



**FREEMAN, CRAFT, MCGREGOR GROUP**

**California Secretary of State  
Consultant's Report on:**

**Accessibility Testing of the  
ES&S EVS 5.2.1.0 Voting System**

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of State by:

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## Revision history

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1.2	2017-07-09	Craft and McGregor	Revision after client review
1.3	2017-08-22	Craft and McGregor	Changes after additional client review

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## Summary of System Components

The Election Systems & Software (ES&S) EVS 5.2.1.0 Voting System Elections voting system submitted for certification testing consisted of the following major components:

### Software Modules:

- Election Management System (EMS), comprised of
  - Electionware, Version 4.7.1.0
  - Event Log Service, Version 1.5.5.0
  - Removable Media Service, Version 1.4.5.0
  - Election Reporting Manager, Version 8.12.1.0
  - Voter Assist Terminal (VAT) Previewer, Version 1.8.6.0
  - ExpressVote Previewer, Version 1.4.1.0

### Hardware Components:

- DS200 Precinct Tabulator, Hardware Version 1.3, Software/Firmware 2.12.2.0
- DS850 Central Tabulator, Hardware Version 1.0, Software/Firmware 2.10.1.0
- AutoMARK VAT, Hardware Versions 1.0, 1.1, 1.3 and 1.31 Software/Firmware 1.8.6.0
- ExpressVote, Hardware Version 1.0, Software/Firmware 1.4.1.0

The specific equipment used in this test was:

- Test Machine #1, AutoMARK VAT, Hardware Version 1.31  
Serial Number AM0208490407
- Test Machine #2, ExpressVote, Hardware Version 1.0  
Serial Number EV0115360738
- Test Machine #3, AutoMARK VAT, Hardware Version 1.3  
Serial Number AM0206461961
- Test Machine #4, ExpressVote, Hardware Version 1.0  
Serial Number EV0115412608

## Scope of Work and Reporting

This report covers work done to assist the California Secretary of State (SOS) with Accessibility Testing for the AutoMARK ballot marking device and the ExpressVote vote capture device.

We are not attorneys and do not offer legal advice. We have assisted the SOS with collecting facts and evidence in order for them to make certification decisions. However, to advise the SOS on the determination of whether the system complies with California's certification requirements would require an interpretation of law. Accordingly we do not provide recommendations or any opinion as to whether the system can be certified.

The work we performed and our findings are strictly limited to the specific serial numbered hardware elements and specific software elements exercised during this test. An inventory of those items is included in the earlier section entitled "Summary of System Components." The results described in this report should be reliable and repeatable for those specific items. The decision to apply those results to decisions regarding other items is solely at the discretion and risk of the Secretary of State and election officials who purchase the system. Although the descriptions of the components can be used as part of a baseline to reach conclusions regarding the compliance of other items, anyone who wishes to determine the compliance of purchased systems or the compliance of a system already in use should conduct appropriate acceptance testing or system validation analysis to support those conclusions.

## Description of System Submitted for Certification

ES&S EVS 5.2.1.0 is a voting system that utilizes paper ballots. Voters can mark their ballots manually using a pen or pencil. The system includes precinct scanner tabulators (DS200) and central count scanners (DS850). The system also includes two ballot-marking devices, the AutoMARK and the ExpressVote. Each of these devices has a touchscreen, keypad, audio ballot and headphones. They can also work with a variety of other voter interface devices including a sip and puff switch and large binary switches. The AutoMARK presents voters with the option to select candidates and propositions using a touch screen or through an audio ballot. After the voter makes their selections, it marks their choices on a paper ballot. The ExpressVote provides the same voting function, but it prints out the voter's selections in readable type and bar codes on a paper cast vote record. Both devices allow a voter to scan a marked ballot and verify their selections. They display the voter's selections on the touch screen and read them through the audio output. Both the marked ballots and the cast vote records can be scanned and tabulated on a DS200 or DS850.

## Approach to Testing

This part of the certification test involved voters with a variety of disabilities. They were asked to vote test ballots on each machine while a tester observed their voting session. After the voting was complete, the tester conducted a structured interview regarding their voting experience, their opinions and any recommendations they may have for future improvements.

## Scope Limitations

Due to a very small pool of volunteers, their experience and interests, this test had severe scope limitations. Only six individuals participated in the test. Two volunteers identified their impairment as visual, three said that they had mobility and dexterity impairments and one chose not to disclose a disability. Individuals with other disabilities did not test the system. Most of the volunteers appeared to have an interest in, and some experience with, accessible interfaces for voting. Some of them voted very quickly. Others explored the functions within the audio and video ballots and exercised the system thoroughly rather than attempting to vote efficiently. In these instances, the time it took the volunteers to cast their ballots does not reflect the amount of time an average voter would require and cannot be used to evaluate the usability of the system. Finally, the ballot selected for the test was very short. It was a two-page ballot with five candidate contests and one question. During the AutoMARK portion of the test, voters were only given the first page of the ballot. When the ExpressVote was exercised, voters were presented with all six choices. The sip and puff interface was not exercised.

## Detailed Reporting on the Phases of Testing

The volunteer test voters were observed as they exercised the AutoMARK and the ExpressVote. As voters completed voting on each machine, a structured interview regarding their experience with the device was conducted. This section contains summaries of the observations and information collected during those interviews. There is a transcription of each set of observations and interviews located in Attachment A, the "Accessibility Test Records."

Each voter was asked to select one of five responses to a statement regarding their experience on the devices. The structured responses were Agree Strongly, Agree Somewhat, Disagree Somewhat, Disagree Strongly and Not Applicable or No Opinion.

The following is a summary of the voters' responses to each:

Statement 1. "The voting method was private."

When asked about the AutoMARK, three voters responded "Agree Strongly" and three responded "Agree Somewhat." Of those voters with visual impairment, one responded "Agree Strongly" and one responded "Agree Somewhat." Among the voters with mobility or dexterity impairments, two responded "Agree Strongly" and one responded "Agree Somewhat." The voter who chose not to disclose their impairment responded "Agree Somewhat."

Regarding the ExpressVote, five voters answered "Agree Strongly" and one "Disagree Somewhat." Both voters with visual impairment responded by saying "Agree Strongly." Of those voters with mobility or dexterity impairments, two replied "Agree Strongly" and one responded "Disagree Somewhat." The voter with undisclosed impairments responded "Agree Strongly." The voter who disagreed somewhat had both mobility and dexterity impairments. The voter tried the keypad and large binary switches but found the touchscreen easiest to use. The angle and height of the screen were adjusted, but none of the adjustments worked for them. In order for them to reach the screen, the privacy shroud had to be removed. They said that, in order to use the ExpressVote easily, it would have to be set up on a table with a privacy screen rather than on the kiosk.

Statement 2. "I feel I can use this system to vote independently."

After voting on the AutoMARK, five voters said that they "Agree Strongly" and one responded with "Agree Somewhat." Both volunteers with visual impairment responded "Agree Strongly." Of the volunteers with mobility or dexterity disabilities, two answered "Agree Strongly" and one "Agree Somewhat." The voter with undisclosed impairments responded "Agree Strongly."

With regard to the ExpressVote, four voters replied, "Agree Strongly," one "Agree Somewhat" and one "Disagree Somewhat." The voters with visual impairment both answered with "Agree Strongly." Among the voters with mobility or dexterity impairments, two responded "Agree Strongly" and one "Disagree Somewhat." The volunteer with undisclosed impairments responded, "Agree Somewhat." The voter who responded with "Disagree Somewhat" is the same voter who had difficulty with the privacy screen on the AutoMARK.

Statement 3. "I am confident that my vote was recorded accurately."

Among the responses for the AutoMARK, four voters answered "Agree Strongly," one said "Agree Somewhat" and one responded "No Opinion." The voters with visual impairment were divided on this question. One responded "Agree Strongly" and one responded "No Opinion."

Of those voters with mobility or dexterity impairments, two answered “Agree Strongly” and one “Agree Somewhat.” The voter with undisclosed impairments answered “Agree Strongly.”

After using the ExpressVote, five voters responded with “Agree Strongly” and one responded “No Opinion.” The voters with visual impairment responded “Agree Strongly” and “No Opinion.” All three of the voters with mobility or dexterity impairments responded “Agree Strongly.” The voter with undisclosed impairments also responded “Agree Strongly.”

Statement 4. “The voting instructions were clear and complete.”

All but one of the volunteers said “Agree Strongly” to this statement regarding the AutoMARK. The remaining volunteer responded “Disagree Somewhat.” Both voters with visual impairment said they “Agree Strongly.” Among the voters with mobility or dexterity impairments, two responded “Agree Strongly” and one “Disagree Somewhat.” The voter with undisclosed impairments also answered “Agree Strongly.”

After voting on the ExpressVote, three voters responded, “Agree Strongly,” two “Agree Somewhat” and one “No Opinion.” Both voters with visual impairment answered “Agree Strongly.” Among the voters with mobility or dexterity impairments, one responded “Agree Strongly,” one “Agree Somewhat” and one had “No Opinion.” The voter with undisclosed impairments answered “Agree Strongly.” The voter who had no opinion on this subject skipped the instructions.

Statement 5. “The voting method was easy to use.”

When they completed voting on the AutoMARK, four voters said “Agree Strongly” and two “Agree Somewhat.” Both voters with visual impairment responded with “Agree Strongly.” Among the voters with mobility or dexterity impairments, one replied “Agree Strongly” and two “Agree Somewhat.” The voter with undisclosed impairments answered “Agree Strongly.”

After using the ExpressVote, four voters answered, “Agree Strongly,” one “Disagree Somewhat” and one “Disagree Strongly.” Both voters with visual impairment answered “Agree Strongly.” Among the voters with mobility or dexterity impairments, one responded, “Agree Strongly,” one “Disagree Somewhat” and one “Disagree Strongly.” The voter with undisclosed impairments also responded “Agree Strongly.”

Statement 6. “I could read the display easily.”



For voting on the AutoMARK, two voters responded “Agree Strongly,” one responded “Agree Somewhat” and three responded “Not Applicable.” The voters with visual impairment responded “Not Applicable.” Among the voters with mobility or dexterity impairments, two answered “Agree Strongly” and one “Agree Somewhat.” The voter with undisclosed impairments said it was “Not Applicable.”

Volunteers were evenly divided on the ExpressVote. Three said “Agree Strongly” and three “Not Applicable.” The voters with visual impairments both answered “Not Applicable.” All three of the voters with mobility or dexterity impairments, responded “Agree Strongly.” The voter with undisclosed impairments also found this statement “Not Applicable.”

Statement 7. “I could understand the speech output.”

On the AutoMARK, three voters answered, “Agree Strongly,” one “Agree Somewhat” and two “Not Applicable.” One voter with visual impairment responded “Agree Strongly” and one “Agree Somewhat.” Among the voters with mobility or dexterity impairments, one responded with “Agree Strongly” and two “Not Applicable.” The voter with undisclosed impairments also responded “Agree Strongly.”

After they completed exercising the ExpressVote, two voters answered, “Agree Strongly,” two “Agree Somewhat” and two “Not Applicable.” One of the voters with visual impairment responded “Agree Strongly” and the other “Agree Somewhat.” Of those voters with mobility or dexterity impairments, one responded “Agree Strongly” and two “Not Applicable.” The voter with undisclosed impairments answered “Agree Somewhat.”

Statement 8. “The assistive device(s) were easy to reach and use.”

After voting on the AutoMARK was completed, three voters responded with “Agree Strongly,” one “Agree Somewhat,” one “Disagree Somewhat” and one “No Opinion.” Among the voters with visual impairment, one said “Agree Strongly” and one “Agree Somewhat.” One voter with mobility or dexterity impairments responded, “Agree Strongly,” one “Disagree Somewhat” and one “No Opinion.” The voter with undisclosed impairments also responded “Agree Strongly.”

On the ExpressVote, four voters answered with “Agree Strongly” and two “Disagree Somewhat.” Both voters with visual impairment replied “Agree Strongly.” Among voters with mobility or dexterity impairments, one responded “Agree Strongly” and two responded “Disagree Somewhat.” The voter with undisclosed impairments responded “Agree Strongly.”

Statement 9. "I found the system confusing to use."

Regarding the AutoMARK, two voters answered "Disagree Somewhat" and four "Disagree Strongly." The voters with visual impairment, both responded with "Disagree Strongly." Of those volunteers with mobility or dexterity impairments, two answered "Disagree Somewhat" and one "Disagree Strongly." The voter with undisclosed impairments responded "Disagree Strongly."

When asked this question after using the ExpressVote, two voters said "Agree Somewhat," one "Disagree Somewhat" and three "Disagree Strongly." Both voters with visual impairment answered "Disagree Strongly." Among the voters with mobility or dexterity impairments, two responded "Agree Somewhat" and one responded "Disagree Strongly." The voter with undisclosed impairments responded "Disagree Somewhat."

Statement 10. "The timeframe it took to vote was what I expected."

With regard to the AutoMARK, four voters responded, "Agree Strongly," one "Disagree Somewhat" and one "No Opinion." One voter with visual impairment responded with "Agree Strongly" and one "No Opinion." All of the voters with mobility or dexterity impairments answered "Agree Strongly." The voter with undisclosed impairments said "Disagree Somewhat."

When they finished with the ExpressVote, two voters responded "Agree Strongly," two "Agree Somewhat," one "Disagree Somewhat" and one "No Opinion." Of the voters with visual impairment, one replied "Agree Strongly" and one "No Opinion." Of those with mobility or dexterity impairments, one answered "Agree Strongly" and two "Agree Somewhat." The response of the voter with undisclosed impairments was "Disagree Somewhat."

After they finished exercising each machine, the volunteers were asked: "Would you be satisfied using this system to vote in an election or would you rather vote using another method? If you prefer another method, what method would you prefer?"

Responses from AutoMARK voters included:

No Opinion.

Yes. Preferred the AutoMARK to the ExpressVote.

I like the ExpressVote better.

Both of these systems have their problems. The AutoMARK is easier for me to use because the Keypad is fixed.

I have voted on this model for years.

This is the one I used in the last election. It's fine.

Responses from ExpressVote voters included:

No preference. I have always used absentee ballots with assistance. If there were a lot of propositions there would be a long time waiting on the AutoMARK to read through it.

Quite happy using this one.

I would use it

I would prefer to use the Edge, the new Los Angeles system, the most recent Dominion system and any of the Remote Accessible Vote by Mail systems.

Satisfied. It was easier than the AutoMARK. The AutoMARK was easier than other methods.

I guess it would be all right. I don't know of another method that I would like.

Each voter was also asked: "Do you have any suggestions for changes on this system and/or any other comments you would like to provide?"

Responses from AutoMARK voters included:

Larger Braille. Protection for sharp edge on privacy shield including color tape with contrasting colors to mark the edge. A separate room for each machine. Poll workers may need training on where to direct people and where the ballot box is located.

Character Recognition (Spelling it out) for Candidate Names. (Text to speech for write-in candidate names)

I had difficulty reaching the keypad. The voter preferred the keypad on the ExpressVote, which they could hold in their hands.

There should be more pronounced bumps for braille.

I require help to remove the ballot. I get a lot of complaints about paper jams.

The AutoMARK gives me a sense of empowerment, and allows me to vote with a sense of privacy.

The write-in process (with the keypad) is ridiculous. There should be a way to let you move around the keyboard grid.

The keypad should be movable. For me, it would be better on the left side but it is nice that it is stationary.

Responses from ExpressVote voters included:

A tape of propositions should be available as part of the instructions.

Voting machines should be in separate rooms to control noise.

On the audio ballot write-in use words to associate with each letter such as a, alpha, b, bravo, I would like the write-in to read back the name. Perhaps spell the name back to you and on a double click read the name.

Pitch and tempo should be adjusted by separate controls.

It needs to be set up on a table with a privacy screen around it. There needs to be a ledge on the lower right where the accessible keypad can sit. It needs more options for angle and height.

Write-ins are not easy or intuitive. It is difficult to scroll all the way through the alphabet. Polling places need small tables to support the keypads. The two-button switch seemed unnatural. It would take forever to use it. The pointer stick on touch screen is easier.

The sensitivity of the touch screen is pretty good. Someone who was weaker might not be able to use it. It's usually the other way around. (Laughed)

The selection area (on the ExpressVote) was easier to hit than the smaller target on the AutoMARK.

Express Vote has more potential if they make it more adjustable and if they add a way to make the keypad fixed. And do something so that if someone has a write-in it doesn't take a half hour to write it in.

The hand held keyboard needs to be taken off a stretch cord. (Note: The voter did not like holding against the constant pull of the stretch cord.)

The instructions were not on the screens and the instructions for pressing next and previous do not match the labels on the keypad.

## **AutoMARK Findings**

Overall, the volunteers were of the opinion that the AutoMARK would let them vote privately and independently.

Five volunteers were confident that their votes were recorded accurately. One visually impaired voter remarked that they had no way to know what was printed on the ballot. This volunteer declined to use the machine to scan and read back the choices from their marked ballot.

Five volunteers felt that the instructions were clear and complete, but one did not. That voter found that the on-screen instructions prompting them to press "next" and "previous" did not match the labels for the keys on the keypad.

All of the volunteers said that the AutoMARK was easy to use.

The three volunteers who used the video display agreed that it was easy to read. The four who exercised the audio ballot said that the speech output was understandable.

Four of the volunteers concluded that the assistive devices on the AutoMARK were easy to reach and use. The two that did not were the same ones who found the ExpressVote not easy to use. In each of these instances, the volunteers had difficulty using the system due to their particular physical conditions. None of the volunteers attempted to use the large binary switches or the sip and puff interface.

All six volunteers disagreed with the statement “I found the system confusing to use.”

Four volunteers said that the time it took to vote on the AutoMARK was as they expected. One of the two who disagreed with the statement said that it was actually faster than they expected.

Voters who attempted to vote for a write-in selection using the keypad were displeased with the need to cycle through the entire alphabet to select each letter. They also found it difficult to verify their write-in input with the audio ballot.

## **ExpressVote Findings**

All but one volunteer were of the opinion that the ExpressVote would let them vote privately and independently. The volunteer who did not, based their opinion on their inability to reach the touch screen while the privacy shroud was in place and the fact that they needed someone to hold the keypad for them. They believed that poll workers would have to be available to assist them if they used the ExpressVote.

Five volunteers were confident that their votes were recorded accurately. One visually impaired voter pointed out that they had no way to know what was printed on the ballot. This volunteer declined to use the ExpressVote to scan and read back the choices from their marked ballot.

Five volunteers felt that the instructions were clear and complete. One said “No Opinion.” This volunteer skipped the instructions.

Four of the volunteers indicated that the ExpressVote was easy to use. One volunteer who did not was the same volunteer who had difficulties with the privacy and independence statements noted above. The other found it difficult to hold the keypad against the tension of the stretch cord.

The three volunteers who used the video display agreed that it was easy to read. Each of the four who exercised the audio ballot said that the speech output was understandable.

Four of the volunteers concluded that the assistive devices were easy to reach and use. The two that did not had difficulty using the system due to their particular physical conditions. One of these two attempted to use the large binary switches but quickly abandoned them. None of the volunteers exercised the sip and puff interface.

Four volunteers disagreed with the statement “I found the system confusing to use.” Two volunteers said they “agreed somewhat” that the ExpressVote was confusing to use.

Four volunteers said that the time it took to vote was as they expected. One of the two who disagreed with the statement said that it was faster than they expected.

Voters who attempted to vote for a write-in selection using the keypad were displeased with the need to cycle through the entire alphabet to select each letter. They also found it difficult to verify their write-in input with the audio ballot.

## **Overall Findings**

Based upon the responses of the volunteers, they were generally positive about voting on either the AutoMARK or the ExpressVote. Only one voter expressed a strong preference for other accessible voting systems.

Even with the limited pool of volunteers and types of disabilities, the tests clearly show that the usability of the systems and their accessible interfaces will vary from one voter to another depending upon their specific condition and their experience with accessible interfaces.

Within the scope limitations of these tests, all voters were able to successfully mark their test ballots. If they were provided with equipment to facilitate privacy in a polling place and poll workers trained to provide assistance, all six could have cast a ballot with the requisite privacy and independence.