 1.3 | Corrected DS200 version number (changed from 1.4.5.11 to 1.4.3.11). |
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## 1.0 INTRODUCTION

The purpose of this Test Plan is to document the procedures that Wyle will follow to perform certification testing of the Election Systems and Software (ES&S) Unity 3.2.0.0 Rev 2 voting system. The previous version of this system, Unity 3.2.0.0 Rev 1, has been fully tested to the EAC 2005 VVSG. As a result of this testing, the Unity 3.2.0.0 Rev 1 system was granted certification under EAC Certification No. ESSUnity3200Rev1. Since that time, three issues were identified, either in fielded units or in the test lab environment, relating to the DS200 component of the Unity 3.2.0.0 system. To resolve the identified issues, ES&S submitted an update to the DS200 firmware. The submitted DS200 firmware (version 1.4.3.11) is the current firmware in the EAC Certified ES&S Unity 3.2.1.0 system (ESSUnity3210). The DS200 with the 1.4.3.11 firmware has not been tested with the Unity 3.2.0.0 Rev 1 EMS. This test campaign will perform integration testing of the DS200 firmware and the entire Unity 3.2.0.0 Rev 1 system, therefore resulting in the Unity 3.2.0.0 Rev 2 voting system. A

The full system details for the previous test campaigns, including system, performance, security, telecommunication, usability, system verification, and TDP deliverables can be reviewed in the approved final certification report (iBeta Report No. (V)2010-30Jun-001(D)) located on the EAC website (www.eac.gov).

### 1.1 References

The list below includes all documents cited in the Test Plan and used in the development of the Test Plan. The documents listed were utilized to perform certification testing.

- Election Assistance Commission 2005 Voluntary Voting System Guidelines, Volume I, Version 1.0, "Voting System Performance Guidelines", and Volume II, Version 1.0, "National Certification Testing Guidelines", dated December 2005
- United States Federal Election Commission Voting System Standards Volume I, “Performance Standards” and Volume II, “Test Standards” dated April 2002
- Election Assistance Commission Testing and Certification Program Manual, Version 1.0, effective date January 1, 2007
- Election Assistance Commission Voting System Test laboratory Program Manual, Version 1.0, effective date July 2008
- National Voluntary Laboratory Accreditation Program NIST Handbook 150, 2006 Edition, "NVLAP Procedures and General Requirements (NIST Handbook 150)", dated February 2006
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, "Voting System Testing (NIST Handbook 150-22)", dated May 2008
- United States 107th Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Wyle Laboratories’ Test Guidelines Documents: EMI-001A, "Wyle Laboratories’ Test Guidelines for Performing Electromagnetic Interference (EMI) Testing", and EMI-002A, "Test Procedure for Testing and Documentation of Radiated and Conducted Emissions Performed on Commercial Products"
- Wyle Laboratories’ Quality Assurance Program Manual, Revision 3
- ANSI/NCSL Z540-1, "Calibration Laboratories and Measuring and Test Equipment, General Requirements"
- ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment"

## 1.0 INTRODUCTION (CONTINUED)

### 1.1 References (continued)

- EAC Notices of Clarification (listed on www.eac.gov)
- EAC Requests for Interpretation (listed on www.eac.gov)

### 1.2 Terms and Abbreviations

Table 1-1 defines all terms and abbreviations applicable to the development of this Test Plan.

**Table 1-1 Terms and Abbreviations**

| Term | Abbreviation | Definition |
|---|---|---|
| Americans with Disabilities Act of 1990 | ADA | ADA is a wide-ranging civil rights law that prohibits, under certain circumstances, discrimination based on disability |
| Audit Manager | AM | System software that provides security and user tracking for Election Data Manager (EDM) and ES&S Ballot Image Manager (ESSIM). |
| Configuration Management | CM | --- |
| Commercial Off the Shelf | COTS | Commercial, readily available hardware or software |
| United States Election Assistance Commission | EAC | Commission created per the Help America Vote Act of 2002, assigned the responsibility for setting voting system standards and providing for the voluntary testing and certification of voting systems. |
| Election Data Manager | EDM | A single-entry database that stores all of a jurisdiction's precinct, office, and candidate information. |
| Election Management System | EMS | --- |
| Election Reporting Manager | ERM | Election results reporting program. |
| ESSIM | ESS Image Manager | A desktop publishing tool that allows users to design and print ES&S paper ballots. |
| Help America Vote Act | HAVA | Act created by United States Congress in 2002. |
| Hardware Programming Manager | HPM | An election package primarily used for converting election files and creating and loading election parameters. |
| National Institute of Standards and Technology | NIST | Government organization created to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhances economic security and improves our quality of life. |
| Physical Configuration Audit | PCA | Review by accredited test laboratory to compare voting system components submitted for certification testing to the manufacturer's technical documentation, and confirmation the documentation meets national certification requirements. A witnessed build of the executable system is performed to ensure the certified release is built from tested components. |
| Quality Assurance | QA | --- |
| Technical Data Package | TDP | Manufacturer documentation related to the voting system required to be submitted as a precondition of certification testing. |
| Voting System Standards | VSS | Published by the FEC, second iteration of national level voting system standards. |
| Voluntary Voting System Guidelines | 2005 VVSG | Published by the EAC, the third iteration of national level voting system standards. |
| Wyle Operating Procedure | WoP | Wyle Test Method or Test Procedure |

## 1.0 INTRODUCTION (CONTINUED)

### 1.3 Scope of Testing

The scope of testing for this test campaign will be limited to evaluating the ability of the DS200 firmware version 1.4.3.11 to interface with the Unity 3.2.0.0 Rev 1 EMS. The firmware has been previously tested in the Unity 3.2.1.0 test campaign and the EMS applications have been tested in the Unity 3.2.0.0 Rev 1 test campaign. The purpose of this test effort will be to verify these two components interface reliably and accurately. A

## 2.0 MATERIALS REQUIRED FOR TESTING

The materials required for certification testing of the ES&S Unity 3.2.0.0 Rev 2, which include software, hardware, test materials, and deliverable materials, were shipped directly to Wyle by ES&S. Some of the equipment to be used during this test effort is the same equipment used during the original certification campaign performed by Wyle.

### 2.1 Software

The previously certified EMS (version 3.2.0.0 Rev 1) shall be used in conjunction with the updated DS200 Firmware (version 1.4.3.11) for system integration testing of the two components. Both the EMS and the DS200 firmware will be retrieved from the "Trusted Builds" archive for each system. This test campaign will not include any new build, but will rely on software from the previous test campaigns.

Table 2-1 presents the software the manufacturer has submitted for testing.

**Table 2-1 Software Submitted for Testing**

| Software Required For Testing | Software Version |
|---|---|
| DS200 Firmware | 1.4.3.11 |
| HPM | 5.7.1.0 |
| EDM | 7.8.1.0 |
| ESSIM | 7.7.1.0 |
| AM | 7.5.2.0 |
| ERM | 7.5.4.0 |
| Log Monitor | 1.0.0.0 |

### 2.2 Equipment

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

## 2.0 MATERIALS REQUIRED FOR TESTING (CONTINUED)

### 2.2 Equipment (continued)

**Table 2-2 Unity 3.2.0.0 Test Equipment**

| Equipment | Description | Serial Numbers |
|---|---|---|
| DS200 | Precinct Count Optical Scanner | ES0107360007, ES0108340178, ES0107380927 |
| Ballot Box | Plastic Ballot Box | E076, E089, E099 |
| Dell Latitude E6410 | Processor: Intel Core VPro I5-520 2.4 Ghz<br>Memory: 2x 1GB, 1067 Mhz Ram<br>Hard Drive Capacity: 250 GB | C42F0M1 |
| COTS Printer | HP LaserJet 4050N | USQX074394 |
| Dell Latitude E6400 (ERM Laptop) | Processor: Intel Duo Core P8600 2.4 Ghz<br>Memory: 1x 2GB, 800 Mhz Ram<br>Hard Drive Capacity: 80 GB | 137FMJ1 |
| Transport Media (USB Flash Drives) | SanDisk 2GB Cruzer Micro | Wyle-assigned numbers as needed: TM-XXX |
| Compact Flash (CF Card) | SanDisk & Toshiba | 512 Mb, 1GB, |

### 2.3 Test Tools/Material

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

**Table 2-3 Test Materials**

| Test Material | Quantity |
|---|---|
| Elections (Wyle 1, ES&S 2) | 3 |
| Miscellaneous Office equipment and supplies (such as report paper) | as required |
| Printer Thermal Paper Rolls | as required |
| Printed Ballots | as required |

### 2.4 Deliverable Materials

At test conclusion, Wyle shall deliver a final report to ES&S and the EAC that includes the following:

- A description of the system integration testing and test results.
- An anomaly list listing any anomalies on Wyle form WH1066, Notice of Anomaly.

All supplied equipment and software furnished to Wyle for this program, except for hardware from the initial certification test campaign, shall be returned to the customer at the conclusion of testing unless otherwise agreed in writing.

## 2.0 MATERIALS REQUIRED FOR TESTING (CONTINUED)

### 2.5 Proprietary Data

All proprietary data that is marked shall be distributed only to those persons that the manufacturer identifies as needing the information to conduct system testing. The manufacturer is required to mark all proprietary documents as such. All organizations and individuals receiving proprietary documents shall ensure those documents are not available to non-authorized persons.

## 3.0 TEST SPECIFICATIONS

### 3.1 Requirements

The strategy for evaluating ES&S Unity 3.2.0.0 Rev 2 was to review the change log and the engineering changes submitted for the modified system. Wyle has determined that the software and hardware meet all applicable EAC 2005 VVSG requirements. This test campaign does not change any of those requirements nor does it add any new requirements.

This test campaign includes the following tests:

- Technical Data Package review to ensure all modifications are documented as applicable.
- System integration test to ensure the two components are interoperable.
- A limited Physical Configuration Audit to baseline the system.

Wyle personnel shall maintain a test log of the procedure(s) employed. This log identifies the system and equipment by model and serial number.

In the event that the project engineer deems it necessary to deviate from requirements pertaining to the test environment, the equipment arrangement and method of operation, the specified test procedure, or the provision of test instrumentation and facilities, the deviation shall be recorded in the test log. (A discussion of the reasons for the deviation and the effect of the deviation on the validity of the test procedure shall also be provided and approved.)

The designated Wyle Operating Procedures (WoP's) for this program are listed below together with the identification and a brief description of the hardware and software to be tested and any special considerations that affect the test design and procedure.

The specific Wyle WoP's to be used during testing include the following:

- WoP 1 Operations Status Checks
- WoP 2 Receipt Inspection
- WoP 3 Technical Data Package Review (limited)
- WoP 4 Test Plan Preparation– ES&S Unity Version 3.2.0.0 Rev. 2 *(This document)*
- WoP 25 Physical Configuration Audit (limited)
- WoP 30 System Integration Test
- WoP 34 Test Report

## 3.0 TEST SPECIFICATIONS (CONTINUED)

### 3.2 Requirements (continued)

The Certified EMS, consisting of a COTS desktop computer as documented in Section 2, shall be configured as follows for the System Integration Testing:

- HPM – version 5.7.3.0
- EDM – version 7.8.1.0
- ESSIM – version 7.7.1.0
- AM – version 7.5.2.0
- ERM – version 7.5.7.0
- Log Monitor – 1.0.0.0

The DS200 shall be configured as follows for the System Integration Testing:

*Optical Scanner* – Three DS200 configured with firmware version 1.4.3.11 will be setup as for normal operation on Election Day will be used for System Integration Testing.

### 3.2 Hardware Configuration and Design

This test campaign requires no hardware testing.

The hardware used in this test campaign will be configured for normal use on Election Day.

### 3.3 Software System Functions

The strategy for this test campaign will be to treat the two components; DS200 and EMS, as black box components since they are both certified components in other EAC certified voting systems. The approach with be to verified these two components interface without modification. If both components interface reliably and accurately without modification then it will be concluded that version 1.4.3.11 of the DS200 firmware can be used to resolve the issues identified in the Unity 3.2.0.0 Rev 1 system.

## 4.0 TEST DATA

### 4.1 Data Recording

All equipment utilized for test data recording shall be identified in the test data package. The output test data shall be recorded in an appropriate manner as to allow for data analysis. For TDP reviews, results shall be compiled in output reports and submitted to ES&S for resolution. Additionally, all test results, including functional test data, shall be recorded on the relevant WoP's and Test Cases. Results shall also be recorded real-time in engineering log books.

## 4.0 TEST DATA (CONTINUED)

### 4.2 Test Data Acceptance Criteria

Wyle shall evaluate all test results against the ES&S provided technical documentation for the ES&S Unity, Version 3.2.0.0, and the requirements set forth in the EAC 2005 VVSG. The E&S Unity, Version 3.2.0.0, shall be evaluated for its performance against the EAC 2005 VVSG. The acceptable range for system performance and the expected results for each test case shall be derived from the ES&S Unity, Version 3.2.0.0 documentation. Per the EAC 2005 VVSG, these parameters shall encompass the test tolerances, the minimum number of combinations or alternatives of input and output conditions that can be exercised to constitute an acceptable test of the parameters involved, and the maximum number of interrupts, halts or other system breaks that may occur due to non-test conditions (excluding events from which recovery occurs automatically or where a relevant status message is displayed).

## 5.0 TEST PROCEDURE AND CONDITIONS

This section describes Wyle's proposed test procedures and the conditions under which those tests shall be conducted.

The following subsections describe test procedures and a statement of the criteria by which readiness and successful completion shall be indicated and measured.

### 5.1 Test Facilities

All testing shall be conducted at the Wyle, Huntsville, AL facility unless otherwise annotated. Hardware operating testing shall be conducted at the appropriate test site with the required support equipment. All instrumentation, measuring, and test equipment used in the performance of this test campaign shall be listed on the Instrumentation equipment Sheet for each test and shall be calibrated in accordance with Wyle's Quality Assurance Program, which complies with the requirements of ANSI/NCSL Z540-1 and ISO 10012-1. Standards used in performing all calibrations are traceable to the National Institute of Standards and Technology (NIST) by report number and date. When no national standards exist, the standards are traceable to international standards or the basis for calibration is otherwise documented.

Unless otherwise specified herein, all remaining tests, including system level functional testing, shall be performed at standard ambient conditions:

- Temperature: 25°C ± 10°C (77°F ± 18°F)
- Relative Humidity: 20 to 90%
- Atmospheric Pressure: Local Site Pressure

Unless otherwise specified herein, the following tolerances shall be used:

- Time ± 5%
- Temperature ± 3.6°F (2°C)
- Vibration Amplitude ± 10%
- Vibration Frequency ± 2%
- Random Vibration Acceleration
  - 20 to 500 Hertz ± 1.5 dB
  - 500 to 2000 Hertz ± 3.0 dB
- Random Overall grms ± 1.5 dB
- Acoustic Overall Sound Pressure Level +4/-2 dB

## 5.0 TEST PROCEDURE AND CONDITIONS

### 5.2 Test Set-Up

All voting machine equipment (hardware and software), shall be received and documented utilizing Wyle Receiving Ticket (Wyle Form No. WL-218) and proper Quality Assurance (QA) procedures. When voting system hardware is received, Wyle Shipping and Receiving personnel shall notify Wyle QA personnel. With Wyle QA personnel present, each test article shall be unpacked and inspected for obvious signs of degradation and/or damage that may have occurred during transit. Noticeable degradation and/or damage, if present, shall be recorded, photographs shall be taken, and the ES&S representative shall be notified.

Wyle QA personnel shall record the serial numbers and part numbers. Comparison shall be made between those numbers recorded and those listed on the shipper's manifest. Any discrepancies noted shall be brought to the attention of the ES&S representative for resolution.

TDP items, including all manuals, and all source code modules received shall be inventoried and maintained by the Wyle Project Engineer assigned to the test program.

For hardware test setup, the system shall be configured as it would be for normal field use. This includes connecting all supporting equipment and peripherals. Wyle personnel shall properly configure and initialize the system, and verify that it is ready to be tested, by following the procedures detailed in the ES&S Unity, Version 3.2.0.0 technical documentation. Wyle will use the operational status test and will measure the system performance levels used during the original certification.

### 5.3 Test Sequence

The components of the ES&S Unity, Version 3.2.0.0, shall be subjected to the tests described in Table 5-1, below. There is no specific sequencing enforced for the execution of the required tests.

**Table 5-1 Unity 3.2.0.0 Software and System Testing Sequence**

| Test | Description | Procedure | Test Level | Specimen | Election Data |
|---|---|---|---|---|---|
| *Technical Data Package (TDP) Review*<br><br>*(Pre-testing Activity)* | Documentation review for compliance, correctness, and completeness | WHVS07.1 WoP 3 | Document | TDP Package | --- |
| *Physical Configuration Audit* | Baseline of the system documentation, software, and hardware 2005 VVSG requirements | WHVS07.3 WoP 25 | Component & Integration | DS200 & EMS | -- |
| *System Integration Test* | Test of the entire system end to end. | WHVS07.5 WoP 30 | System | DS200 & EMS | GEN01<br>MI-PRIM<br>OH-PRIM |
| *Test Report* | Generation of final test report | WoP 34 | --- | --- | --- |

## 5.0 TEST PROCEDURE AND CONDITIONS (CONTINUED)

### 5.4 Test Operation Procedures

Wyle shall provide the step-by-step procedures for each test case to be conducted. Each step is assigned a test step number and this number, along with critical test data and test procedures information, shall be listed onto a Wyle Test Control Record for control and the recording of test results.

Any test failures shall be recorded on the Wyle Notice of Anomaly form (Wyle Form No. WH1066). These Anomalies shall be reported to the manufacturer and the EAC.

### 5.5 System Level Test

A system integration test shall be performed to ensure all interacting components function as a system without issues. Wyle has chosen three election definitions for system level testing: a Wyle-generated general election (GEN04), and two ES&S-provided actual state primary elections from states that have the Unity 3.2.0.0 Rev1 system fielded (Michigan and Ohio). This strategy was chosen to demonstrate that the DS200 and the EMS can interface reliably and accurately using both a primary and a general election containing multiple voting variations.

Wyle will input the GEN04 election definition to test support for the following:

- Partisan offices
- Non-Partisan offices
- Write-in voting
- Straight Party voting
- N-of-M voting.

The two state primary election definitions shall be used to test support for the following:

- Michigan
    - Open Primary
    - Two Parties
    - Partisan offices
    - Non-Partisan offices
    - Write-in voting
    - N-of-M voting
    - Referendums
- Ohio
    - Closed Primary
    - Partisan offices
    - Non-Partisan offices
    - N-of-M voting
    - Multi-page ballot
    - Split Precincts

# APPENDIX A

# TEST PROCEDURE DESCRIPTION

| Test Procedure | Test Procedure Description |
|---|---|
| WoP 1 Operational Status Checks | When all tests, inspections, repairs, and adjustments have been completed, normal operation shall be verified by conducting an operational status check. During this process, all equipment shall be operated in a manner and under environmental conditions that simulate election use to verify the functional status of the system. Prior to the conduct of each of the environmental hardware non-operating tests, a supplemental test shall be made to determine that the operational state of the equipment is within acceptable performance limits. |
| WoP 2 Receipt Inspection | Documenting the receiving inspection of equipment. |
| WoP 3 Technical Data Package Review | Track all documentation changes through the technical data package. |
| WoP 4 Test Plan Preparation – ES&S Unity 3.2.0.0 Rev 2 (*This Document*) | Approval of this document shall fulfill the requirements of this procedure. |
| WoP 25 Physical Configuration Audit | The physical configuration audit will be limited to base lining the system to ensure all software and hardware used in testing is the software and hardware that was certified. |
| WoP 30 System Integration Test | Test to ensure the DS200 firmware version 1.4.3.11 and the EMS Unity 3.2.0.0 Rev 1 components interface reliably and accurately. |
| WoP 34 Test Report | National Certification Test Report |