Five Cedars Group
Alternate Format Ballot
Remote Accessible Vote by Mail System

Staff Report

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Secretary of State's Office of
Voting Systems Technology Assessment
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I. <u>INTRODUCTION</u>

1. Scope

This report presents the test results for all phases of the certification test of the Five Cedars Group, Alternate Format Ballot Remote Accessible Vote by Mail system. The purpose of the testing is to test the compliance of the voting system with the relevant California Voting System Standards, State and Federal laws. Testing also uncovers other findings, which do not constitute non-compliance, and those findings are reported to the voting system vendor to address the issues procedurally.

2. Summary of the Application

Five Cedars Group submitted an application for the Alternate Format Ballot (AFB) Remote Accessible Vote by Mail system, which is comprised of the following major components:

- HTML Alternate Format Ballot
- AFB Ballot Generator

In addition to the ballot, which includes the HTML source code, Five Cedars Group was required to submit the following: 1) the technical documentation package (TDP); 2) all the software components to field a complete working version of the ballot, including all peripheral devices, for the Functional Test Phase.

3. Contracting and Consultants

Upon receipt of a complete application, the Secretary of State released a Request for Proposal (RFP) for assistance with the Security Review, both Source Code and Security testing. The statement of work (SOW) also had an option for the Secretary of State to use the awarded contractor for Functional testing, if it deemed necessary.

Through the formal California contracting process, the Secretary of State awarded a contract to SLI Compliance (SLI), 4720 Independence Street, Wheat Ridge Colorado.

II. <u>SUMMARY OF THE SYSTEM</u>

1. HTML Alternate Format Ballot

The AFB is an HTML ballot that is generated from text files supplied to Five Cedars by a County that implements the AFB. The implementing County will be

responsible for identifying the correct ballot style for a given voter, and then downloading the AFB ballot to that voter. Currently, AFB ballots can only be generated from text files exported from the Hart system. Once downloaded, the AFB ballot is marked on the voter's home equipment, and then the voter prints a cast vote record (CVR) on their home printer. A cast vote record is a record of the ballot that has been cast, but is not an actual ballot. The AFB CVR is then mailed back to the jurisdiction using a vote by mail ballot envelope. The QR code on the cast vote record contains the following information: a random number which is also printed on the cast vote record in human readable format, the ballot style, a version number , and the codes for the contest choices. The QR code does not contain any voter information. The contest choices are printed in the format 1:3, where 1 represents the first contest on the ballot, and the three represents the third choice in the contest. The CVR is duplicated on ballot at the implementing County.

The computer downloading the AFB ballot can be disconnected from the internet after the ballot is delivered with no adverse results.

2. AFB Ballot Generator

The AFB Ballot Generator is a Windows application that reads County supplied Hart BOSS ballot definition files, creates logical internal data tables, which it uses to build the accessible HTML ballots. The program was written in Microsoft VB.NET using Framework 4.5. The ballots are built by populating a set of pre-built ballot HTML templates which are assembled into a single HTML file for each ballot style required. If the county has supplied XLF ballot translation files, the AFB Ballot Generator will use the translation pairs, and a set of the HTML templates already translated into the desired language, to build ballots in the desired language.

III. <u>TESTING INFORMATION AND RESULTS</u>

1. Background

Five Cedars Group submitted an application to the Secretary of State for certification of the Alternate Format Ballot on April 24, 2017. California assigned AFB the project number CA-AFB1.

California certification testing of the AFB system began in June 2017. The testing began with the Functional Testing, followed by Accessibility Testing, Source Code Review, and finally Security Review.

2. Functional Test Data and Results

The Functional Test of the Five Cedars AFB system was conducted by Secretary of State staff and Five Cedars staff at the Secretary of State's Office located at 1500 11th Street, Sacramento, California from June 5 through June 6, 2017.

The Secretary of State ran the Functional Test as if it were a voter using the system for the first time. Testing was conducted with four (4) laptop computers and one (1) printer provided by Five Cedars. OVSTA tested the Alternate Format Ballot using the following end user equipment:

Table 2A: Functional Test Equipment	
Hardware	**Software**
Hewlett Packard (HP) Spectre laptop	Windows 10, Microsoft Narrator, JAWS version 18 screen reader, and a free reader from Australia called NVDA
Apple MacBook Air laptop	Apple accessibility software
Chromebook	ChromeVox version 53.0.2785.154 accessibility software
Apple iPad	Standard Apple accessibility software

The cast vote records were printed on a Canon P1100 ink jet printer.

The Five Cedars representative generated ballots with the Five Cedars Ballot Generator software. The ballots were generated from the San Mateo 2012 General Election using comma separated text files exported from the Hart BOSS 4.3 system. The seven text files exported from the San Mateo 2012 General Election were:

- Candidate.txt
- Candidate_detail.txt
- Contest.txt
- Contest_and_Precinct.txt
- Election.txt
- Party.txt
- Precinct.txt

The Five Cedars Ballot Generator software worked as expected and generated AFB ballots correctly. At this time, the Five Cedars system will only generate ballots from text files that are exported from a Hart BOSS 4.3 system.

The AFB ballot will allow over-votes, but warns the voter of the over-vote condition. The ballot also warns the voter of under-votes if you click on the "Test This Ballot" button. The AFB performed as expected against all California Secretary of State test cases, as well as the vendor supplied AFB test cases supplied by Five Cedars.

Table 2B: Test Environment and Results	
Test Environment	**Result**
HP Spectre laptop using Windows 10 and Narrator with Internet Explorer browser.	Performed as expected.
HP Spectre laptop using Windows 10 and Narrator with Microsoft Edge browser.	Narrator encountered many problems with the Microsoft EDGE browser.
HP Spectre laptop using Windows 10 and JAWS version 18 screen reader with Internet Explorer browser.	Performed as expected.
HP Spectre laptop using Windows 10 and JAWS version 18 screen reader with Microsoft Edge browser.	JAWS encountered many errors when using the Microsoft Edge browser.
HP Spectre laptop using Windows 10 and NVDA free reader with Internet Explorer browser.	Performed as expected.
HP Spectre laptop using Windows 10 and NVDA free reader with Microsoft Edge browser.	NVDA encountered many errors when using the Microsoft Edge browser.
Apple MacAir laptop running Sierra version 10.12.4, and the standard Apple accessible software	Performed as expected.

Apple iPad running IOS 11, and the standard Apple accessibility software	Performed as expected.
Chromebook laptop using ChromeVox version 53.0.2785.154 accessibility software.	Experienced one failure.
Dell laptop running Windows 7 with Narrator	Worked approximately 50% of the time.

The QR code was scanned from the cast vote record using an iPhone 4 smart phone running the following apps:

- Free QR Code Reader & BarCode Scanner from MixerBox Inc.
- QR Reader for iPhone by TapMedia Ltd.
- I-nigma QR Code and Data Matrix and 1D BarCode Reader from 3GVision.

The free QR code reader from MixerBox, Inc. would not read the QR code. The QR Reader for iPhone by TapMedia Ltd. would not read the QR code.   The I-nigma QR code Reader from 3GVision read the QR code as expected with no problems or errors.

Findings

The computer downloading the AFB ballot can be disconnected from the internet after the ballot is downloaded with no adverse results.
The AFB performed as expected against all California Secretary of State test cases, as well as the vendor supplied AFB test cases supplied by Five Cedars.

3. Source Code Review

The Source Code Review for the Five Cedars AFB system was conducted by SLI. The Source Code Review includes proprietary source code. The AFB system code was tested to the applicable California Voting System Standards (CVSS) requirements, and any applicable industry standards, as detailed below.

SLI conducted a source code review of the source code for compliance to the CVSS. The source code was reviewed for adherence to the applicable standards in sections 5 and 7 of the CVSS. The expected outcome was that no issue would be found. The actual outcome was a determination that for the "Dead Code" (CVSS 5.2.7.e) requirement found in the source code base reviewed, two discrepancies were written against the code base, and for the

"Sufficient Header Comments" (CVSS 5.2.6.a-h) requirement found in the source code base reviewed, three discrepancies were written against the code base.

The source code was reviewed for adherence to other applicable coding format conventions and standards including best practices for the coding language used. The expected outcome for this review was that no issue would be found. The actual outcome for this review was a determination that the source code was clean and met all CVSS and applicable standards requirements in this category.

An analysis of the program logic and branching structure was conducted. The expected outcome was that no issue would be found. The actual outcome was a determination that the program logic and branching structure was reasonable and sufficient for the functionality implemented.

An evaluation of whether the system is designed in a way that allows meaningful analysis, was conducted, including:

- Whether the architecture and code is amenable to an external review.
- Whether code analysis tools can be usefully applied.
- Whether the code complexity is at a level that obfuscates its logic.

The expected outcome was that no issue would be found. The actual outcome was a determination that the architecture and code is amenable to external review and that the code complexity does not obfuscate the logic. Code analysis tools could be applied to this code base, but it is of a small quantity that manual review was as useful, if not more so.

The AFB source code was searched for exposures to commonly exploited vulnerabilities including buffer overflows and SQL issues.

- The expected outcome for this review was that no exposures to commonly exploited vulnerabilities would be found in the AFB source code.
- The actual outcome for this review was a determination that no exposures to commonly exploited vulnerabilities were found in the AFB source code.

The AFB source code was evaluated for the use and correct implementation of cryptography and key management. The expected outcome for this review was that cryptography and key management would be found to be correctly implemented in the AFB source code, as per the CVSS. The actual outcome for this review was a determination that cryptography and key management is correctly implemented in the AFB source code.

The AFB source code was analyzed for its ability to appropriately accommodate error and exception handling. The expected outcome for this review was that no issues with error and exception handling would be found in the AFB source code. The actual outcome for this review was a determination that no error and exception handling issues were found in the AFB source code.

The AFB source code was evaluated in two areas for the likelihood of security failures being detected.

> a. Evaluate whether audit mechanisms are reliable and tamper resistant. The expected outcome for this review was that audit mechanisms in the AFB source code would be found to be reliable and tamper resistant. The actual outcome for this review that no issues were found – audit mechanisms in the AFB source code were found to be reliable and tamper resistant.

> b. Evaluate whether data that might be subject to tampering is properly validated and authenticated The expected outcome for this review was that any data in the AFB source code that might be subject to tampering would be properly validated and authenticated. The actual outcome for this review was that no issues were found – any data in the AFB source code that might be subject to tampering is properly validated and authenticated.

The AFB source code was evaluated for the risk that a user can escalate his or her capabilities beyond those authorized. The expected outcome for this review was that in the AFB source code, a user cannot escalate his or her capabilities beyond those authorized. The actual outcome for this review was a determination that in the AFB source code, a user cannot escalate his or her capabilities beyond those authorized.

The AFB source code was evaluated for embedded, exploitable code (such as "Easter eggs") that can be triggered to affect the system. The expected outcome for this review was that no embedded, exploitable code (such as "Easter eggs") that can be triggered to affect the system would be found to be resident in the AFB source code. The actual outcome for this review was a determination that no embedded, exploitable code (such as "Easter eggs") that can be triggered to affect the system was found to be resident in the AFB source code.

The AFB source code was evaluated that no code for dynamic memory access features which would permit the replacement of certificated executable code or control data or insertion of exploitable code or data would be found. The expected outcome for this review was that code for dynamic memory access features which would permit the replacement of certificated executable code or control data or insertion of exploitable code or data would not be found in the AFB source code. The actual outcome for this review was a determination that

no code for dynamic memory access features which would permit the replacement of certificated executable code or control data or insertion of exploitable code or data was found in the AFB source code.

The AFB source code was evaluated for use of runtime scripts, instructions, or other control data that can affect the operation of security relevant functions or the integrity of the data. The expected outcome for this review was that no use of runtime scripts, instructions, or other control data would be found in the AFB source code. The actual outcome for this review was a determination that no use of runtime scripts, instructions, or other control data that can affect the operation of security relevant functions or the integrity of the data was found in the AFB source code.

The AFB source code was evaluated that no code for dynamic memory access features which would permit the replacement of certificated executable code or control data or insertion of exploitable code or data would be found. The expected outcome for this review was that code for dynamic memory access features which would permit the replacement of certificated executable code or control data or insertion of exploitable code or data would not be found in the AFB source code. The actual outcome for this review was an determination that no code for dynamic memory access features which would permit the replacement of certificated executable code or control data or insertion of exploitable code or data was found in the AFB source code.

The AFB source code was evaluated for design and implementation to ensure that sound, generally accepted engineering practices are followed, checking to verify that code is defensively written against bad data, errors in other modules, changes in environment, user errors, and other adverse conditions. The expected outcome for this review was that generally accepted engineering practices are followed and the code is defensively written in the AFB source code. The expected outcome for this review was a determination that in the AFB source code, generally accepted engineering practices are followed and the code is defensively written against bad data, errors in other modules, changes in environment, user errors, and any other potential adverse conditions.

Discrepancies

Ten discrepancies for the "Sufficient Header comments" requirement were found in the AFB source code base reviewed, as a result, ten discrepancies were written against the code base.

Vulnerabilities

For any vulnerabilities discovered, SLI was tasked with identifying the particular

standards applicable to each vulnerability. To the extent possible, reported vulnerabilities included an indication of whether the exploitation of the vulnerability would require access by:

- A Voter. Voters usually have low knowledge of the Remote Accessible Vote by Mail Machine System (RAVBMS) design and configuration. Some may have more advanced knowledge. A voter may carry out attacks designed by others.
- An Elections official insider. Elections official have a wide range of knowledge of the RAVBMS design and configuration. An official may have unrestricted access to the RAVBMS for long periods of time. Their designated activities include:

  - Set up and pre-election procedures;
  - Election operation;
  - Post-election processing of results; and
  - Archiving and storage operations.

- A Vendor insider: A vendor insider has great knowledge of the RAVBMS design and configuration. They have unlimited access to the RAVBMS before it is delivered to the purchaser and, thereafter, may have unrestricted access when performing warranty and maintenance service and when providing election administration services.

No vulnerabilities were found within the source code reviewed, as a result, no findings were written against the code base.

Findings

Ten discrepancy findings were located within the AFB system.

No potential vulnerabilities were identified within the AFB code base.

Within the AFB code base, all findings were low risk vulnerabilities that would require an in-depth knowledge of the code base and how it operates to be able to successfully subvert the system. To exploit them successfully, it would require modifying the code.

4. Security

Security testing was done at SLI. Testing was implemented without any prior knowledge of the source code.

The testing was divided into three phases.

- Phase I included a review of all pertinent documents for appropriate processes and procedures for implementing a secure system. This included review of the system design and architecture.
- Phase II included testing of relevant software, operating systems and hardware configurations.
- Phase III included testing of all telecommunications aspects of the system.

Phase I

Table 4A: Documentation Review	
Testing Performed	**Results**
5.5 Vote Secrecy on Electronic Ballot Marking (EBM) Systems a. Immediately after the ballot is recorded to persistent electronic storage or printed, erasing the selections from the device's display, working memory, and all other storage, including all forms of temporary storage. b. Immediately after the voter chooses to cancel his or her ballot, erasing the selections from the display and all other storage, including buffers and other temporary storage.	Review of the Technical Data Package (TDP) validated that the requirement was satisfactorily covered.
6.1.2 Data Transmissions These requirements apply to the use of telecommunications to transmit data for the preparation of the system for an election, the execution of an election, and the preservation of the system data and audit trails during and following an election. While this section does not assume a specific model of voting system operations and does not assume a specific model for the use of telecommunications to support such operations, it does address the following types of data, where applicable: - **Voter Authentication**: Coded information that confirms the identity of a voter for security purposes for a system that transmits votes individually. - **Ballot Definition**: Information that describes to a	Review of the Technical Data Package (TDP) validated that the requirement was satisfactorily covered.

voting machine the content and appearance of the ballots to be used in an election. • **Vote Count**: Information representing the tabulation of votes at any level within the control of the jurisdiction, such as the polling place, precinct or central count. **List of Voters**: A listing of the individual voters who have cast ballots in a specific election. Additional data transmissions used to operate a voting system in the conduct of an election, but not explicitly listed above, are also subject to the requirements of this section.	
6.2 Design, Construction, and Maintenance Requirements Design, construction, and maintenance requirements for telecommunications represent the operational capability of both system hardware and software. These capabilities **shall** be considered basic to all data transmissions.	Review of the Technical Data Package (TDP) validated that the requirement was satisfactorily covered.
6.2.1 Confirmation Confirmation occurs when the system notifies the user of the successful or unsuccessful completion of the data transmission, where successful completion is defined as accurate receipt of the transmitted data. To provide confirmation, the telecommunications components of a voting system shall notify the user of the successful or unsuccessful completion of the data transmission. In the event of unsuccessful transmission the user shall be notified of the action to be taken.	Review of the Technical Data Package (TDP) validated that the requirement was satisfactorily covered.
7.1.1 Elements of Security Outside Manufacturers Control The requirements of this section apply to the capabilities of a voting system that must be provided by the manufacturer. However, an effective security program requires well defined security practices by the purchasing jurisdiction and the personnel managing and operating the system. These practices include: • Administrative and management --including access controls.	Review of the Technical Data Package (TDP) validated that the requirement was satisfactorily covered.

• Internal security procedures. • Adherence to, and enforcement of, operational procedures (e.g., effective password management). • Security of physical facilities. • Organizational responsibilities and personnel screening.	
7.2 Access control Access controls are procedures and system capabilities that detect or limit access to system components in order to guard against loss of system integrity, availability, confidentiality, and accountability. Access controls provide reasonable assurance that system resources such as data files, application programs, and computer-related facilities and equipment are protected against unauthorized operation, modification, disclosure, loss or impairment. Unauthorized operations include modification of compiled or interpreted code, run-time alteration of flow control logic or of data, and abstraction of raw or processed voting data in any form other than a standard output report by an authorized operator. Access controls may include physical controls, such as keeping computers in locked rooms to limit physical access, and technical controls, such as security software programs designed to prevent or detect unauthorized access to sensitive files. The access controls described in this section are limited to those controls required to be provided by system manufacturers.	Review of the Technical Data Package (TDP) validated that the requirement was satisfactorily covered.
7.2.1 General Access Control • Voting system equipment **shall** provide access control mechanisms designed to permit authorized access to the voting system and to prevent unauthorized access to the voting system. Access control mechanisms on the EMS **shall** be capable of identifying and authenticating individuals permitted to perform operations on the EMS. • Voting system equipment **shall** provide controls that permit or deny access to the device's software and files. • The default access control permissions **shall**	Review of the Technical Data Package (TDP) validated that the requirement was satisfactorily covered.

implement the minimum permissions needed for each role or group identified by a device. • The voting device **shall** prevent a lower-privileged process from modifying a higher-privileged process. • An administrator of voting system equipment **shall** authorize privileged operations. • Voting system equipment **shall** prevent modification to or tampering with software or firmware through any means other than the documented procedure for software upgrades.	
7.2.2 General Access Control Identification requirements provide controls for accountability when operating and administering a voting system. • The voting system **shall** identify users and processes to which access is granted and the specific functions and data to which each entity holds authorized access.	Review of the Technical Data Package (TDP) validated that the requirement was satisfactorily covered.
7.4.5 Software Reference Information The manufacturer **shall** provide the National Software Reference Library (NSRL), any California certified escrow facility, pursuant to Title 2, Division 7, Chapter 6 of the California Code of Regulation, and the Office of the Secretary of State with a copy of the software installation disk, including the executable binary images of all third party software. Further, the manufacturer **shall** deposit the source code, tools, and documentation, to allow the complete and successful compilation of a system in its production/operation environment. The manufacturer **shall** document that the process used to verify the software distributed on unalterable storage media is the certified software by using the reference information provided by the NSRL or other designated repository before installing the software. The manufacturers **shall** document to whom they provide voting system software.	Review of the Technical Data Package (TDP) validated that the requirement was satisfactorily covered.
7.4.6 Software Setup Validation Setup validation methods **shall** verify the contents of all	Review of the Technical Data Package (TDP)

system storage locations (e.g., system registers, variables, files, etc.) containing election specific information (e.g., ballot style, candidate registers, measure registers, etc.).	validated that the requirement was satisfactorily covered.
7.8 Testing – Security The S-ATA **shall** design and perform test procedures that test the security capabilities of the voting system against the requirements. These procedures **shall** focus on the ability of the system to detect, prevent, log, and recover from the broad range of security risks identified. These procedures **shall** also examine system capabilities and safeguards claimed by the manufacturer in the TDP to go beyond these risks. The range of risks tested is determined by the design of the system and potential exposure to risk. Regardless of system design and risk profile, all systems **shall** be tested for effective access control and physical data security. The S-ATA may meet these testing requirements by confirming proper implementation of proven commercial security software. In this case, the manufacturer must provide the published standards and methods used by the U.S. Government to test and accept this software, or it may provide references to free, publicly available publications of these standards and methods, such as government web sites. At its discretion, the S-ATA may conduct or simulate attacks on the system to confirm the effectiveness of the system's security capabilities.	Review of the Technical Data Package (TDP) validated that the requirement was satisfactorily covered.

Phase II

In this phase, functional tests were exercised in order to verify and validate security requirements, following are the requirements with their accompanying results:

- 5.5 Vote Secrecy on DRE and EBM Systems
- 7.2.1 General Access Control
- 7.2.2 Access Control Identification
- 7.2.4 Access Control Authorization
- 7.4.5 Software Reference Information

- 7.4.6 Software Setup Validation
- 7.6 Telecommunications and Data Transmission
- 7.8 Testing – Security
- 7.8.1 Access Control
- 7.8.2 Data Interception and Disruption

Table 4B: Phase II Functional Security Test		
CVSS Requirement	**Testing Performed**	**Result**
5.5 Vote Secrecy on Electronic Ballot Marking (EBM) Systems • Immediately after the ballot is recorded to persistent electronic storage or printed, erasing the selections from the device's display, working memory, and all other storage, including all forms of temporary storage. • Immediately after the voter chooses to cancel his or her ballot, erasing the selections from the display and all other storage, including buffers and other temporary storage.	Testing was performed to verify how the system handled a ballot being printed and the browser closed, as well as when the ballot is closed prior to being printed. Attempts were made to resume a ballot, as well as to determine if any ballot information resided in history or cache.	AFB performed as expected and the requirement is met.
7.2.1 General Access Control General requirements address the high-level functionality of a voting system. These are the fundamental access control requirements upon which other requirements in this section are based. • Voting system equipment **shall** provide access control mechanisms designed to permit authorized access to the voting system and to prevent unauthorized access to the voting system.	Review of the requirement and attempted validation concludes that the Five Cedars AFB product does not have any built in access control mechanisms. Paradigm used is for the jurisdiction to host ballot files on their voter registration system.	For this particular product and suggested delivery system this requirement is not applicable.
7.2.2 Access Control Identification Identification requirements provide controls for accountability when	Review of the requirement and attempted validation concludes that the Five	For this particular product and suggested

operating and administering a voting system. • The voting system **shall** identify users and processes to which access is granted and the specific functions and data to which each entity holds authorized access.	Cedars AFB product does not have any built in access control identification mechanisms. Paradigm used is for the jurisdiction to host ballot files on their voter registration system.	delivery system this requirement is not applicable.
7.2.4 Access Control Authorization Voting systems **shall** explicitly deny subject's access based on access control lists or policies.	Review of the requirement and attempted validation concludes that the Five Cedars AFB product does not have any built in access control authorization mechanisms. Paradigm used is for the jurisdiction to host ballot files on their voter registration system.	For this particular product and suggested delivery system this requirement is not applicable.
7.4.5 Software Reference Information The voting system equipment **shall** be designed to allow the voting system administrator to verify that the software is the certified software by comparing it to reference information produced by the NSRL or other designated repository.	Review of the requirement and attempted validation concludes that the system does not have checks in place to validate that any software is the certified software, as there is no software involved, simply custom made HTML ballots.	For this particular product and suggested delivery system this requirement is not applicable.
7.4.6 Software Setup Validation • Setup validation methods **shall** include a software verification method that ensures that the voting system software has not been modified illegitimately. o The voting systems **shall**	Review of the requirement and attempted validation concludes that the system doesn't have checks in place to validate that the AFB ballot system is the correct system, as there	N/A

include any supporting software and hardware necessary to conduct the software verification method. ○ The manufacturer **shall** document the process used to conduct the software verification method. ○ The software verification method **shall** not modify the voting system software on the voting system.	is no software involved, simply custom made HTML ballots.	
7.6 Telecommunications and Data Transmission There are four areas that must be addressed by telecommunications and data transmission security capabilities: access control, data integrity, detection and prevention of data interception, and protection against external threats.	Review of the requirement confirmed that the system utilizes electrical or optical transmission, and that the ballot may be sent via SSL or in other unspecified mediums. It was determined that no technology is utilized to verify unaltered receipt by the voter. What is sent/served is a blank ballot that does not contain any voter data or voting selections. Main security protocol is that once the blank ballot is delivered, there are no more communications between the voter and the ballot delivery system, all interactions remain local to the voter's environment.	For this particular product and suggested delivery system this requirement is not applicable.
7.8 Testing Security The S-ATA **shall** design and perform test procedures that test the security capabilities of the voting system against the requirements. These	Confirmed that the AFB HTML ballot doesn't require internet access once the ballot has been downloaded. Confirmed there are no external	AFB performed as expected and the requirement was met.

procedures **shall** focus on the ability of the system to detect, prevent, log, and recover from the broad range of security risks identified. These procedures **shall** also examine system capabilities and safeguards claimed by the manufacturer in the TDP to go beyond these risks. The range of risks tested is determined by the design of the system and potential exposure to risk. Regardless of system design and risk profile, all systems **shall** be tested for effective access control and physical data security. The S-ATA may meet these testing requirements by confirming proper implementation of proven commercial security software. In this case, the manufacturer must provide the published standards and methods used by the U.S. Government to test and accept this software, or it may provide references to free, publicly available publications of these standards and methods, such as government web sites. At its discretion, the S-ATA may conduct or simulate attacks on the system to confirm the effectiveness of the system's security capabilities.	connections from the ballot to any outside server or service. With the exception of printing the Summary there are no external connections from the ballot.	
7.8.1 Access Control For those access control features built in as components of the voting system, the S-ATA **shall** design tests to confirm that these security elements work as specified. Specific activities to be conducted by the S-ATA **shall** include: Specific tests designed by the S-ATA to verify the correct operation of all documented access control	Review of the requirement and attempted validation determined that the Five Cedars AFB product contains no access control capabilities beyond those of which the jurisdiction plans to implement. The requirement for security of the interactive ballots are based upon the already in place	N/A

procedures and capabilities, including tests designed to circumvent controls provided by the manufacturer. These tests **shall** include:	Absentee/Mail-in ballot system and the security of the delivery method (Email, HTTPS, File sharing).	
o Performing the activities that the jurisdiction will perform in specific accordance with the manufacturer's access control policy and procedures to create a secure system, including procedures for software and firmware installation. o Performing tests intended to bypass or otherwise defeat the resulting security environment. These tests **shall** include simulation of attempts to physically destroy components of the voting system in order to validate the correct operation of system redundancy and backup capabilities. This review applies to the full scope of system functionality. It includes functionality for defining the ballot and other pre-voting functions, as well as functions for casting and storing votes, vote canvassing, vote reporting, and maintenance of the system's audit trail.		
7.8.2 Data Interception and Disruption For systems that use telecommunications, as provided for in section 6 of the Standards and consistent with California law, to transmit official voting data, the SATA **shall** review, and conduct tests of, the	Review of the requirement verified that this system does not utilize telecommunications for the transmission of official voting data. Only delivery of blank ballot that does not contain	AFB performed as expected and the requirement was met**.**

data interception and prevention safeguards specified by the manufacturer in its TDP. The S-ATA **shall** evaluate safeguards provided by the manufacturer to ensure their proper operation, including the proper response to the detection of efforts to monitor data or otherwise compromise the system.	voter data or choice selections.	

Phase III

Table 4C: Phase III Telecommunications Testing		
CVSS Requirement	**Testing Performed**	**Result**
6.1.2 Data Transmission These requirements apply to the use of telecommunications to transmit data for the preparation of the system for an election, the execution of an election, and the preservation of the system data and audit trails during and following an election. While this section does not assume a specific model of voting system operations and does not assume a specific model for the use of telecommunications to support such operations, it does address the following types of data, where applicable: **Voter Authentication**: Coded information that confirms the identity of a	This requirement is here because of the transmission of electronic AFB HTML ballots from the jurisdiction to the Voter. As such all of the security associated with these AFB HTML ballots falls to the jurisdictions and their absentee / mail-in voting programs. The AFB HTML ballots does not retain voter vote selections. The AFB HTML ballots does not transmit results or selections to a remote server. The AFB HTML ballots requires no telecommunications to use with the exception of the initial download of the ballot.	AFB performed as expected and the requirement was met.

voter for security purposes for a system that transmits votes individually **Ballot Definition**: Information that describes to a voting machine the content and appearance of the ballots to be used in an election **Vote Count**: Information representing the tabulation of votes at any level within the control of the jurisdiction, such as the polling place, precinct or central count **List of Voters**: A listing of the individual voters who have cast ballots in a specific election. Additional data transmissions used to operate a voting system in the conduct of an election, but not explicitly listed above, are also subject to the requirements of this section.		
6.2 Design, Construction, and Maintenance Requirements Design, construction, and maintenance requirements for telecommunications represent the operational capability of both system	Review of the requirement confirmed that this system consists of an HTML Alternate format ballot which is typically used for absentee and mail in ballot marking. All telecommunications aspects of the system are controlled by state and	AFB performed as expected and the requirement was met.

hardware and software. These capabilities **shall** be considered basic to all data transmissions.	local jurisdiction requirements. AFB HTML ballots do not utilize specific telecommunications channels once the AFB HTML ballots has been downloaded and opened on the voter's machine.	
6.2.1 Confirmation Confirmation occurs when the system notifies the user of the successful or unsuccessful completion of the data transmission, where successful completion is defined as accurate receipt of the transmitted data. To provide confirmation, the telecommunications components of a voting system shall notify the user of the successful or unsuccessful completion of the data transmission. In the event of unsuccessful transmission the user shall be notified of the action to be taken.	This requirement was determined to be not applicable. As the AFB HTML ballots don't transmit votes to a remote system. The Voter is able to fill out the ballot, confirm selections on the ballot and then print the ballot for mail in ballot processing at a remote location For this particular product and suggested delivery system this requirement is not applicable.	

Potential Vulnerabilities

To the extent possible, reported vulnerabilities include an indication of whether the exploitation of the vulnerability would require access by:
- o Voter: Usually has low knowledge of the voting machine design and configuration. Some may have more advanced knowledge. May carry out attacks designed by others. They have access to the machine(s) for less than an hour.

- o Poll worker: Usually has low knowledge of the voting machine design and configuration. Some may have more advanced knowledge. May carry out attacks designed by others. They have access to the machine(s) for up to one week, but all physical security has been put into place before the machines are received.
- o Elections official insider: Wide range of knowledge of the voting machine design and configuration. May have unrestricted access to the machine for long periods of time. Their designated activities include:

  - Set up and pre-election procedures;
  - Election operation;
  - Post-election processing of results; and
  - Archiving and storage operations.

- o Vendor insider: With great knowledge of the voting machine design and configuration. They have unlimited access to the machine before it is delivered to the purchaser and, thereafter, may have unrestricted access when performing warranty and maintenance service, and when providing election administration services.

7.2.1 General Access Control

The AFB system is a replacement ballot delivery method, designed for voters with disabilities to mark and print a CVR. Since AFB doesn't require or utilize internet connectivity during the process of marking the CVR, the risk of the being compromised is negligible unless the main source of the AFB system at the jurisdiction is compromised, which can be addressed through manual processes and procedures.

For the vulnerability in question, the level of access required to take advantage of this potential vulnerability would be inclusive to the following actors:

- Voter, who can attempt to modify the delivered HTML ballot, or attempt to remotely exploit the web server serving the HTML ballot files.
- Election official insider, who could attempt to remotely exploit the web server serving the HTML ballot files.
- Vendor Insider, who could attempt to locally exploit the web server serving the HTML ballot files.

7.4.5 Software Reference Information

Due to the nature of the application it is possible to locally modify the AFB HTML ballot with advanced knowledge of HTML and JavaScript, however the impact is

mitigated by the voter being able to proof the CVR prior to and after printing, and then again before utilizing the jurisdictions already defined vote-by-mail procedures.

For the vulnerability in question, the level of access required to take advantage of this potential vulnerability would be inclusive to the following actors:

- Voter, who can attempt to modify the server code remotely.
- Election official insider, who could attempt to modify the server code remotely.
- Vendor Insider, who could attempt to locally modify the server code.

Findings

The AFB system is designed
for voters with disabilities to mark and print a CVR, which means that once the HTML file is delivered, the entire file/application runs in the current browser session.

Since the AFB doesn't utilize incoming or outgoing connections once the ballot is loaded this reduces the possibility of interception or manipulation through network attack vectors.

This however poses a risk of server side contamination, to help mitigate this the vendor provides high level documentation about the processes/procedures and security to mitigate these risks. Including but not limited to:

- Secure hosting
- Physical security of hosting sites
- Network security
- Inventory and configuration management
- Access control
- Monitoring and logging

For the vulnerability in question, the level of access required to take advantage of this potential vulnerability would be inclusive to the following actors:

- Voter, who could attempt to modify the delivered HTML, or attempt to remotely exploit the web server serving the HTML files.
- Election Official Insider, who could attempt to remotely exploit the web server serving the HTML files.
- Vendor Insider, who could attempt to locally exploit the web server serving the HTML files.

Voter Privacy is ensured by removing client side storage of marked selections, which allows the voter to verify and print a CVR.

The ability to tamper with the client side HTML is always present due to the fact there are no server side verifications or validations in place. In this context however the ability to affect large numbers of ballots is reliant upon server side compromise (initial AFB ballot delivery), and the failure of the Absentee/Mail-in ballot system. The voter is given the ability to proof and confirm selections within the interactive ballot system as well as the paper ballot summary.

For the vulnerability in question, the level of access required to take advantage of this potential vulnerability would be inclusive to the following actors:

- Voter, who could attempt to modify the delivered HTML.

No discrepancy findings were located within the AFB system. Two potential vulnerabilities were identified within the AFB system, as listed in the Potential Vulnerabilities section above.

5. Accessibility

For Accessibility, Usability and Privacy Testing the SOS conducted two phases of End User Usability testing. Additionally, SLI conducted three phases of testing for Accessibility, Usability and Privacy: documentation of usability and accessibility testing performed during system development, functional usability and accessibility testing and privacy testing.

SOS End User Usability Testing

The SOS conducted end user Accessibility testing from July 5 to July 7, 2017. Approximately twenty-four (24) testers participated in the testing. The testers were recruited through several channels including several groups within the accessibility community. Each tester used his/her own technology, including any auxiliary peripheral devices and screen reading software to access, mark, and print their paper cast vote record.

The testers were asked to complete pre and post surveys, documenting such information as demographics, the technology used for testing, and the tester's post-test experience using the system. The survey results of each are included in **Attachment A** of this report. Please note that personally identifying information such as names, email addresses, and telephone have been redacted.

One (1) technical issue was identified, requiring mitigation. A tester using an iMAC computer system, with the Safari 10 browser, experienced the following issue when pressing the "check your ballot for mistakes" and "show my ballot summary page" buttons. The system would not advance to the ballot summary page. Five Cedars implemented a code change to fix the issue. The tester

attempted to use the system again, with success. The issue was marked as resolved.

SLI Accessibility, Usability and PrivacyTesting

The California Voting Systems Standards (CVSS) were written in such a way to be applicable to a wide variety of voting technology. Therefore, the relevant portions of the CVSS are reviewed as they relate to the Remote Accessible Vote by Mail (RAVBM) for purposes of this report. The use of "voting system" shall apply to RAVBM.

Testing was divided into three phases.

- Phase I includes review of all pertinent documents as an inspection of the manufacturer's documentation of usability and accessibility testing performed during system development.
- Phase II includes all Usability and Accessibility testing.
- Phase III includes Privacy testing. This testing will verify California Election Code specific requirements,

    o The RAVBM shall not have the capability, including an optional capability, to use a remote server to mark a voter's selections transmitted to the server from the voter's computer via the Internet. [EC19295(a)]
    o The RAVBM shall not have the capability, including an optional capability, to store any voter identifiable selections on any remote server. [EC19295(b)]
    o The RAVBM shall not have the capability, including the optional capability, to tabulate votes. [EC19295(c)]

Phase I

In this phase, documentation was reviewed to verify and validate the following:

- Review of the manufacturer's documentation of usability and accessibility testing performed during system development.

Review of the Technical Data Package (TDP) validated that the requirement was satisfactorily covered.

Phase II

In this phase, functional tests were exercised in order to verify and validate the requirements noted in the following sections. The tools listed below were utilized during testing in Phase II.

Table 5A : Consultant Tools		
Tool Name	**Tool Purpose**	**Tool Use**
Wave Web Accessibility evaluation tool	Tool to evaluate accessibility of web sites, to WCAG 2.0 and Section 508.	The vendor provided url's were run through MAUVE to help determine accessibility.
A11y.css	Tool to evaluate web application regarding conformance to ISO 9241-171: Ergonomics of human-system interaction Guidance on software accessibility.	The vendor provided url's were run with A11y to help determine compliance.
Evaluera website	Tool to evaluate web applications regarding conformance to WCAG 2.0 standards.	The vendor provided url's were run through 508 checker to help determine compliance.
Chromevox – Screen reader extension of Google Chrome.	Tool is a screen reader that is an extension of Google Chrome, to assist visually impaired users.	Screen reader used for Accessibility and Usability testing.

Usability

Usability:

- The test lab **shall** report all the effectiveness metrics for usability as defined and measured by the Voting Performance Protocol (VPP).
- The test lab **shall** report the average voting session time, as measured by the VPP. Note that this requirement does not apply to the audio interface of a system or to the use of special input devices for voters with dexterity disabilities.
- The test lab **shall** report the average voter confidence, as measured by the VPP.

SLI evaluated AFB against Section 3.2 *et al* of the CVSS. This section covers the requirements for Usability of a system. SLI found that the vast majority of the requirements were satisfactorily met. AFB failed on three (3) of the requirements. Each is listed in the table along with a response/mitigation:

Table 5B: Usability Testing		
CVSS Requirement	**Result**	**Mitigation/Response**
CVSS (3.2.7.c.ii) No repeating keys - No key or control on a voting system **shall** have a repetitive effect as a result of being	AFB does not meet this requirement.	None

held in its active position.		
CVSS (3.2.8.e): Voter Inactivity Time	AFB does not meet this requirement.	AFB cannot regulate a voter's inactivity, voting session time, or place any other time restraints on a voter using the system. The system concludes the session once the voter retrieves the ballot. Thus, there is no longer any communication with the system to place a time restriction of any sort on the voter.
CVSS (3.2.8.f): Alert Time – Upon expiration of the voter inactivity time, the voting system shall issue an alert and provide a means by which the voter may receive additional time. The alert time shall be between 20 and 45 seconds. If the voter does not respond to the alert within the alert time, the system shall go into an inactive state.	AFB does not meet this requirement.	

Accessibility

SLI evaluated AFB against the applicable portions of the CVSS for Accessibility Testing for compliance. The table below shows each of the applicable CVSS sections, and the result of compliance.

Table 5C: Accessibility Testing	
CVSS Requirement	**Result**
CVSS (3.3.1.a.i.1): Accessibility throughout the voting session - A VEBD shall be integrated into the manufacturer's complete voting system so as to support accessibility for disabled voters throughout the voting session. Documentation of Accessibility Procedures - The manufacturer shall supply documentation describing: recommended procedures that fully implement accessibility for voters with disabilities; and CVSS (3.3.1.a.i.2): How a VEBD supports those procedures.	Review of the requirement validated that the requirement was satisfactorily covered.
CVSS (3.3.1.b) : Complete information	Review of the requirement validated

in alternative formats - When the provision of accessibility involves an alternative format for ballot presentation, then all information presented to non-disabled voters, including instructions, warnings, error and other messages, and contest choices, shall be presented in that alternative format	that the requirement was satisfactorily covered.
CVSS (3.3.1.d): Secondary means of voter identification - If a voting system provides for voter identification or authentication by using biometric measures that require a voter to possess particular biological characteristics, then the system shall provide a secondary means that does not depend on those characteristics.	Review of the requirement showed that no biometric measures are required, so this requirement is not applicable.
CVSS (3.3.1.e.i): Accessibility of paper-based vote verification - If a VEBD generates a paper record (or some other durable, human-readable record) for the purpose of allowing voters to verify their votes, then the system shall provide a means to ensure that the verification record is accessible to all voters with disabilities. i. Audio readback for paper-based vote verification - If a VEBD generates a paper record (or some other durable, human-readable record) for the purpose of allowing voters to verify their votes, then the system shall provide a mechanism that can read that record and generate an audio representation of its contents.	Review of the requirement validated that the requirement was not applicable, as a voter will implement their own hardware. If a voter has equipment that utilizes either OCR technology, or a QR reader with audio playback, then they would be able to obtain an audio read back of their printed ballot.
CVSS (3.3.2.c): Distinctive buttons and controls - Buttons and controls on accessible voting stations shall be distinguishable by both shape and color. This applies to buttons and controls implemented either "on-screen" or in hardware. This requirement does not apply to sizeable groups of keys, such as a conventional 4x3 telephone keypad or a full alphabetic keyboard.	Review of the requirement validated that the requirement was not applicable, as a voter will implement their own hardware.
CVSS (3.3.2.d): Synchronized audio	Review of the requirement validated

and video - The voting station shall provide synchronized audio output to convey the same information as that which is displayed on the screen. There shall be a means by which the voter can disable either the audio or the video output, resulting in a video-only or audio-only presentation, respectively. The system shall allow the voter to switch among the three modes (synchronized audio/video, video-only, or audio-only) throughout the voting session while preserving the current votes.	that the requirement was not applicable, as a voter will implement their own hardware. Synchronized audio/video, video-only, or audio only are all obtainable. If voter environment contains a screen, audio output and a screen reader, synchronized output is available. Voter can turn off audio to have video only. Likewise voter can turn off video display to have Audio only.
CVSS (3.3.3.b.1): Audio-tactile interface - The accessible voting station shall provide an audio-tactile interface (ATI) that supports the full functionality of the visual ballot interface. Full functionality includes at a minimum: o Instructions and feedback on initial activation of the ballot (such as insertion of a smart card), if applicable; CVSS (3.3.3.b.2): Instructions and feedback to the voter on how to operate the accessible voting station, including settings and options (e.g., volume control, repetition); CVSS (3.3.3.b.3): Instructions and feedback for navigation of the ballot; CVSS (3.3.3.b.4): Instructions and feedback for contest choices, including write-in candidates; CVSS (3.3.3.b.5): Instructions and feedback on confirming and changing votes; CVSS (3.3.3.b.6): Instructions and feedback on final submission of ballot.	Review of the requirements validated that these requirements were not applicable, as voter will implement their own hardware.
CVSS (3.3.3.c.vii): Audio features and	Review of the requirements validated

characteristics - Voting stations that provide audio presentation of the ballot shall do so in a usable way, as detailed in the following sub-requirements. iv. Intelligible audio - The audio presentation of verbal information by both recorded and synthetic speech shall be readily comprehensible by voters who have normal hearing and are proficient in the language. This includes such characteristics as proper enunciation, normal intonation, appropriate rate of speech, and low background noise. Candidate names shall be pronounced as the candidate intends. This requirement applies to those aspects of the audio content that are inherent to the voting system or that are generated by default.	that these requirements were not applicable, as voter will implement their own hardware.
CVSS (3.3.3.d): Ballot activation - If the voting station supports ballot activation for nonblind voters, then it shall also provide features that enable voters who are blind to perform this activation.	Review of the requirement validated that the requirement was satisfactorily covered.
CVSS (3.3.4.b): Support for non-manual input - The accessible voting station shall provide a mechanism to enable non-manual input that is functionally equivalent to tactile input. All the functionality of the accessible voting station (e.g., straight party voting, write-in candidates) that is available through the conventional forms of input, such as tactile, shall also be available through non-manual input mechanisms such as mouth sticks and "sip and puff" switches.	Review of the requirements validated that these requirements were not applicable, as a voter will implement their own hardware.
CVSS (3.3.6.a): Reference to audio requirements - The accessible voting station shall incorporate the features listed under the requirements for voting equipment that provides audio presentation of the ballot.	Review of the requirements validated that these requirements were not applicable, as voter will implement their own hardware.
CVSS (3.3.6.b): Visual redundancy for	Review of the requirement validated

sound cues - If the voting system provides sound cues as a method to alert the voter, the tone shall be accompanied by a visual cue, unless the station is in audio-only mode.	that the requirement was satisfactorily covered.
CVSS (3.3.7): Use of ATI- For voters who lack proficiency in reading English, the voting equipment shall provide an audio interface for instructions and ballots.	Review of the requirements validated that this requirement was not applicable, as a voter will implement their own hardware.
CVSS (3.3.8): Speech not to be required by equipment - Voting equipment shall not require voter speech for its operation.	Review of the requirement validated that the requirement was satisfactorily covered.

Phase III

SLI evaluated AFB, for compliance with California Elections Code (EC) requirements for privacy within an RAVBM system, in addition to the applicable portions of the CVSS. The table below shows each of the applicable code sections and CVSS sections, and the result of compliance.

Table 5D: Privacy Testing	
Applicable California Elections Code Section & CVSS Requirement	**Result**
EC Section 19295(a): The RAVBM shall not have the capability, including an optional capability, to use a remote server to mark a voter's selections transmitted to the server from the voter's computer via the Internet.	Review of the requirement validated that the requirement was satisfactorily covered.
EC Section 19295 (b): The RAVBM shall not have the capability, including an optional capability, to store any voter identifiable selections on any remote server.	Review of the requirement validated that the requirement was satisfactorily covered.
EC Section 19295(c): The RAVBM shall not have the capability, including the optional capability, to tabulate votes.	Review of the requirement validated that the requirement was satisfactorily covered.
CVSS (3.2.4.1.a): Visual privacy - The ballot, any other visible record containing ballot information, and any input controls shall be visible only to the voter during the voting session and ballot submission.	Review of the requirement validated that the requirement was satisfactorily covered, as the voter will utilize their own hardware in the environment of their choosing.
CVSS (3.2.4.1.b): Auditory privacy -	Review of the requirement validated

During the voting session, the audio interface of the voting system shall be audible only to the voter.	that the requirement was satisfactorily covered, as the voter will utilize their own hardware in the environment of their choosing.
CVSS (3.2.4.1.c): Privacy of warnings - The voting system shall issue all warnings in a way that preserves the privacy of the voter and the confidentiality of the ballot.	Review of the requirement validated that the requirement was satisfactorily covered, as the voter will utilize their own hardware in the environment of their choosing.
CVSS (3.2.4.1.d): No receipts - The voting system shall not issue a receipt to the voter that would provide proof to another of how the voter voted.	Review of the requirements validated that this requirement was not applicable, as voter will implement their own hardware, and print their own marked ballot, as a RAVBMS system.
CVSS (3.2.4.2.a): No information shall be kept within an electronic CVR that identifies any alternative language feature(s) used by a voter.	Review of the requirement validated that the requirement was satisfactorily covered, as CVR's are not created.
CVSS (3.2.4.2.b): No information shall be kept within an electronic CVR that identifies any accessibility feature(s) used by a voter.	Review of the requirement validated that the requirement was satisfactorily covered, as CVR's are not created.

Findings

The AFB application is an HTML 5 SPA (Single Page Application), which means that once the initial server call for the application is processed the entire application runs in the current browser session.

Voter privacy is achieved by removing client side storage of marked selections, the voter is allowed to verify and print a ballot summary card for use in currently setup jurisdiction absentee /mail in voting programs.

The system was written to WCAG 2.0 guidelines to implement accessibility features.

Usability was generally met, with the exception of repetitive keys.
The voter is given the ability to proof and confirm ballot selections within the AFB interactive ballot system as well as the paper ballot summary.

One discrepancy finding was determined within the Five Cedars AFB RAVBMS. That of the repetitive key, that when a key is pressed, if held, the action is repeated multiple times. The other two discrepancies found are not applicable, as a voter's session time cannot be regulated.

IV. COMPLIANCE WITH STATE AND FEDERAL LAWS

1. **Elections Code Review**

§19293 (b) Remote accessible vote by mail system standards adopted by the Secretary of State pursuant to subdivision (a) shall include, but not be limited to, all of the following requirements:

> (1) The machine or device and its software shall be suitable for the purpose for which it is intended.
> (2) The remote accessible vote by mail system shall preserve the secrecy of the ballot.
> (3) The remote accessible vote by mail system shall be safe from fraud or manipulation.
> (4) The remote accessible vote by mail system shall be accessible to voters with disabilities and to voters who require assistance in a language other than English if the language is one in which a ballot or ballot materials are required to be made available to voters.

The system meets these requirements. Review of the requirement showed that English, Spanish, Hindi, Khmer, Korean, Tagalog, Thai, Vietnamese and Chinese are supported, however with external translation services, the system can support other languages as required.

§19295 A remote accessible vote by mail system or part of a remote accessible vote by mail system shall do not any of the following:

> (a) Have the capability, including an optional capability, to use a remote server to mark a voter's selections transmitted to the server from the voter's computer via the Internet.
> (b) Have the capability, including an optional capability, to store any voter identifiable selections on any remote server.
> (c) Have the capability, including the optional capability, to tabulate votes.

The system meets these requirements.

2. **Section 508 and WCAG Compliance Review**

AFB was written to WCAG 2.0 guidelines to implement accessibility features. The system also complies with the applicable portions of Section 508.

V. **CONCLUSION**

The Five Cedars Group AFB Remote Accessible Vote by Mail system, in the configuration tested and documented by the California Installation meets all applicable California and federal laws.

Attachment A

Q1 Name

Answered: 14   Sk pped: 0

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█	█████			█████████

███ 19

Five Cedars Alternate Ballot Format 1.0 Pre-Test Survey

Q2 Age

Answered: 14   Sk pped: 0

#	RESPONSES	DATE
1	55	7/9/2017 8:48 PM
2	66	7/7/2017 9:37 AM
3	65	7/6/2017 10:54 AM
4	53	7/5/2017 5:07 PM
5	64	7/5/2017 4:46 PM
6	69	7/5/2017 2:58 PM
7	65	7/5/2017 2:20 PM
8	51	7/5/2017 1:42 PM
9	45	7/5/2017 1:36 PM
10	72	7/5/2017 11:54 AM
11	63	7/5/2017 10:59 AM
12	53	7/5/2017 10:57 AM
13	57	7/5/2017 10:49 AM
14	46	7/5/2017 9:40 AM

Q3 Phone

Answered: 14   Sk pped: 0

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Q4 Email

Answered: 14   Sk pped: 0

Q5 Please describe the disabilities or difficulties you have that may interfere with you being able to mark a ballot privately and independently.

Answered: 13   Skipped: 1

#	RESPONSES	DATE
1	B nd	7/9/2017 8:50 PM
2	I am tota y b nd.	7/7/2017 9:39 AM
3	I am tota y b nd and requ re a systemwh ch a ows the se ect ons to be read and the ab ty to check a box e ectron ca y.	7/6/2017 10:57 AM
4	I have a cogn t ve d sab ty that requ res someone to support me n the vot ng process. I am perfect y capab e of mak ng my own dec s ons on what to vote on the ba ot. But, the vot ng process (as t s r ght now) s too comp ex for me to do t a by myse f.	7/5/2017 5:13 PM
5	I have Cerebra Pa sy and cannot wr te or hand e paper	7/5/2017 4:49 PM
6	Tota y b nd	7/5/2017 3:12 PM
7	Tota y b nd.	7/5/2017 2:23 PM
8	none	7/5/2017 1:44 PM
9	I am b nd.	7/5/2017 11:56 AM
10	I susta ned a severe c osed TBI wh ch eft me w th severe Atax a and other ssues. My Atax a makes t neear mposs b e to mark a ba ot as I shake so bad y.	7/5/2017 11:02 AM
11	Tota y b nd	7/5/2017 11:01 AM
12	I am a most tota y b nd and cannot read pr nt.	7/5/2017 10:51 AM
13	I have Cerebra Pa sy, wh ch causes a s gn f cant oss of f ne motor sk s and mpa red speech. I cannot phys ca y wr te we enough to mark a paper ba ot.	7/5/2017 9:48 AM

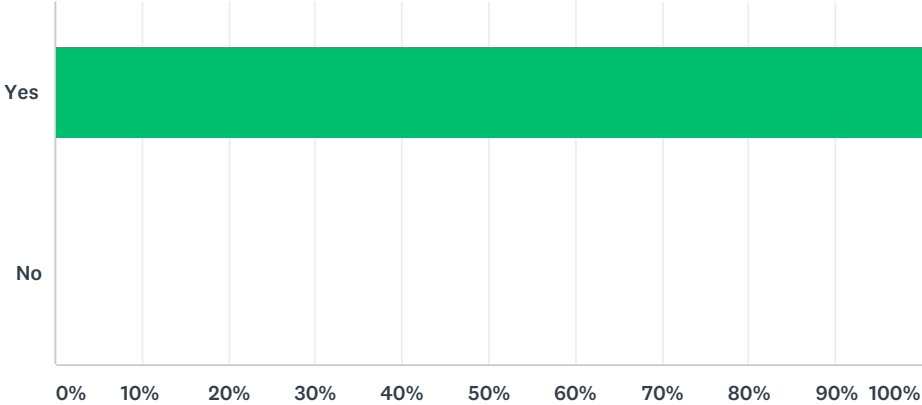# Q6 Which language would you prefer voting in ?

Answered: 12   Sk pped: 2
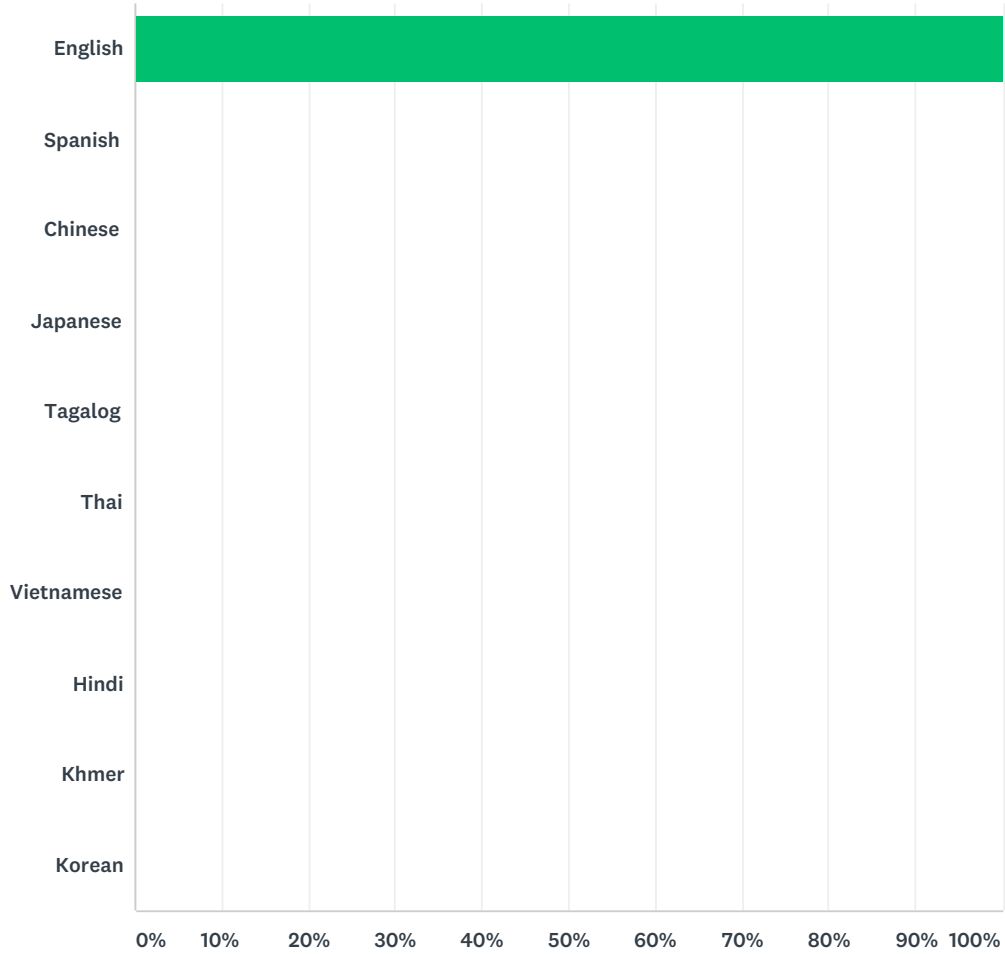
ANSWER CHOICES	RESPONSES	
Eng sh	100.00%	12
Span sh	0.00%	0
Ch nese	0.00%	0
Japanese	0.00%	0
Taga og	0.00%	0
Tha	0.00%	0
V etnamese	0.00%	0
H nd	0.00%	0
Khmer	0.00%	0
Korean	0.00%	0
TOTAL		12

#	OTHER (PLEASE SPECIFY)	DATE
	There are no responses.	

#	OTHER (PLEASE SPECIFY)	DATE

Q7 Have you ever voted before?

Answered: 13   Sk pped: 1

ANSWER CHOICES	RESPONSES	
Yes	100.00%	13
No	0.00%	0
TOTAL		13

Q8 If "No", what has prevented you from voting in the past?

Answered: 0   Sk pped: 14

#	RESPONSES	DATE
	There are no responses.	

Q9 What method of voting do you use most often?

Answered: 12   Sk pped: 2
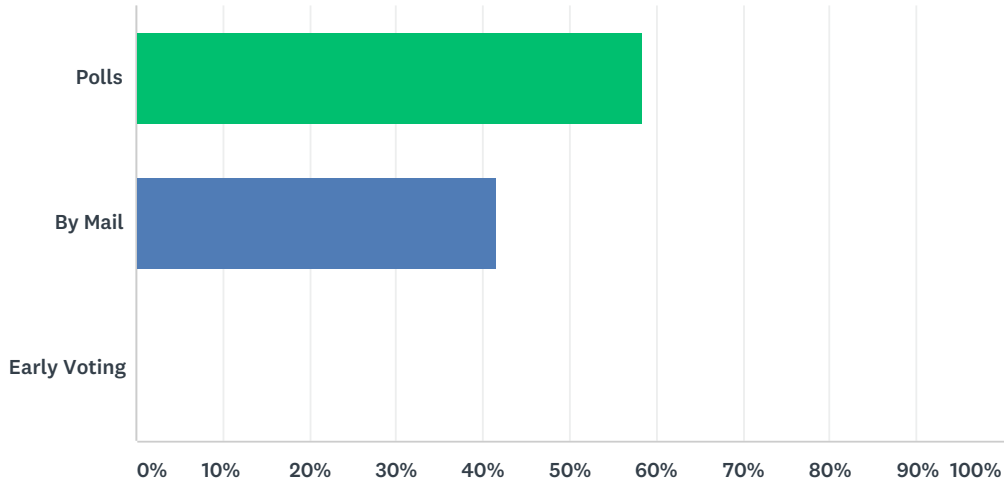
ANSWER CHOICES	RESPONSES	
Po s	58.33%	7
By Ma	41.67%	5
Ear y Vot ng	0.00%	0
TOTAL		12

#	OTHER (PLEASE SPECIFY)	DATE
1	I request and rece ve ba ot by ma then return comp eted to the po	7/5/2017 1:44 PM
2	Automark	7/5/2017 11:02 AM

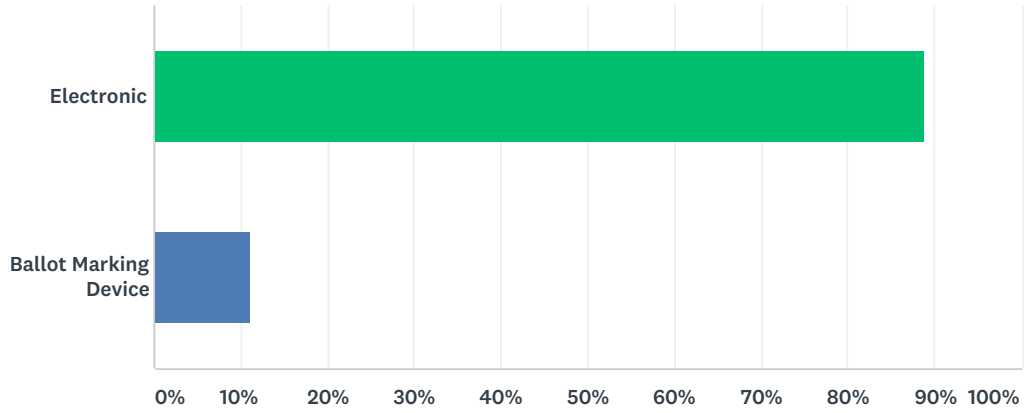# Q10 Have you ever used a voting system with any special accessibility accommodations?

Answered: 14   Sk pped: 0
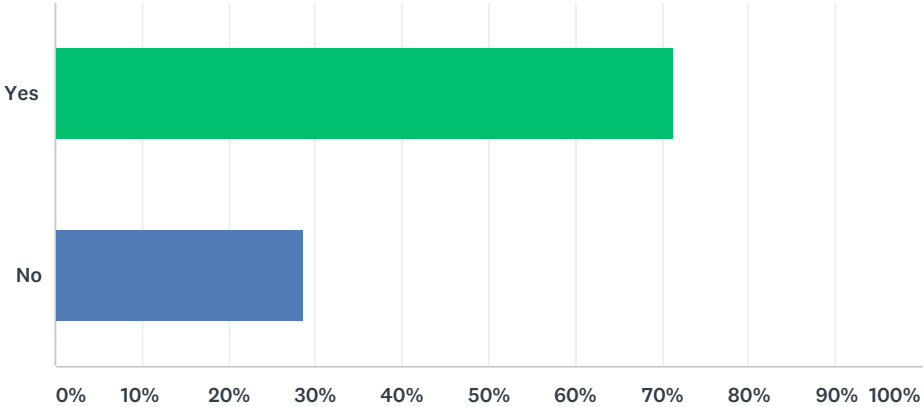
ANSWER CHOICES	RESPONSES	
Yes	71.43%	10
No	28.57%	4
TOTAL		14

Q11 If "Yes", which type of voting system?

Answered: 9   Sk pped: 5

ANSWER CHOICES	RESPONSES	
E ectron c	88.89%	8
Ba ot Mark ng Dev ce	11.11%	1
TOTAL		9

#	OTHER (PLEASE SPECIFY)	DATE
1	DRE, ABMD, VBM, VBP, OBM, and VotePad.	7/5/2017 3:12 PM

Q12 What operating system are you using?

Answered: 14   Sk pped: 0
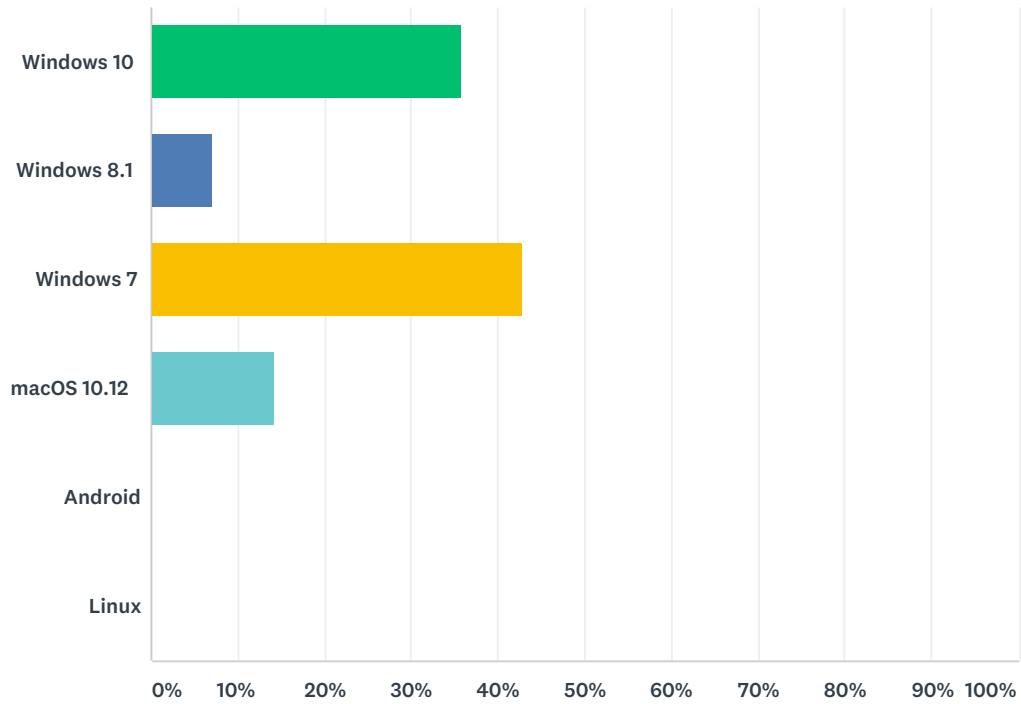
ANSWER CHOICES	RESPONSES	
W ndows 10	35.71%	5
W ndows 8.1	7.14%	1
W ndows 7	42.86%	6
macOS 10.12	14.29%	2
Andro d	0.00%	0
L nux	0.00%	0
TOTAL		14

#	OTHER (PLEASE SPECIFY)	DATE
1	Home prem um Ed.	7/5/2017 1:45 PM

Q13 What internet browser are you using?

Answered: 13   Sk pped: 1
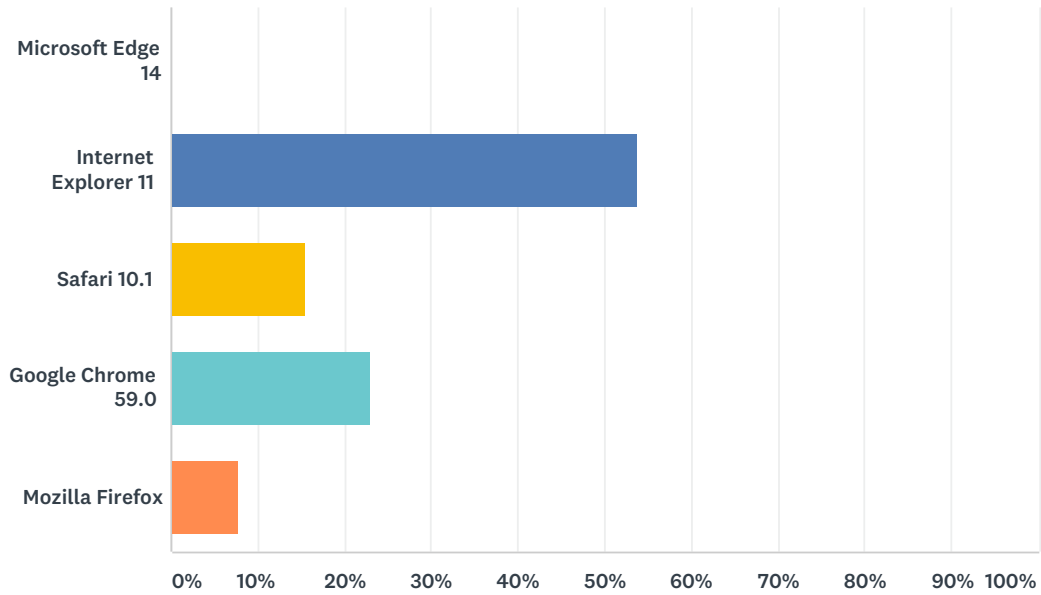
ANSWER CHOICES	RESPONSES	
M crosoft Edge 14	0.00%	0
Internet Exp orer 11	53.85%	7
Safar 10.1	15.38%	2
Goog e Chrome 59.0	23.08%	3
Moz a F refox	7.69%	1
TOTAL		13

#	OTHER (PLEASE SPECIFY)	DATE
1	IE, F refox, Chrome.	7/5/2017 2:26 PM

Q14 List the auxiliary devices and/or software you are using for electronic accessibility.

Answered: 9   Sk pped: 5
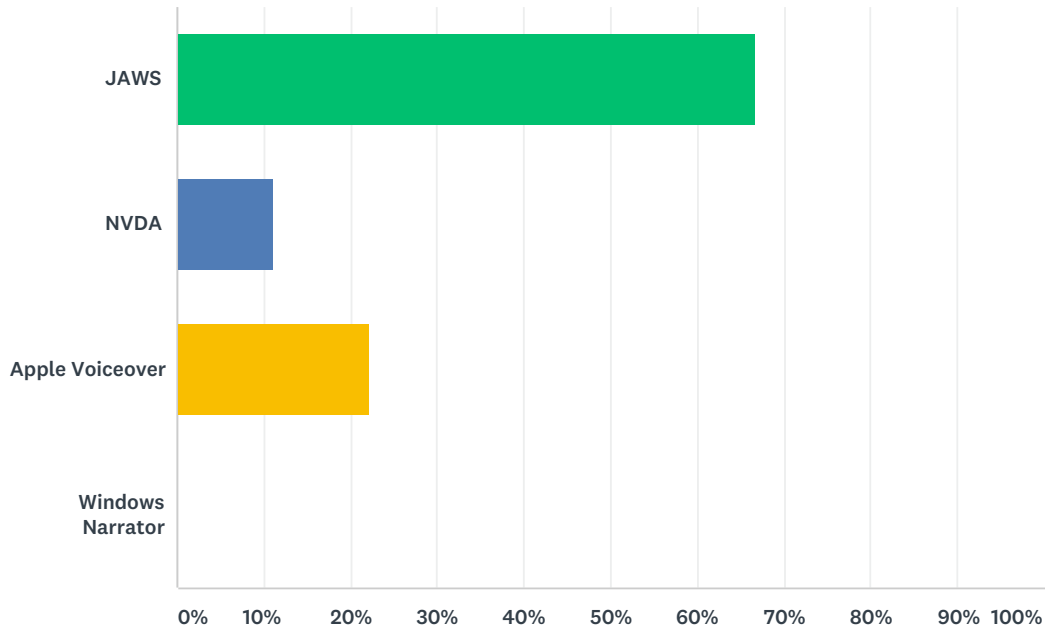
ANSWER CHOICES	RESPONSES	
JAWS	66.67%	6
NVDA	11.11%	1
App e Vo ceover	22.22%	2
W ndows Narrator	0.00%	0
TOTAL		9

#	OTHER (PLEASE SPECIFY)	DATE
1	Act vewords and MS mouse-keys	7/5/2017 4:53 PM
2	W ndow-Eyes	7/5/2017 3:38 PM
3	Openbook OCR scann ng software.	7/5/2017 2:26 PM
4	Can use W ndow-Eyes as 2ndary test, but t s now defunked.	7/5/2017 1:45 PM
5	None	7/5/2017 11:05 AM
6	The "mouse keys," "f ter keys" and "st cky keys" opt ons ava ab e under "Ease of Access" n the W ndows 7 (and 10) Contro Pane .	7/5/2017 9:57 AM

Q15 What is the make and model of the hardware you are using (PC, Laptop, Tablet, etc.)?

Answered: 14   Sk pped: 0

#	RESPONSES	DATE
1	App e MacBook Pro	7/9/2017 8:56 PM
2	W ndows Pc sony v o	7/7/2017 9:43 AM
3	Th s s a De desktop PC.	7/6/2017 11:00 AM
4	Mac 21.5 nch m d 2014	7/5/2017 5:17 PM
5	PC	7/5/2017 4:53 PM
6	Gener c PC desktop	7/5/2017 3:38 PM
7	Asus Mode : X555YA-DB84Q	7/5/2017 2:26 PM
8	de A-6 INSPIRON 15 3000 ser es aptop AMD processor	7/5/2017 1:46 PM
9	De Opt -p ex 755 (pc)	7/5/2017 1:45 PM
10	MSI GT60	7/5/2017 12:04 PM
11	Unknown (at the brary)	7/5/2017 11:05 AM
12	Custom PC	7/5/2017 11:03 AM
13	Laptop	7/5/2017 10:53 AM
14	PC	7/5/2017 9:57 AM

Q16 What is the printer make and model you are using?

Answered: 14   Sk pped: 0

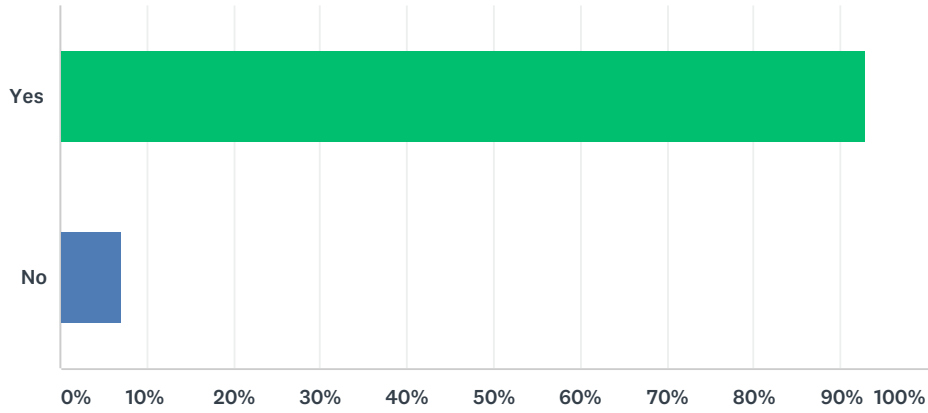| #	RESPONSES	DATE
1	Brother MFD	7/9/2017 8:56 PM
2	hp azar jet pr nter	7/7/2017 9:43 AM
3	and a so a Canoscan Cannon scanner.	7/6/2017 11:00 AM
4	HP Envy 4500	7/5/2017 5:17 PM
5	N/A	7/5/2017 4:53 PM
6	Canon MX920	7/5/2017 3:38 PM
7	None.	7/5/2017 2:26 PM
8	HP desk jet 2600 ser es	7/5/2017 1:46 PM
9	I own none. W prov de t fs of comp eted ba ots	7/5/2017 1:45 PM
10	my company's combo pr nter	7/5/2017 12:04 PM
11	Unknown (at the brary)	7/5/2017 11:05 AM
12	HP 2050	7/5/2017 11:03 AM
13	do not know	7/5/2017 10:53 AM
14	HP Laserjet 3011	7/5/2017 9:57 AM

Q17 What antivirus software are you using?

Answered: 7   Sk pped: 7
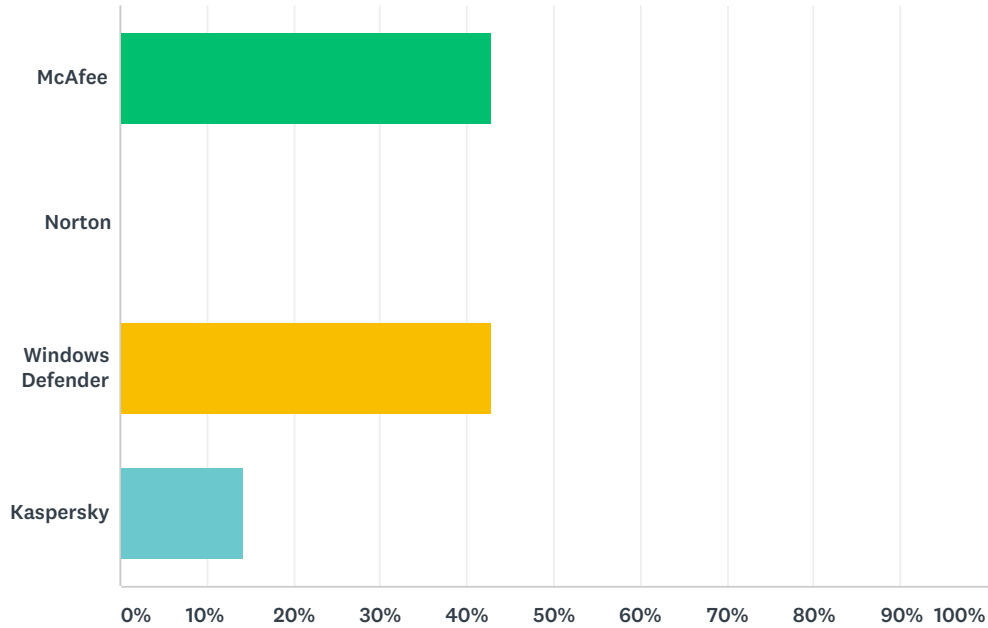
ANSWER CHOICES	RESPONSES	
McAfee	42.86%	3
Norton	0.00%	0
W ndows Defender	42.86%	3
Kaspersky	14.29%	1
TOTAL		7

#	OTHER (PLEASE SPECIFY)	DATE
1	Don't know	7/9/2017 8:56 PM
2	M crosoft secur ty essent a s	7/7/2017 9:43 AM
3	M crosoft Essent a s	7/6/2017 11:00 AM
4	M croSoft	7/5/2017 3:38 PM
5	Ma ware Bytes.	7/5/2017 2:26 PM
6	M crosoft Sec. Essent a s (/W nDefender?)	7/5/2017 1:45 PM
7	System Center Endpo nt Protect on, Ma warebytes and	7/5/2017 12:04 PM
8	Unknown (at the brary)	7/5/2017 11:05 AM
9	eSet NOD32	7/5/2017 11:03 AM

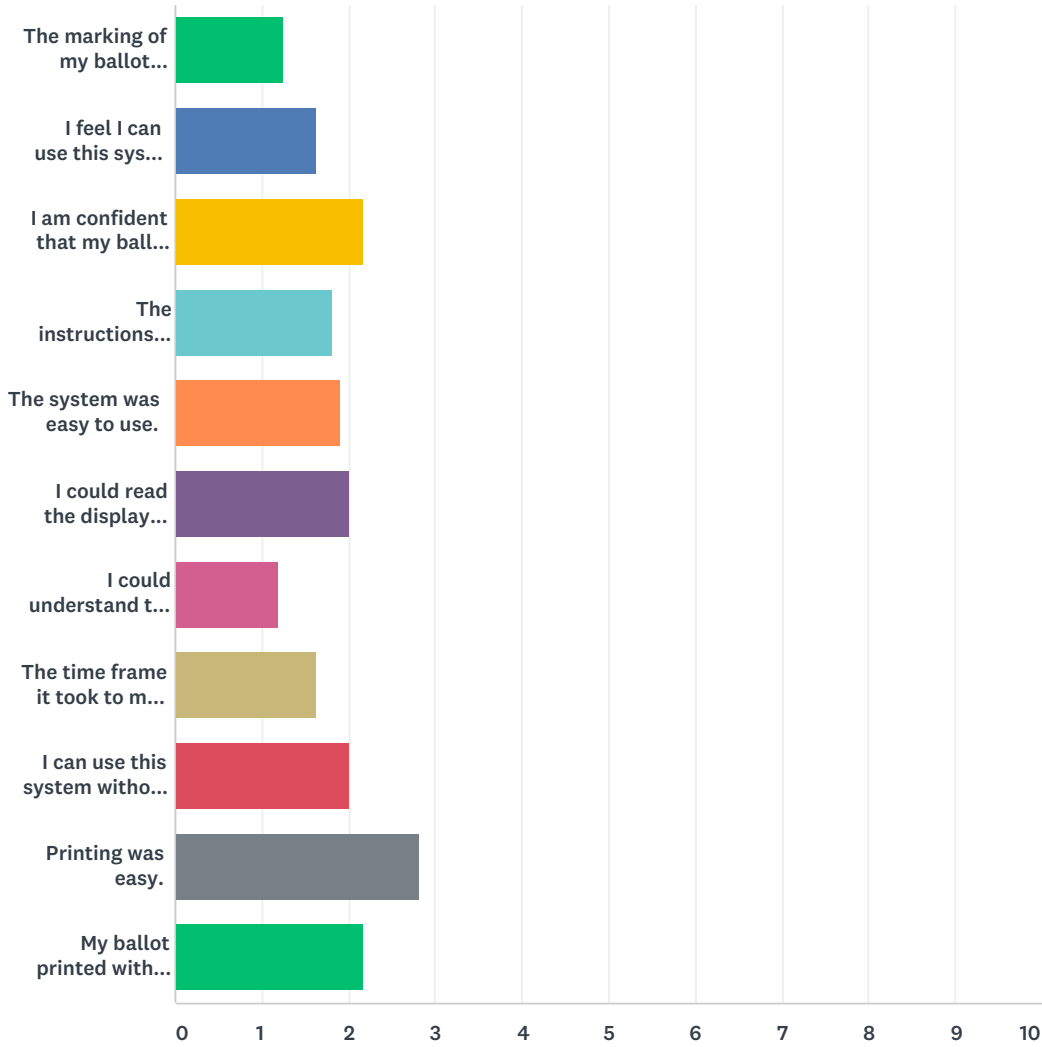# Q18 Is your antivirus software up to date?

Answered: 14   Sk pped: 0

ANSWER CHOICES	RESPONSES	
Yes	92.86%	13
No	7.14%	1
TOTAL		14

Q1 For each question, please indicate how strongly you agree or disagree with the statement.
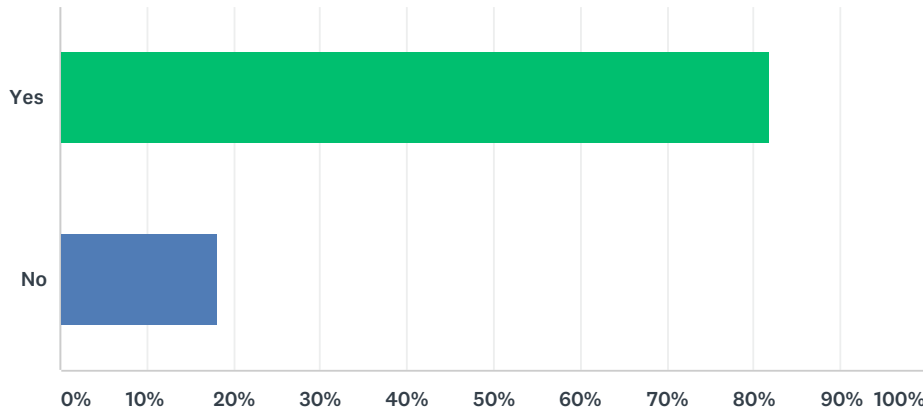
Answered: 12   Skipped: 0

	AGREE STRONGLY	AGREE SOMEWHAT	NEUTRAL	DISAGREE SOMEWHAT	DISAGREE STRONGLY	TOTAL	WEIGHTED AVERAGE
The marking of my ballot method was private.	75.00% 9	25.00% 3	0.00% 0	0.00% 0	0.00% 0	12	1.25
I feel I can use this system to mark my ballot independently.	72.73% 8	9.09% 1	9.09% 1	0.00% 0	9.09% 1	11	1.64
I am confident that my ballot was recorded accurately.	63.64% 7	0.00% 0	0.00% 0	27.27% 3	9.09% 1	11	2.18
The instructions were clear and complete.	54.55% 6	27.27% 3	9.09% 1	0.00% 0	9.09% 1	11	1.82
The system was easy to use.	54.55% 6	27.27% 3	0.00% 0	9.09% 1	9.09% 1	11	1.91
I could read the display easily.(If applicable)	55.56% 5	0.00% 0	33.33% 3	11.11% 1	0.00% 0	9	2.00

1 / 7

I could understand the speech output. (If applicable)	80.00% 8	20.00% 2	0.00% 0	0.00% 0	0.00% 0	10	1.20
The time frame it took to mark my ballot was what I expected.	63.64% 7	27.27% 3	0.00% 0	0.00% 0	9.09% 1	11	1.64
I can use this system without technical help.	63.64% 7	9.09% 1	0.00% 0	18.18% 2	9.09% 1	11	2.00
Printing was easy.	27.27% 3	18.18% 2	18.18% 2	18.18% 2	18.18% 2	11	2.82
My ballot printed with the correct selections.	45.45% 5	18.18% 2	18.18% 2	9.09% 1	9.09% 1	11	2.18

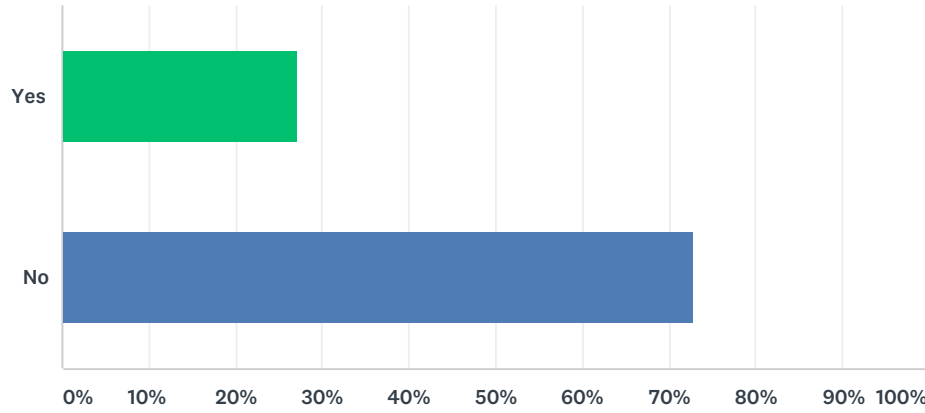# Q2 Would you be satisfied using this system to mark your ballot in an election?

Answered: 11   Skipped: 1

ANSWER CHOICES	RESPONSES	
Yes	81.82%	9
No	18.18%	2
TOTAL		11

Q3 Would you rather mark your ballot using another method?

Answered: 11   Skipped: 1

ANSWER CHOICES	RESPONSES	
Yes	27.27%	3
No	72.73%	8
TOTAL		11

Q4 If you prefer another method, what method would you prefer?

Answered: 5   Skipped: 7

#	RESPONSES	DATE
1	LA County BMD	7/18/2017 9:40 PM
2	I would prefer a ballot which printed all on one page. Marking the ballot was easy, but scanning it after printing it was not so simple. Keeping the pages in order required other software such as Open Book 9.0. The ideal situation would be to actually transmit the ballot and print a receipt as proof, if necessary.	7/7/2017 7:35 PM
3	I sometimes use absentee ballots and someone to help me mark the items.	7/7/2017 1:18 PM
4	Electronic voting at polling place. Marked neutral for visibility of display question, since I am totally blind and do not have a screen physiccally connected to my computer. Recommend an "NA" choice be added to such a question, since that would be a more accurate statement. Marked "disagree somewhat" for the speech component because there were occasional typos in ballot/glitches in web coding that made me have to look at some things more closely to figure out what was going on, but my speech synth has very clear audio. Also recommend "NA" option here for those who do not use/need speech access. I imagine that if this were a real ballot, such glitches and typos would be fixed, but must not assume this for purposes of testing. I could not verify accuracy of .tif ballot, so marked neutral wich also should have been "NA". I am in VERY STRONG disagreement with ANY kind of vbm system that REQUIRES printed ballots, signed envelopes or other documentationthat MUST be relegated to the ancient methods of quill and parchment (ink on paper). Though marking would be private and independent, sighted assistance would be REQUIRED to complete the task of actuating the mailing, which renders such systems unusable. Since I can neither read nor write print without either technological or human intervention, I will not participate in programs or systems that propagate the enforcement of such arcane measures, which means *heavy sigh* I'll probably never be able to vote by mail. Though I know that electronic voting machines at polling places spit out print scrolls (receipts or something), I have the poll workers take them directly. Those pages shut me out (can neither read nor verify their physical content independently), so I don't work with them. This means that people who can't physically read, write or manipulate print will never actually be able to be a part of this important voting alternative until such barbaric rules as paper proof are removed from it. *heavy sigh* Very disappointing. That makes the act of voting more difficult than it has to be, wich will prevent some from participating and make others have to fight even harder to make it possible for pwd to get out and vote. This means that some important voices from our community are silenced. We should make vbm truly accessible for ALL CALIFORNIANS, not just those with access to print. Voting can be rigged whether paper is present or not. We have seen this, have we not?	7/7/2017 12:40 PM
5	So far, Democracy live is better.	7/7/2017 9:37 AM

Q5 Do you have any suggestions for changes on this system and/or any other comments you would like to provide?

Answered: 11   Skipped: 1

#	RESPONSES	DATE
1	Yes, and I will send them to the Sec. of State in an Email report.	7/18/2017 9:40 PM
2	I had no problems with this system.	7/9/2017 10:22 PM
3	In general, your system is superb, very easy to navigate, and highly accessible. My only suggestion is to expand a bit your instructions on "printing" the ballot. What the user wants to do is to save as PDF the ballot, and attach that to an email. This is what the system ends up doing, but the general user would be confused, thinking that printing and mailing a hard copy ballot is the only option. I can help write or review any such amended instructions; contact me at ttford@gmail.com	7/8/2017 10:17 AM
4	The write-in option should be available for all candidates. So far, Democracy live seemed to have the easiest system to print and scan into email.	7/7/2017 7:35 PM
5	This basic system was easy enough to use. I'd only suggest that the final printed ballot come out as one page very like what happens at the pole.	7/7/2017 7:20 PM
6	I really like the option of seeing either the whole ballot or one race at a time. I tried using both methods, and I think both were good. I can imagine that going one race at a time would help voters with certain disabilities a great deal.	7/7/2017 6:32 PM
7	No, I was quite happy.	7/7/2017 1:18 PM
8	See above. *rueful smile* should have looked at all questions befor deciding where to put the long rant.	7/7/2017 12:40 PM
9	When I was trying this voting system, I had gotten to the bottom of my ballot. There were three buttons there. One button wanted to check the ballot for mistakes (which I pushed with my mouse) and it refused to work for me! The other button at the end of ballot that refused to work (even though I pressed it up to 20 times) was the button to get to the ballot summary page (that I had to get to for the SoS to make a PDF of the ballot summary page to then email to the SoS). i am not entirely sure that my votes were accurately recorded by the SoS because of the fact I couldn't get to my ballot summary page. I do like this voting system very much. But, the SoS has to overcome the technical difficulties of such a voting system. The only button on bottom of the ballot that was indeed working was the button to take you back up to the beginning of the ballot. I pushed that button several times (to test it) and each time it immediately took me to the beginning of the ballot. I personally feel that this particular voting system is worth pursuing because it can be a great help to people with disabilities exercise their right as US citizens to vote in local, state, and national elections. Just overcome the technical difficulties in administrating the voting system. FYI: I was using an iMac with Safari 10 when I ran into my technical difficulties with the new voting system.	7/7/2017 12:03 PM
10	Again, voter should be required to enter address manually. Less confusing chatter and explanations: for instance, having a link for ballot and one for mark your ballot, puzzling. For the Presidential race, checkboxes were not announced. If I make an error like over-voting, I shouldn't have to hunt and up-arrow to the error message. Jaws routinely did not work properly after I entered a write-in candidate. When I'd try to return to the page, Jaws said, "end of ballot" even though it wasn't. I had to restart Jaws in order to read with arrow keys again. I also found it confusing being presented with "show ballot" and "check for mistakes". Simpler if I simply can review ballot and then hit "back if I find any mistakes. Clunky. The Laguna Beach city council race choices were incorrectly recorded.	7/7/2017 9:37 AM

| 11 | Overall I am quite impressed with the quality of the online voting interface. The markup and error handling messages are excellent. The two areas in which enhancement could be considered are the registration and supplemental information. Since this was a demonstration I do not expect the interaction leading to the ballot is necessarily reflective of the experience for a live ballot because I would like to see more verification and display of voter registration information. For the ballot itself, there are frequently cases where more information is desired about candidates and measures so it would be helpful to provide access to this information either through links to the supplemental resources or through buttons that toggle the display of such information on the page under each item. Also, as I recall, there was a question in my mind when starting the ballot what shortcut keys would apply for quick navigation and selection. So perhaps there could be a reference to this sort of information for JAWS users and other assistive software or devices? | 7/7/2017 9:26 AM |