

# Software Qualification Test Report Sequoia WinEDS 3.1.074

**Original Report Version 1.0 for WinEDS 3.1.074 created 2006-10-12**

Revision to detail decision on regression testing Edge II Plus 1.2.33 2006-10-17

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**Prepared For:**

**The National Association of State Election Directors**

**Prepared By:**



**CIBER, Inc.  
Independent Test Authority**



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CIBER, Inc.  
7501 South Memorial Parkway  
Suite 107  
Huntsville, AL 35802

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## Report revision history

<b>Version</b>	<b>Description</b>
Version 1.0	Original release
Version 1.1	Update **Note in Section 5 and footnotes. Updated VVPAT to VeriVote VVPAT. Updated WinEDS version in Test Cases.

1	INTRODUCTION .....	1
1.1	Test Agency Test Agency History And Capability .....	1
1.2	Document Overview .....	1
2	QUALIFICATION TEST BACKGROUND.....	2
3	SYSTEM IDENTIFICATION.....	4
4	SYSTEM OVERVIEW .....	9
5	QUALIFICATION TEST RESULTS.....	10
5.1	Technical Data Package (TDP) Review Summary.....	10
5.2	Source Code Review Summary .....	11
5.3	Functional Test Summary .....	11
5.4	Recommendation For Qualification.....	12
Appendix A	TECHNICAL DATA PACKAGE (TDP) REVIEW .....	13
Appendix B	SOURCE CODE REVIEW .....	14
Appendix C	FUNCTIONAL TEST REVIEW .....	17
Appendix D	WITNESSED COMPILES .....	32
D.1	Witness Compile OCX Modules.....	34
D.2	Witness Compile PowerBuilder Component .....	52
D.3	Witness Compile VB (.dll Modules).....	78
D.4	Witness Compile SQL Server .....	80
D.5	Witness Compile OBW 1.2.....	81
D.6	Witness Compile SPR Host .....	85
D.7	Witness Compile WinEDS Flash Recorder .....	86
D.8	Witness Compile Election Reporting.....	93
D.9	Witness Compile Election Results.....	104
D.10	Witness Compile HAAT Listener.....	107
Appendix E	HARDWARE REPORTS.....	112

# 1 INTRODUCTION

CIBER is pleased to submit this report summarizing the qualification testing of the Sequoia WinEDS 3.1.074 voting system.

## 1.1 Test Agency Test Agency History And Capability

CIBER Inc. has been providing IT consulting services for over 20 years. Although the Independent Test Authority (ITA) division name has changed due to an aggressive acquisition and merger market, the ITA division of the company has had the same leadership in place since inception. Founded in 1974, the company's consultants now serve client businesses from 60 CIBER, 10 DigiTerra, 5 Solution Partners and 4 EnspHERics offices in the U.S., Canada and Europe. With offices in 10 countries, CIBER's 6,000 IT specialists continuously build, test and upgrade our client's systems to "competitive advantage status." CIBER provides a single source for IT solutions, including:

Full-solution ASP services

Applications maintenance and support

- Testing and IQA
- Web and database hosting
- Enterprise solutions, including SAP, Oracle and Peoplesoft
- Application outsourcing
- eBusiness, from architecture through execution
- Knowledge management and training

The company has been involved in numerous QA and IQA testing projects for commercial, state, and federal government customers. CIBER has an interim accreditation as an ITA through the National Association of State Election Directors (NASED).

## 1.2 Document Overview

This document consists of five main sections: Introduction, Qualification Test Background, System Identification, System Overview, and Qualification Test Results. The Qualification Background gives general information about the qualification test process. The System Identification Section gives information about the Sequoia software and supporting hardware. The System Overview describes the software and the Qualification Test Results Section provides a summary of the results of the testing process.

Detailed information including the Technical Data Package (TDP) Review, Source Code Review, Functional Test Review and Witness Compile are included as appendices to this report.

## 2 QUALIFICATION TEST BACKGROUND

The primary purpose of Software Qualification Testing is to demonstrate compliance with levels of design, performance, and quality claimed for them by manufacturers. The tests are also intended to demonstrate that the system meets or exceeds the requirements of the Federal Election Commission (FEC) 2002 Voting System Standards (VSS).

The scope and detail of the requirements for qualification have been tailored to the design and complexity of the software submitted by Sequoia for testing. The qualification test procedure is intended to discover defects in software design and system operation which, should they occur in actual election use, could result in failure to complete election operations in a satisfactory manner.

The tests have been designed to evaluate system compliance to the 2002 FEC Voting System Standards (VSS). The evaluation includes selective in-depth examination of software, the inspection and evaluation of system documentation and optional tests verifying system performance and function under normal and abnormal conditions.

A definition of terms and nomenclature found in the Sequoia voting system is listed below:

WinEDS	Application used to design and print ballots and to produce reports.
Optech Insight & Insight Plus	Optical Paper Ballot Scanner
Edge model I , II, & II Plus	DRE voting device
AVC Advantage (Advantage D10)	Full Face DRE voting device
400C	Optical Paper Ballot Scanner
Card Activator	Device used to create cards for voters
HAAT	(Hybrid Activator Accumulator and Transmitter) Device used to create cards for voters and to consolidate results and print consolidation reports.
HAAT Listener	This is a software component is used to receive unofficial consolidated results from the HAAT 100 via a public IP address. Once the data is received and verified the data is stored in WinEDS for reporting.
VeriVote VVPAT	(Voter Verifiable Paper Audit Trail) printer attached to the Edge models I & II that provides a paper audit of a voters selections.
OBW	Optech Ballot Wizard is used to lay out the ballot and create ballot pages, visio documents and PDF files.
SPR	Smart Pack Reader is a software component that runs on the WinEDS Server and receives unofficial voting results that are transmitted by the Optech Insight. It puts these results in a file that is accessible to WinEDS.
WFR	WinEDS Flash Recorder is a software component that runs on the WinEDS Workstation. It contains an interface by which the user can send multiple WinEDS cartridges to a COTS USB Hub.

## Election Night Reporting

This is a software application that contains two components; Election Reporting and Election Results. Election Reporting captures data from the WinEDS database at specific processing points to generate unofficial reports for election night reporting. The Election Results component is a console application that scrolls the reported data in real time.

### 3 SYSTEM IDENTIFICATION

The system submitted by Sequoia consisted of the previously certified system version 3.1.038 with the following changes:

- **Integration of Edge II Plus and HAAT 100 with transmission**

These models of devices are added to the configuration for the first time and will be validated integrating them with all other devices utilized in a system election.

- **WinEDS Flash Recorder(WFR)**

A new software utility was added that takes range of cartridges created in WinEDS and copies them using a COTS USB Hub to the removable USB style cartridges. This application has three components. Cartridge Administrator creates labels for administrating the bulk copy function. Cartridge Production physically copies the cartridges onto the USB style cartridges. Cartridge Tally sends a range of cartridges back to WinEDS for the tally process.

- **NEW Security Implemented**

WinsEDS has added security on voting results. The transmission of voting results to the tally program. The ability to detect changes to the vote tally files after they have been placed on the memory cartridge. The report of files that were detected with mismatched CFC totals.

- **Election Night Reporting**

Election Night Reporting is a new application that transfers data from WinEDS during processing and provides unofficial results real time. While it is tied closely to WinEDS, Election Night Reporting is a stand-alone application. It is comprised of two components Election Reporting and Election results. The Election Reporting component retrieves copies for the WinEDS database during processing between the WinEDS batch process. Reports can be run on data WinEDS has processed up to that point. The Election Results component is a console that scrolls updates from the Election Reporting database.

- **Enhancements to the manual positioning for the Advantage Style DRE**

The Manual Positioning Wizard for the Advantage ballot layout has been enhanced to allow direct entry and editing of contest and candidate positions.

- **Cartridge Creation User Interface**

A new window was created to track cartridge creation activity. The information tracked includes machine assignment, cartridge creation date, election and cartridge versioning.

- **Added Multiple Judge's Marks to the Paper Ballot Systems**

The Optech Insight/Insight Plus and 400C have the ability to read two "Judge's Marks". The Judge's initials and the Precinct can be added to a ballot and read in Optech Insight/Insight Plus and 400C. Additionally, the parameter to allow poll workers to override the rejection of a ballot without these marks was added.

The system submitted by Sequoia for qualification testing consisted of the following software source code components. These components when compiled create the WinEDS Version 3.1.074:

### Sequoia Software

The following components were built from source code that CIBER had reviewed and then placed in the CIBER archive. CIBER copied the source code from its Archive to the vendor's development computer and then witnessed the vendor build each component.

Component	Sub Components	Installed Components
OCX	3rd - Third Party Serial I/O library used w/ OCX to communicate with the MPR. version 1.0.1.2	WSC32.DLL
	AcvAdvProp version 1.1.2.3	AvcAdvProp.cpl
	avccore version 1.2.15.2	AvcCore.ocx
	avcedge version 1.2.25.4	AvcEdge.ocx
	Build 1.0.1.1	(Build batch files and docs)
	Cryptscr 1.0.3.2	Cryptscr.exe
	ScriptWiz version 2.1.8.5	ScriptWiz.exe
	Seq400c version 1.2.6.3	Seq400c.ocx
	seqmpr version 1.0.11.1	SeqMpr.ocx
	spvutil version 1.2.9.1	Spvutil.dll
	Spv400c version 1.2.25.2	Spv400c.dll
	Svsmpr version 1.0.28.3	Svsmpr.dll
PB 3.1.074	Archive, audio, blt, blt_dw, cart, config, e_setup, edge, gen, InEagle, main, pfl_dw, profile, reports, rpt_arg, rpt_elec, rpt_nst, rpt_pfl, rpt_pst, rpt_rslt, schlr, sec, seqIV, stats, tally, TS, util	WinEDS31.exe archive.pbd audio.pbd ballots.pbd ballots_dw.pbd cartridge.pbd configuration.pbd edge.pbd election_setup.pbd generation.pbd ineagle.pbd main.pbd pfcapsrv.pbd pfcdwsrv.pbd pfcmain.pbd pfcutil.pbd pfcwsvr.pbd pfeapsrv.pbd pfedwsrv.pbd pfemain.pbd pfeutil.pbd pfewsvr.pbd profile.pbd profile_dw.pbd reports.pbd reports_election.pbd reports_nested.pbd reports_post.pbd reports_profile.pbd reports_results.pbd report_argument.pbd scheduler.pbd security.pbd sequoia400.pbd statistics.pbd



		tally.pbd toolsmith.pbd utilities.pbd
SQL 3.1.074		SQL tables, triggers, stored procedures and functions
VB 3.1.074	CommonBAS, Contest Preview, ContestPreviewEdge, Header, HeaderEdge, Layout, LayoutEdge	ContestPreview.dll ContestPreviewEdge.dll Header.dll HeaderEdge.dll Layout.dll LayoutEdge.dll Setup_Resources.exe
Other COTS	EzMr.exe and ezUSB.sys  Cypress Semiconductor Corporation	Driver for Advantage Cartridge Reader.  Not part of this release. Needed to complete witness build.
	GraphicsProcessor2002 and GraphicsProcessor2002effect GDIPlus Aurigma Imaging Technology, www.aurigma.com.	Used by the application for scaling of bitmap images (graphical languages)
	NCTAudioFile.dll NCTAudioPlayer.dll NCTAudioRecord.dll NCTAudioTransform.dll NCTTextToAudio.dll NCTSoft www.NTCSoft.com	The NCT third party controls are used by the WinEDS application to manage audio recordings and to convert text to speech.

The following components were built from source code that CIBER had reviewed and then placed in the CIBER archive. CIBER copied the source code from its Archive to the vendor's development computer and then witnessed the vendor build each component. The following table identifies the version and source for each component.

Software Component	Version	Source
Optech Ballot Wizard	1.2	CIBER Archive
SPR Host	1.0.10	CIBER Archive
Election Reporting	1.1.7.0	CIBER Archive
Election Results	1.1.1.0	CIBER Archive
HAAT Listener	1.5.2	CIBER Archive
WinEDS Flash Recorder	1.0.17.0	CIBER Archive

The following software was provided to the vendor as trusted builds from the ITA archive. These components were installed in the devices used in this test under the oversight of CIBER. The following table identifies the version and source for each component.

Software Component	Version	Source
400-C/WinETP	1.14.3	Wyle Laboratories Archive
Sequoia Edge Firmware	5.0.31	Wyle Laboratories Archive
**Sequoia Edge II Plus Firmware	**1.2.32	SysTest Archive
HAAT Firmware	2.1.18	SysTest Archive
Advantage Main Board Firmware	10.3.5	Wyle Laboratories Archive
Insight APX	2.12	Wyle Laboratories Archive
Insight HPX	1.44	Wyle Laboratories Archive
Insight CPX	1.14	Wyle Laboratories Archive
Insight Memory Packer	2.15	Wyle Laboratories Archive
Card Activator	5.0.31	Wyle Laboratories Archive

\*\*Note: The functional system end-to-end testing used firmware version 1.2.32. A defect was found in this firmware after testing was concluded. A description of this anomaly and the resolution is described in Section 5 of this document. The audience of this report should review all hardware reports listed in Appendix E for the full details of

testing on the Edge II Plus. The testing for this specific defect can be found in SysTest Report EDGE2plus Model 300 Version 1.2.33 Amendment C Rev 01

The following components are installed on the WinEDS Workstations and Server and are required by the WinEDS System.

**Cots Software**

Microsoft Windows XP with SP2
Microsoft Windows Server 2003 with SP1
Microsoft Visio 2002
Adobe Acrobat Professional 6.0
Microsoft Office 2003 SP1
Microsoft Vision 2002 SP2
Microsoft SQL Server SP3a

The system submitted by Sequoia for qualification testing consisted of the following hardware components:

**Sequoia Hardware**

Optech Insight & Insight Plus HPX K1.44, APX K2.12 (Wyle Report 52125-06)
Optech Insight CPX 1.14 (Wyle Report 52125-05)
Insight Memory Pack Receiver 2.15 (Wyle Report 50932-03)
Edge I 5.0.31 (Wyle report 51884-10)
Edge II 5.0.31 (Wyle report 51884-10)
**Edge II Plus 1.2.32 (SysTest Report EDGE2plus Model 300 Version 1.2.33 Amendment C Rev 01)
Edge Audio Unit 5.0 Rev C(Wyle report 51884-10)
VeriVote VVPAT 4.3 (Wyle report 51884-10)
Card Activator 5.0.31 (Wyle report 51884-10)
HAAT Model 50 2.1.18 (SysTest Report HAAT Version 2.1.18 Amendment A Rev 01)
HAAT Model 100 2.1.18 (SysTest Report HAAT Version 2.1.18 Amendment A Rev 01)
400C 3.00P/WinETP 1.14.3 (Wyle report 52125-07)
Sequoia Advantage 10.3.5 (Wyle report 51884-11)

\*\*Note: The functional system end-to-end testing used firmware version 1.2.32. A defect was found in this firmware after testing was concluded. A description of this anomaly and the resolution is described in Section 5 of this document. The audience of this report should review all hardware reports listed in Appendix E for the full details of testing on the Edge II Plus. The testing for this specific defect can be found in SysTest Report EDGE2plus Model 300 Version 1.2.33 Amendment C Rev 01

Wyle Laboratories and SysTest Labs performed qualification testing of the above hardware, which is documented in their reports. The following reports are attached:

- Wyle Report Number 52125-05      Wyle Report Number 51884-10
- Wyle Report Number 52125-06      Wyle Report Number 51884-11
- Wyle Report Number 52125-07      Wyle Report Number 50932-03

- SysTest Report HAAT Version 2.1.16 Amendment A Rev 01
- SysTest Report HAAT Version 2.1.18 Amendment A Rev 01
- SysTest Report Edge2Plus Model 200/300 DRE Version 1.1.62 Rev 02
- SysTest Report Edge2Plus Model 300 DRE Version 1.2.24 Rev 01
- SysTest Report Edge2Plus Model 300 DRE Version 1.2.32 Amendment B Rev 01
- SysTest Report Edge2Plus Model 300 DRE Version 1.2.32 Amendment B Rev 02
- SysTest Report Edge2Plus Model 300 DRE Version 1.2.33 Amendment C Rev 01

## COTS Hardware

Dell Latitude 610
Dell Optiplex 280
SYSCARD Technology PCCextend Cardbus
Targus 4 port 2.0 USB Hub
HP LaserJet 1200

The documentation submitted by Sequoia for review testing consisted of the following:

Part Number	Revision	Document Title
089351511	1.12	WinEDS 3.1 Technical Data Package
089350011	1.16	WinEDS 3.1 System Overview
089350111	1.13	WinEDS 3.1 Functional Specification
089350211	1.11	WinEDS 3.1 Software Specification
089350311	1.04	WinEDS 3.1 Security Specification
089350411	1.04	WinEDS 3.1 Test & Verification Specification
089352111	1.05	WinEDS 3.1 Operators Manual
089350511	1.04	WinEDS 3.1 Personnel & Training Requirements
089350611	1.07	WinEDS 3.1 Configuration Management Plan
089351911	1.04	WinEDS 3.1 Quality Assurance Program
089352411	1.07	WinEDS 3.1 Change Release Summary*
089350811	1.04	WinEDS 3.1 AVC SDK: For AVC Advantage
089350911	1.04	WinEDS 3.1 AVC SDK: For AVC Edge
089352211	1.03	WinEDS 3.1 Installation Guide*
089351811	6.06	WinEDS 3.1 Reference Guide*
089352011	2.07	WinEDS 3.1 Sample Reports
089352311	1.01	WinEDS 3.1 SDK: For Insight and Eagle
089351111	1.04	WinEDS 3.1 SDK: For Optech 400-C
089351611	1.05	WinEDS 3.1 Specification Diagrams
089351211	1.16	WinEDS 3.1 System Database
089351311	2.01	WinEDS 3.1 Visio Templates: For AVC Advantage
089351411	2.01	WinEDS 3.1 Visio Templates: For AVC Edge
089352501	1.01	Election Reporting / Results Operator's Guide
089352601	1.02	WinEDS Flash Recorder Operators Manual

## HAAT Listener TDP Documents

Part Number	Document Title	Revision
190-32881-00	WinEDS/HAAT Listener Technical Data Package	1.03
190-32882-00	WinEDS/HAAT Listener System Overview	1.05
190-32883-00	WinEDS/HAAT Listener Functional Specification	1.03
190-32884-00	WinEDS/HAAT Listener Software Specification	1.04
190-32885-00	WinEDS/HAAT Listener Security Specification	1.02
190-32886-00	WinEDS/HAAT Listener Test & Verification Specification	1.02
190-32887-00	WinEDS/HAAT Listener Operator's Manual*	1.04
190-32888-00	WinEDS/HAAT Listener Personnel & Training Requirements	1.00
190-32889-00	WinEDS/HAAT Listener Configuration Management Plan	1.04
190-32890-00	WinEDS/HAAT Listener Quality Assurance Program	1.02

\*Denotes documentation delivered to the customer by Sequoia

## **4 SYSTEM OVERVIEW**

The Sequoia Voting System supports both paper ballots and electronic voting. The client applications are executed on a standard PC configured with a Windows XP and the server applications are executed on a standard PC configured with Windows server 2003. The following peripherals are connected to client PC:

- Laser printer for printing election ballots and reports
- MPR for reading/writing Insight & Insight Plus cartridges
- Card reader/writer for accessing Edge I & II cartridges
- USB 4 port hub

The user defines a ballot using the WinEDS application on the PC. The definition can include a selection of foreign languages and audio for visually disadvantaged voters. Ballot definitions are written to the flash Memory for the 400C, the MPR for the Optech Insight and Insight Plus and the results cartridge for the Edge model I, II, & II Plus.

The Sequoia system provides an early election capability that allows the various devices to accept votes for a specified time period before Election Day.

The Optech Insight and Optech Insight Plus are polling place paper ballot scanners that scan paper ballots and records the selections as record candidate summary totals to the MPR. The Optech Insight and Optech Insight Plus are used for Absentee, Early and Election Day polling place voting. The Optical Insight provides the option to incorporate a modem for transmitting unofficial election results to the SPR Host.

The Edge I, Edge II, and Edge II Plus are DRE type voting machines. These devices can be configured to have either a standard thermal printer attached for reporting or a VVPAT which allow the voter to view their selections on paper before casting their ballot. The VVPAT also serves as a report printer.

The AVC Advantage (Advantage D10) is also a DRE. 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.

The 400C is a paper based optical scanner. The 400C can be configured as an absentee, central count or Election Day modes.

Card Activator and HAAT 50/100 are card activating devices located at the polling location. The HAAT 100 has additional features that allow for consolidation of both USB cartridges and Insight cartridges. After consolidation, the HAAT 100 can transmit unofficial consolidated results to a third party that can provide the data to the HAAT Listener via a public IP address. The transmission is accomplished by the use of aircards and the cell phone data network.

The HAAT Listener is a software application attached to a network. It receives data that has been consolidated by the HAAT 100 and forwards the data to the WinEDS database.

WinEDS Flash Recorder (WFR) is a software application to allows for bulk copy functionality to USB cartridges and bulk read from USB cartridges. The cartridges are created in WinEDS and save to the local hard drive. The WFR application then uses multi-thread processes to copy/read data.

Election Night Reporting application is comprised of two modules; Election Reporting and Election Results. Election Reporting captures data from the WinEDS database at specific processing points to generate unofficial reports for election night reporting. The Election Results component is a console application that scrolls the reported data in real time.

## **5 QUALIFICATION TEST RESULTS**

### **5.1 Technical Data Package (TDP) Review Summary**

The vendor submitted changes to the version 3.1.038 WinEDS TDP. The ITA verified that those changes conformed to the 2002 FEC Standards and that they were accurate and complete. These TDP documents served as the basis for verifying the Software Test Plan that was used for functional testing.

The review included reconciling the document changes to the changes that were observed in the source code and functional testing to ensure that the TDP fully describes the updated system.

Upon final review of the aforementioned documents, CIBER concludes that the TDP submitted Sequoia meets the requirements under the FEC standards of 2002.

## **5.2 Source Code Review Summary**

The code was reviewed in order to evaluate its compliance with the FEC standards for source code. These standards are intended to ensure that the overall objectives of the logical correctness, system integrity, reliability, and accuracy are being met. It was also reviewed for its adherence to any Sequoia coding standards.

The review process compared version 3.1.074 code to the previously certified version 3.1.038 source code to identify all changes. The modules containing these changes were then manually inspected to verify that the changes complied with the FEC 2002 Standard.

It was determined that Sequoia WinEDS 3.1.074 meets the standards required by the 2002 VSS.

## **5.3 Functional Test Summary**

The main goal of functional testing was to verify that the changes submitted with this release of WinEDS operate correctly, do not create any adverse effects and that the entire WinEDS system conforms to the FEC standards and to the vendor's stated capabilities. The software that was tested consisted of two installations of the WinEDS 3.1.074 application. One installation was placed on the PC running Windows 2003 server and one installation on PC's (workstations) running Windows XP. The Sequoia WinEDS 3.1.038 had been certified under the 2002 Federal Standard and this testing focused on the changes to that system and the addition of the new devices. The testing included end-to-end tests that provided a regression test of the WinEDS Application operating in an integrated system configuration that included the hardware and software components identified in Section 3.

**\*\*NOTE:** The Edge II Plus was submitted with firmware version 1.2.32. All testing was conducted using this firmware. After testing was complete, a defect was found in the allocation of memory for write-in candidates. This defect was random in origin and was not noted during the system end-to-end testing, in which 12 system level test cases were conducted.

Sequoia initiated a source code update to the functions that allocate memory blocks for the file that stores text of write-in candidates. The purpose of this update was to change the way memory was allocated for the storage of text in the write-in function of the Edge II Plus. The file that stores these values is initially empty. As write-in candidates are added more spaces gets added. Even though more space gets added some write-in votes were overwritten. The update explicitly enforced the existing memory positions.

A test plan was created by the Hardware ITA (SysTest) in conjunction with CIBER. The tests focused on recreating the defect on firmware version 1.2.32 and verifying the resolution in firmware version 1.2.33. Another test was conducted to insure firmware 1.2.33 could perform under increased volume of ballots cast. CIBER deemed that the issue was isolated to the Edge II Plus write-in function. It is CIBER opinion that this defect did not need to undergo any further system end-to-end testing.

The detailed testing for this specific defect can be found in SysTest Report EDGE2plus Model 300 Version 1.2.33 Amendment C Rev 01.\*\*

After completion of final functional testing, CIBER concludes that Sequoia WinEDS 3.1.074 Voting System meets the functional requirements provided by the 2002 VSS as well as the additional requirements stated or derived from the TDP.

#### **5.4 Recommendation For Qualification**

It has been demonstrated through the TDP review, source code review, and functional testing that the Sequoia WinEDS 3.1.074 successfully meets the required acceptance criteria of the FEC Voting System Standards of 2002.

It is upon completion of this testing that CIBER recommends to the NASED committee that Sequoia WinEDS 3.1.074 be certified.

**Pages 13 through 113 of the 10/12/06 Ciber WinEDS 3.1.074 Report  
have been redacted because they contain trade secrets of Sequoia  
including proprietary source code and related materials.**