wyle laboratories

Wyle Laboratories, Inc.
7800 Highway 20 West
Huntsville, Alabama 35806
Phone (256) 837-4411 • Fax (256) 721-0144
www.wylelabs.com

TEST REPORT

CHANGE RELEASE REPORT
OF THE
SEQUOIA AVC ADVANTAGE
DRE VOTING MACHINE
(FIRMWARE VERSION 10.3.5)

for

Sequoia Voting Systems
7677 Oakport Street, Suite 800
Oakland, CA 94621

(sd)

STATE OF ALABAMA
COUNTY OF MADISON }

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

SUBSCRIBED and sworn to before me this 20th day of Sept 20 06

Notary Public, in and for the State of Alabama at Large

My Commission expires 9/15/07

PREPARED BY: _W. Owens, Project Engineer_ 9/19/06 Date

APPROVED BY: _James E. Feller, NCT, Sr. Project Engineer_ 9/19/06 Date

WYLE Q. A.: _Fou Raul F. Terceno, Q. A. Manager_ 9/20/06 Date

ACCREDITED
CERT. # 845.01

QMI
ISO 9001:2000

WH-1404, Rev. Feb '97

TABLE OF CONTENTS

WYLE LABORATORIES, INC.
Huntsville Facility

1.0   INTRODUCTION

1.1   Scope

This report presents the test results for Hardware Qualification Testing of the Sequoia Advantage DRE Voting Machine.

1.2   Objective

The objective of this test program was to ensure that the Sequoia Voting Systems Advantage DRE Voting Machine, Firmware Version 10.3.5, continued to comply with the guidelines of the Federal Election Commission (FEC) Voting System Standards (VSS), April 2002, under which it was originally qualified.

1.3   Summary

A change release to the Advantage firmware was implemented, requiring a review of the source code and follow-up regression testing to ensure continued compliance with the requirements of the 2002 FEC VSS, under which it was originally qualified.

The regression testing (functional tests) was limited to the resident machine firmware and hardware used at the precinct level and did not include any election management software, which typically resides on a personal computer and is used for ballot definition, absentee, and report canvassing activities.

In-depth source code review and testing of the election management software including end-to-end system level testing will be performed by the software ITA, CIBER, Inc. which will issue the results of such testing under a separate report.

It was demonstrated that the Advantage DRE, as tested, using firmware release 10.3.5, successfully met the qualification test requirements of the Federal Election Commission Voting System Standards, April 2002.

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

2.0   REFERENCES

- Sequoia Voting Systems Purchase Order No. 10006806

- Sequoia Voting Systems Change Release Summary-Main Application, Version 10.2.4 from 10.2.0

- Sequoia Voting Systems Change Release Summary-Main Application, Version 10.3.0 from 10.2.4

- Sequoia Voting Systems Change Release Summary-Main Application, Version 10.3.1 from 10.3.0

- Sequoia Voting Systems Change Release Summary-Main Application, Version 10.3.2 from 10.3.1

- Sequoia Voting Systems Change Release Summary-Main Application, Version 10.3.3 from 10.3.2

- Sequoia Voting Sequoia Voting Systems Change Release Summary-Main Application, Version 10.3.5 from 10.3.3

2.0   REFERENCES (continued)

- FEC April 2002 Voting System Standards, Volume I, "Performance Standards', and Volume II, 'Test Standards"

- Wyle Laboratories' Test Report No. 51884-09, "Hardware Qualification Testing of the AVC Advantage DRE Voting Machine (Firmware Release 10.1.9)", dated May 24, 2006

- Wyle Laboratories' Quality Assurance Program Manual, Revision 2

- MIL-STD-45662A, "Calibration System Requirements"

- ANSI/NCSL Z540-1, "Calibration Laboratories and Measuring and Test Equipment, General Requirements"

- ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment"

3.0   CUSTOMER

Sequoia Voting Systems
7677 Oakport Street, Suite 800
Oakland, CA 94621

4.0   TEST HARDWARE/FIRMWARE DESCRIPTION

The following paragraphs address, in greater detail, the design methodology and product description of the AVC Advantage DRE Voting Machine, of which the Sequoia Voting Systems' Technical Data Package was the source for much of this information.

4.1   AVC Advantage

The AVC Advantage is a Direct-Record Electronic voting machine.   It performs the following functions:

- Validate and load ballot definitions.

- Perform pre-election testing and verifications.

- Perform election day voting.

- Perform post-election testing and verifications.

- Print Zero Proof and Results Reports.

- Perform maintenance diagnostic tests and functions such as Audit Trail Transfer, Set Time/Date, and print the Event Log report.

The AVC Advantage provides a full-face ballot presentation for the voter, with up to 504 voting positions. The voting positions are represented by an array of pushbutton switches and LEDs. A printed overlay is used to indicate each contest and candidate, and to provide instructions as desired by the jurisdiction. A Mylar sheet is secured on top of the printed overlay to protect it.

Privacy panels, a privacy curtain and an integral booth light are standard. Internal battery backup provides up to 16 hours of operating time.

4.0 TEST HARDWARE/FIRMWARE DESCRIPTION (continued)

4.1 AVC Advantage (continued)

The AVC Advantage is tended by a pollworker. A separate Operator Panel is provided for the pollworker, and permits rapid activation for voting and monitoring of machine status (including error conditions).

The AVC Advantage hardware consists of the following major components:

- **Main CPU:** This is an embedded AMD Elan SC400 based system, running ROM-DOS. It contains 8 Mb of DRAM, 2 Mb of Flash ROM (used for application program storage, ballot definition, and vote data storage), a PCMCIA slot (used for the results cartridge), a battery backed real time clock, and a serial port for communication with the I/O Board.

- **I/O Board CPU:** This is the original Z80 CPU. With firmware version 10, it manages I/O devices and communicates via a dedicated serial port with the Main CPU. It contains program ROM, system ROM, configuration ROM, time and date clock, backup batteries, timers and counters, speaker (beeper), and additional circuits for self-monitoring, connecting the other assemblies, and controlling AVC power consumption.

- **Voter Panel:** The Voter Panel contains all the selection and display devices for the voter. This includes an array of switch modules to select candidates and answer questions, write-in modules to enter write-in selections, cast vote switches to finalize all the voter's selections, and a booth light to light up the front of the ballot.

4.2 Hardware

- **Write-in Keyboard:** The write-in keyboard and display is located below the Voter Panel. The keyboard is used for entering write-in names; the display provides prompts and confirmations to the voter. The write-in keys consist of the letters A-Z, enter (\n), comma (,), hyphen (-), period (.) and apostrophe ('), plus 4 arrow keys: up, down, left, right.

- **Operator Panel:** The Operator Panel contains all the selection and display devices for the maintenance technician or poll worker including switches and LEDS to select and display 12 options, activate or test. An LCD message display. Indicators for ac on and low battery. Automatic power on/off when the panel is inserted/removed.

- **Report Printer:** An integral thermal printer is used for printing reports.

- **Power Supply:** The power supply includes a 32 amp-hour backup battery that can power the AVC Advantage for up to 16 hours.

The AVC Advantage includes an optional audio voting interface that is enabled by the pollworker. This interface uses Sequoia's standard Rev D Audio Box (also used on the AVC Edge touchscreen machine). The voter navigates through the ballot using Next, Back, and Select buttons. Help instructions are available at any time. The audio box allows the voter to control the volume and playback speed.

All voting functionality that is available to sighted voters is included for audio voting. Ballots cast with the audio interface are not distinguished in any way from those cast using visual voting.

4.0   TEST HARDWARE/FIRMWARE DESCRIPTION (continued)

4.2   Hardware (continued)

The AVC Advantage weighs approximately 265 lbs. When opened into the voting position, the AVC Advantage overall dimensions are: Height: 78", Width: 49", and Depth: 46". The AVC Advantage is designed to operate with a standard 120 VAC, 60 Hz power source.

4.3   Firmware

4.3.1   Advantage Firmware

The Advantage firmware is partitioned so that the application code resides on the audio subsystem CPU (Application CPU) and the Z80 CPU board (I/O Processor) serves the role of front-end I/O processor. Communications between the I/O Processor and Application CPU is through the serial port.

In depth discussion of the software design concepts are documented in the Sequoia Voting Systems AVC Advantage 10, Software Technical Specification, Document Version 1.01, Part Number 096050012, January 2006.

5.0   MATERIALS REQUIRED FOR TESTING

5.1   Equipment

Sequoia provided a sufficient number of Advantage machines to ensure that parallel testing where feasible could be performed. Each Advantage was configured for Audio Ballot processing. The following serial numbers were taken from the Advantage machines used for testing: 11642 and 22052.

5.2   Test Materials

Sequoia provided all ancillary support material required during the course of the ITA Hardware Qualification Testing.

5.3   Deliverable Materials

Sequoia provided the latest versions of all hardware and software specifications and poll-worker hardware and software user/maintenance manuals. All user manuals have an identifiable Version Number or Document Control Number or Release Date.

The following documents constitute the deliverable materials to the end user:

- Sequoia Voting Systems AVC Advantage Audio Accessory, Poll Worker/Operator's Manual, Part Number 096116603

- Sequoia Voting Systems AVC Advantage 10, Operators Manual, Part Number 096050062

- Sequoia Voting Systems AVC Advantage 10, Maintenance Manual, Part Number 096050052

- Sequoia Voting Systems AVC Advantage 10, Pollworker Guide, Part Number 096050112

- Sequoia Voting Systems AVC Advantage 10, Personnel & Training, Part Number 096050002

6.0   TEST SPECIFICATIONS

6.1   Functional Qualification Tests

The Advantage was subjected to a series of tests to simulate Election Day activities at the precinct level. These tests were performed to ensure compatibility of voting machine functions at the precinct level using the revised firmware.

These included activities to simulate:

a) verification of hardware status via diagnostic reports prior to election

b) performing procedures required to prepare hardware for election operations

c) obtaining 'zero' machine report printouts on all contest fields

d) performing procedures to open the polling place and enable ballot counting

e) casting of ballots to demonstrate proper processing, error handling, and generation of audit data

f) performing hardware operations required to disable ballot counting and closing the polls

g) obtaining machine reports and verifying correctness

h) obtaining machine generated audit logs and verifying correctness

Additionally, logic and accuracy tests were performed and functionality of the following Ballot Logic types was verified:

- General Election
- Closed Primary Election
- Open Primary Election
- Partisan/Non-Partisan
- Straight Party
- Cross Party Endorsement
- Ballot Rotation (limited to rotation between machines)
- Recall Issues w/Options
- Split Precincts
- Vote N-of-M
- Write-In Voting
- Overvotes (disallowed) and Undervotes
- Blank Ballots

Attachment B contains an overall functional qualification matrix addressing those precinct level hardware characteristics reviewed during hardware qualification testing.

6.0   TEST SPECIFICATIONS (continued)

6.1   Functional Qualification Tests (continued)

6.1.1   Source Change Specific Functional Tests

Functional tests were performed to verify source specific changes associated with Change Release 10.3.5. This was done to ensure proper implementation of the changes. The changes associated with the 10.3.5 added functional enhancements, improvements in the overall structure, maintainability, and readability of the code as well as addressing any bugs identified during actual use or as a result of introduction through a previous step release while still in development. Additionally, some changes were imbedded in overall system operation and not specific to a singular functional attribute.

Source specific functional testing was performed to verify specific functional changes where feasible.

The following synopsis list revisions associated with the revised release 10.3.5:
- Incorporated additional Multilanguage support functions
- Added multiple page receipt capabilities
- Added support for future VVPAT printer
- Conditioned code build and variable types to allow for alternate future protected modes
- Refined VVPAT support
- Coorected FEC code review issues
- Added vote total count protection

6.2   System Level Volume/Accuracy Tests

The Advantage was subjected to volume/accuracy tests. During the volume and accuracy testing, the Advantage was subjected to the casting of a large number of ballots to verify vote recording accuracy, i.e., at least 1,549,703 ballot positions correctly read and recorded. Testing was performed using an automated Logic & Accuracy test routine. The test utility was implemented with a test script consisting of one contest containing 503 positions; 3600 ballots were then cast resulting in an excess of 1,549,703 positions accurately recorded via the machine totals report.

7.0   TEST EQUIPMENT AND INSTRUMENTATION

All instrumentation, measuring, and test equipment used in the performance of this test program were calibrated in accordance with Wyle Laboratories' Quality Assurance Program, which complies with the requirements of ANSI/NCSL 2540-1, ISO 10012-1, and Military Specification MIL-STD-45662A. 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.

8.0   WYLE QUALITY ASSURANCE

All work performed on this program was completed in accordance with Wyle Laboratories' Quality Assurance Program Manual.

8.0   WYLE QUALITY ASSURANCE (continued)

The Wyle Laboratories Huntsville Facility, Quality Management System is registered in compliance with the ISO-9001:2000 International Quality Standard. Registration has been completed by Quality Management Institute (QMI), a Division of Canadian Standards Association (CSA).

Wyle Laboratories is accredited (Certificate No.: 845.01) by the American Association for Laboratory Accreditation (A2LA), and the results shown in this test report have been determined in accordance with Wyle's scope of accreditation unless otherwise stated in the report.

Pages A-1 through B-28 of the 9/18/06 Wyle Report No. 51884-11 have been redacted because they contain trade secrets of Sequoia including proprietary source code and related materials.