DOMINION VOTING SYSTEMS
DEMOCRACY SUITE 5.10A

System Components
Election Management System: Software version 5.10.50.83
ImageCast Evolution: Software version 5.10.10.3
ImageCast Central: Software version 5.10.2.0001
ImageCast X: Software version 5.10.12.4
Adjudication: Software version 5.10.50.10
ImageCast Precinct 2: Software version 5.10.5.1
Mobile Ballot Production: Software version 5.10.50.83
ImageCast Voter Activation: Software version 5.10.50.83

Staff Report

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Secretary of State's Office of
Voting Systems Technology Assessment
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I. INTRODUCTION

1. Scope

The purpose of this report is to present the test results for the updated version of the Dominion Voting Systems Democracy Suite (DS) 5.10 voting system, now referred to as DS5.10A. The purpose of testing is to verify functionality of performance enhancements, bug fixes, additional languages added to the system to comply with California Elections Code section 14201 language requirements, and added jurisdictional specific reports. Support for the following languages was added to the system: Indonesian, Laotian, Mien, Urdu, Bengali, Burmese, Gujarati, Hindi, Thai, Mongolian, Nepali, Tamil, and Telegu. A new California report export package was added to the system which includes corrections to various calculations in the District Canvas and Election Summary reports, changes to the Election Night Export report to include the precinct reporting flag, and changes to California auto-reporting templates.

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. The procedures for mitigating any additional findings are made to the documentation, specifically the California Use Procedures.

2. Summary of the Application

Dominion submitted an application for the DS 5.10A voting system, which is comprised of the following major components:

- Election Management System: Software version 5.10.50.83
- ImageCast Evolution: Software version 5.10.10.3
- ImageCast Central: Software version 5.10.2.0001
- ImageCast X: Software version 5.10.12.4
- Adjudication: Software version 5.10.50.10
- ImageCast Precinct 2: Software version 5.10.5.1
- Mobile Ballot Production: Software version 5.10.50.83
- ImageCast Voter Activation: Software version 5.10.50.83
- Canon G1130 V1 1.33
- Canon G1130 V2 2.02
- Canon G2140 1.23
- ImageCast HiPro 1.2.2.1
- Oki C712 Printer
- Oki M402dne Printer

Testing was accomplished utilizing the DS5.10 voting system hardware already at the California Secretary of State's office. The DS5.10A testing was accomplished using the exact same hardware that was certified for DS5.10, except the IntraScan scanner that was replaced at the start of testing. Pro V&V, a Federally Certified Voting Systems Test

Laboratory reviewed the source code, and then supplied the trusted build of the DS5.10A voting system. Dominion was also required to provide the California Use Procedures for the DS5.10A system.

II. SUMMARY OF THE SYSTEM

The DS 5.10A computers represented in this system are all operating on Microsoft Windows 10 systems that were patched current at the time the trusted build was created by Pro V&V for the functional testing. Currently, Microsoft is scheduling Extended Support for Windows 10 until October 14, 2025. Microsoft is currently scheduling Extended Support for Server 2016 until January 1, 2027.

The network protocol used in the DS5.10A is Transmission Control Protocol/Internet Protocol (TCP/IP) using Dynamic Host Configuration Protocol (DHCP) for addressing. The DHCP service runs on both Election Event Designer (EED) and Results Tally Reporting (RTR) servers. Domain Name Service (DNS) is used for address resolution and runs on both servers. Unused ports are closed on all machines, and services that are not needed are disabled. The system is setup in a client server configuration, with all election data stored on the servers. This facilitates backups, and the server drives are encrypted. The Election Management System (EMS) and RTR servers utilize Dell Self Encrypting Drive (SED) Technology. These drives are provisioned with a key at installation time, and the EMS database files are stored under the encrypted disk drives. The encryption platform utilizes a National Institute of Standards and Technology (NIST) certified hardware-based cryptographic engine which provides real-time encryption and decryption of data using AES-256 algorithms. In addition, the encrypted storage platforms provide the access control through using iButton security keys.

The default storage configuration on the servers is two drives in a RAID 1 (Disk Mirroring) configuration for the operating system, and four drives in a RAID 10 (mirroring and striping) configuration for data storage.

The system does not include modems, or telecommunications devices, and there is no provision for accessing external networks. No failover/redundant configuration was tested, however, the servers each run both EED and RTR providing redundancy.

The Democracy Suite 5.10A voting system consists of eight major components.

1. Election Management System (EMS), v. 5.10.50.83

EMS is a set of the following applications that are responsible for pre-voting and post-voting activities, including ballot layout, generation of audio files, programming media for voting equipment, importing results data, and accumulating and reporting results.

a) EMS-Election Data Translator (EDT), v. 5.10.50.83

EDT is an application that imports and exports election data, such as districts, precincts, contests, candidates, translations, etc., to and from the election project (a.k.a. election definition).

b) EMS-Election Event Designer (EED), v. 5.10.50.83
EED is an application that handles most of the pre-voting activities. EED is the application that receives the imported data from EDT and Audio Studio to generate ballot structure, ballot artwork, and tabulator files, including all the audio for an accessible voting session on the precinct tabulators.

c) EMS-Audio Studio, v. 5.10.50.83
Audio Studio is an application that assists jurisdictions with the creation of audio files. It can be used to verify, listen, and record audio files in EED.

d) EMS-Results Tally Reporting (RTR), v. 5.10.50.83
RTR is the main application for post-voting activities. It receives election results from the tabulators, allows for validation of the results, and reports the results. RTR can be used for the addition, and deletion of tabulator files. It also allows for manual resolution of qualified write-ins.

e) EMS-File System Service, v. 5.10.50.83
File System Service is a stand-alone service running on client machines enabling access to low level operating system application programming interface (API) for portioning compact flash (CF) cards.

f) EMS-Data Center Manager, v. 5.10.50.83
Data Center Manager is a system-level configuration application used in EMS back-end data center configuration.

g) EMS-Application Server, v. 5.10.50.85
Application Server is a server-side application responsible for executing long running processes, such as rendering ballots, generating audio files and election files.

h) EMS-Adjudication Service, v. 5.10.50.10
EMS-Adjudication Service is a software service that provides EMS data to the Adjudication Services application.

i) EMS-Smart Card Helper Service v. 5.10.11.24
EMS-Smart Card Helper Service is a software service that provides the connection to the smart card reader to allow you to program technician, poll worker, and voter cards.

j) EMS-ImageCast Voter Activation v. 5.10.50.83
EMS-ImageCast Voter Activation is a software service that allows you to activate voter cards.

2. ImageCast Evolution (ICE), v. 5.10.10.3

ICE is an all-in-one precinct optical scan tabulator and ballot marking device. The ICE can accept pre-marked ballots, give voters a second-chance notification on ballot errors, and provide a final ballot review based on the machine's interpretation of the hand-marked ballot. The software prevents the scanning and tabulating of a vote with a marginal mark based on thresholds set in EED. The ballot marking capabilities allow a voter to place a blank ballot into the machine and vote using the accessible tactile interface (ATI), sip-n-puff, or paddle switches. When the ballot marking capabilities are turned on the voter also has the capability to use the audio features. The version submitted for California has the audio capability to handle any of the ten languages required by the U.S. Department of Justice (English, Spanish, Chinese, Japanese, Tagalog, Korean, Vietnamese, Thai, Hindi, and Khmer).

3. ImageCast X (ICX), v. 5.10.12.4

The ICX was tested in two versions: The Avalue-21 Classic and the Avalue 21 Prime. ICX is an accessible ballot marking device. The ballot marking capabilities allow a voter to vote using the accessible tactile interface (ATI), sip-n-puff, or paddle switches. The version submitted for California has the audio capability to handle any of the ten languages required by the U.S. Department of Justice (English, Spanish, Chinese, Japanese, Tagalog, Korean, Vietnamese, Thai, Hindi, and Khmer). The ICX requires the voter to insert an activation card which is generated by a poll worker. The activation card can be created with accessible options enabled so that the voter is presented with all the accessible options when the voting session is initiated.

4. ImageCast Central (ICC), v. 5.10.2.0001

ICC uses commercial-off-the-shelf (COTS) Canon DR-X10C, Canon DR-G1130, Canon DR-G2140, and Interscan HiPro scanners at the central tabulation location to scan vote by mail ballots and post-voting ballots, such as provisional ballots, vote by mail ballots not delivered until Election Day, ballots that need to be duplicated, and ballots that were scanned into a multi-precinct ICE tabulator. The results from batches scanned through the ICC are dropped into a folder on the server for the Adjudication Client to access.

5. Adjudication Client, v. 5.10.50.12

Adjudication Client is an application that allows the jurisdiction to resolve a ballot on screen that would normally be out stacked to be remade or hand counted because it had one or more exception conditions, such as write-ins, over-votes, marginal marks, under-votes, or because it is a completely blank ballot. The Adjudication Client has two roles, Administration and Ballot Inspection. The functionality of the Administration role is to configure user accounts, exception reasons (e.g. write-ins and over-votes), batch management, and report generation. In the California configuration, the Administration role must be performed directly on the server. Ballot Inspection allows users to review ballots that have at least one exception condition as defined by the Administration role. The user may accept the ballot as is or resolve the ballot pursuant to California law.

Each ballot that is adjudicated is stamped with the username of the user who made the change.

6. ImageCast Precinct 2, v. 5.10.5.1

The ImageCast Precinct 2 (ICP2) device is a precinct-level, optical scan ballot counter designed to provide two major functionalities: ballot scanning and tabulation, and ballot review and second chance voting. The ballot review feature allows voters to review their selections and change any votes by remarking the ballot. Once a paper ballot is processed, the voting results for a given ballot are displayed on the monitor for verification. The results are presented in text format, which allows voters to identify any voting errors they may have made and to verify that the tabulator has correctly identified the selections.

## 7. Mobile Ballot Production, v. 5.10.50.83

The Mobile Ballot Production (MBP) 5.10A.11.24 system is an on-demand ballot printing system consisting of a Dell Latitude 3490 laptop, OKI C712, and OKI C931 printers.

The MBP 5.10A.11.24 system operates in conjunction with the Democracy Suite 5.10A voting system. The DS 5.10A EMS creates MBP ready ballot images in .PDF format complete with tint and watermark. These ballot images are exported to the MBP laptop, and then printed on blank paper. To identify the correct ballot style, the MBP system can sort by precinct, ballot group, and several other data points. Once setup and configuration are complete, the MBP laptop only contains geopolitical information, and does not contain any voter information. The MBP system will generate many different reports, including total number of ballots printed, and number of each ballot style printed. The reports can be generated in Excel, Word, and PDF formats.

8. ImageCast Voter Activation, v. 5.10.50.83

The ImageCast Voter Activation (ICVA) 5.10A.11.24 application is a polling place/vote center location tool that allows poll workers to program smart cards for voters in order to activate voting sessions on ImageCast X. Voter Activation cards can be created in either standard or accessible modes. The ICVA consists of the application, Dell Latitude 3490 laptop and USB Smart Card reader/writer.

High Level Block Diagram

Democracy Suite™– System High-level Block Diagram
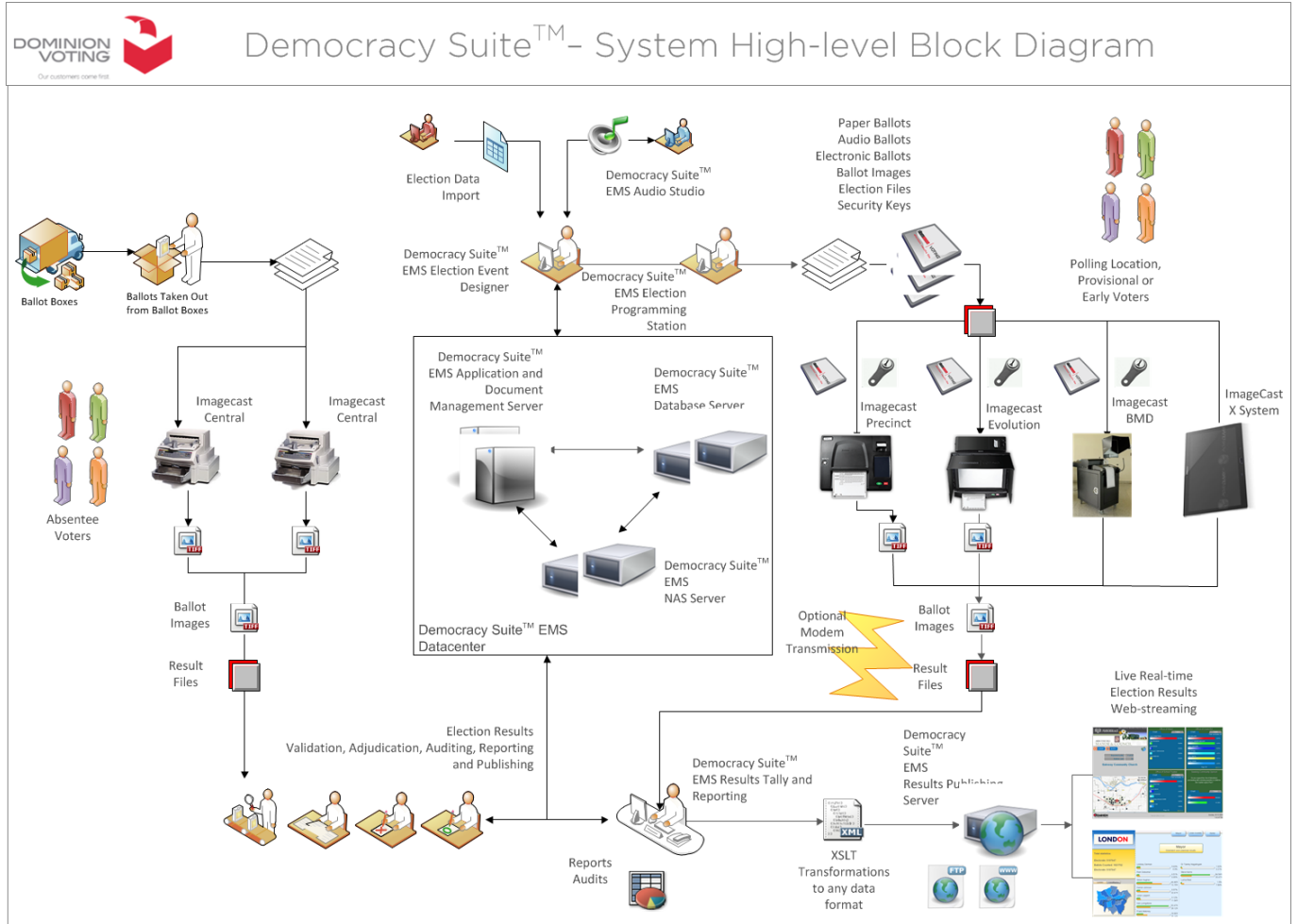
# III. TESTING INFORMATION AND RESULTS

1. Background

Dominion submitted an application to the Secretary of State for Administrative Approval of modifications to the DS5.10 voting system. The purpose of testing is to verify functionality of bug fixes, performance enhancements, and additional languages added to the system to comply with California Elections Code section 14201 language requirements and added jurisdictional specific reports. Support for the following languages was added to the system: Indonesian, Laotian, Mien, Urdu, Bengali, Burmese, Gujarati, Hindi, Thai, Mongolian, Nepali, Tamil, and Telegu. A new California report export package was added to the system which includes corrections to various calculations in the District Canvas and Election Summary reports, changes to the Election Night Export report to include the precinct reporting flag, and changes to California auto-reporting templates. The updated voting system was named Democracy Suite 5.10A.

The testing began with the creation of the trusted build by Pro V&V, a federally certified Voting System Test Laboratory. Pro V&V also performed a source code review of the DS 5.10A voting system in June 2020. Please refer to the Source Code Review Report from Pro V&V.

Functional testing of the Dominion DS 5.10A voting system was conducted by Office of Voting Systems Technology Assessment (OVSTA) staff at the Secretary of State's Office located at 1500 11th Street, Sacramento, California from June 4, 2020, through June 23, 2020.

The test lab was configured in a real-world environment simulating an actual voting system in use by a California County. The Vote Center/Polling Place was setup with the Voter Activation Card Laptop, ICX machines, ICE machine, and Mobile Ballot Production for on demand printing. EED and RTR were setup as per the logical map below. Strict adherence to the air-gap architecture was maintained throughout testing. Media of any kind was only allowed to go from EED to RTR, and was then cleaned, reformatted and returned to the test.

Functional Testing Configuration
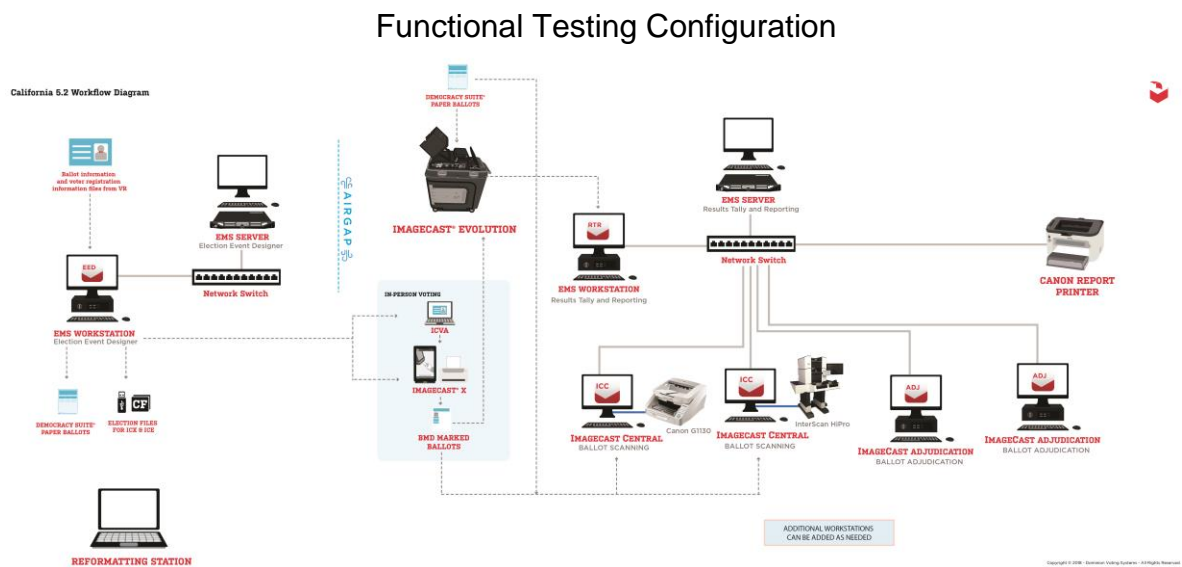
2. Functional Testing Summary

Functional testing was conducted utilizing the DS5.10 voting system hardware stored with the California Secretary of State's office from prior certification testing, with the exception of the IntraScan Scanner, which needed to be replaced due to a malfunctioning cable.

The Secretary of State ran the Functional Test as if it were a jurisdiction that just purchased the voting system. Testing of the system began by setting up all equipment in a configuration that mirrored a production voting system. The DS5.10A architecture

allows elections officials to use one or more, permanent server(s) and set of central-office voting devices, known to be running unaltered, certified software and firmware to create memory cards before each election and to use another, physically separate "sacrificial" server and set of voting devices after the election to tabulate results and generate reports. To transfer election specific data, the ICP2 machines utilize SD cards, the ICC and ICE machines utilize CF cards, and the ICX utilizes USB sticks. The election specific data (files) transferred on these cards are encrypted. An iButton is required to unencrypt the SD and CF cards for the ICP2, ICC, and ICE, and a smartcard is needed to unencrypt the USB sticks used to transfer data to the ICX machines. The key used for these devices can be unified or not. A unified key is one that is election specific. A key specific to that iButton (polling place specific) can be used also. This would prevent a malicious actor from accessing the entire system with just one key.

The hardware consisted of two Dell PowerEdge R640 servers (EMS & RTR Server), two Dell Tower 3430 (Clients), three Dell OptiPlex 3050 All in Ones (ICCs) with touch screen, Dell 7060 (ICC High Speed Scanner), and two Dell Latitude 3490 laptops (Voter Activation Card & EED Cleaner). Testing began with the installation of the voting system trusted build software, and then continued through the security hardening process. Then the firmware was installed on the ICX, ICE, and ICP2 machines.

The trusted build included Windows Defender on all EED and RTR systems Windows based computers. The ICX voting machines running Android do not have anti-virus installed. The ICE and ICP2 machines run firmware without an operating system.

After the trusted build installations, HASHes of the "Trusted Build" installations were generated to accomplish validations of the installations at a later date.

Functional Testing of the system included a Logic and Accuracy (L&A) test election using ballots from the General Test Election, and three main election types: a Presidential Primary, a Presidential General, and a Special Recall. The test deck ballots were created using the following general rules:

- Per California Elections Code (EC) 13002, ballots are printed with a watermark and tint from the approved list for California;
- Pursuant to the requirements of EC 13203, ballots are clearly labeled as TEST BALLOTS instead of OFFICIAL BALLOTS;
- Ballots contain Instructions to Voters per EC 13204 and 13205, but may also include instructions at the bottom of the ballot per EC 13231;
- Candidates are listed per EC 13103;
- Candidate's political party are listed per EC 13105;
- Per EC 13107, each candidate is to have an occupation listed under the candidate's name. For economy of testing, the following 'occupation' was used for all candidates: Occupation Prints Here - la ocupacion demuestra aqui.

The test elections were conducted with the primary goal of exercising the new languages to make sure that all components were capable of these languages. Pre-printed ballots were supplied by Dominion. Polls were opened and voting at the precincts/vote centers simulating both early voting for a vote center, and election day voting were accomplished using the ICE, ICP2, and ICX. Ballots were scanned on all ICCs simulating mail-in ballots. At the close of polls, the memory cards from the ICE voting machine and the ICX voting machines were brought into RTR. Ballots scanned on the ICCs were aggregated to RTR. Ballots containing an exception condition were resolved using adjudication. Next, results were tabulated, validated against the expected results, and published. The Official Canvass Summary report and Statement of Votes Cast reports were generated. Additionally, the Secretary of State Supplemental Statement of Votes (SSOV) report was generated. All test elections were evaluated for airgap compliance, with a "cleaner" laptop used to wipe, reformat, and scan all media for malware prior to being re-introduced into the EED environment again.

Ballots from the General Election were utilized to complete an L&A test election to evaluate the system. Ten ballots were removed from the test deck. In addition, 5 ballots in each language were printed on the MBP, and 5 ballots in each language were marked and printed on each ICX Prime and ICX Classic, utilizing standard voter activation cards. An expected results spreadsheet was created, and the ballots were scanned in equal numbers on the ICP2, G1130 and G2140 scanners.

Polls were closed, all results were merged into RTR, and all reports were generated and saved.

At this time, it was noted that the IntraScan scanner was displaying a 911 error. In addition, the IntraScan scanner displayed a 912 error. A patch cable and the motion control boards were replaced without success. After further troubleshooting, the IntraScan scanner was replaced. Dominion did a root cause analysis, and this was later determined to be a zip tie that wore through a harness cable resulting from normal wear. In addition, the firmware for the ICE was missing the Burmese font. The firmware including the Burmese font for the ICE was regenerated by Pro V&V, and the ICE was reimaged with the updated firmware.

At the start of the L&A test election, it was noted that the ICE was unable to print a ballot. The ink cartridge was replaced, and the ICE functioned as normal. It is recommended that the ink cartridge be replaced after any amount of storage time for the ICE.

The General Election was conducted after the L&A, simulating a county that has done an L&A, and then moves the machines to the polling places and conducts the actual election.

Presidential General Election: The Presidential General Election was tested in English, Indonesian, Laotian, Mien, and Urdu. One bilingual ballot style was included consisting of English and Urdu. The election included two ballot measures. The ICX, ICP2, and ICCs were programmed to support the entire election in all five languages. The election included ten precincts, 18 contests, and 45 options, with two write-ins. The

candidates were rotated per EC 13111. The order of offices on the ballot were per EC 13109. Per EC 13105, each partisan candidate had the party affiliation listed to the right of their name. This election was printed on twelve-inch ballots which are the smallest ballot size possible and included two cards. Adjudication was set to filter blank ballots, ambiguous marks, overvotes, and write-ins.

Polls were opened and zero tapes were printed. It was verified that the ICX utilizes a localization file to present each language correctly on the navigation tabs, information screens, and options on the voter interface. The file is named <language_localizations>.json. The pre-printed test deck was scanned though each ICC. The MBP was utilized to print 5 ballots in each language. The twenty-five ballots printed on the MBP were scanned on the ICP2 and ICE. Five ballots in each language were marked and printed on the ICX Prime, and 5 ballots of each language were marked and printed on the ICX Classic. All ICX printed ballots were then scanned on the ICE, and then on the ICP2. All ballots printed on the MBP, as well as all ballots printed on both ICXs were then scanned through all ICCs.

A voter activation card was created for accessible sessions and used to exercise each language on the ICE and both ICXs. The ATI, headphones, text size, contrast, security screen, and language options worked as expected. Ballots appeared to print in the correct language. Ballots were fed in all orientations and the scanners performed as expected. Ballots were then scanned on the ICCs and results were as expected.

All ballots were adjudicated, aggregated in RTR, and tabulated. The results were evaluated, and the expected results did not match the actual count. A pattern of error was identified, and this led to the error being attributed to the 10 ballots which were used for the L&A. These ballots had not been returned to the general test deck. After they were added back, the results matched the expected results.

Polls were closed in accordance with California Use Procedures. At this time, it was noted that the ballot counter on the ICP2 display reads ballots but displays the number of cards. Results were generated from ICP2 and ICE, and results media were used to transfer results back to RTR. Post-Election results were consolidated from the ICCs. Results included generation of all reports and verifying canvass – Summary, Statement of Vote (SOV), Supplementary Statement of Vote (SSOV), over-votes, and under-votes. Backups were taken as if the files would be supplied to the California Secretary of State to meet the "Vote Count" program requirement prior to an election.

Primary Election: The Presidential Primary was tested in English, Bengali, Burmese, Gujarati, Hindi, and Thai. The election included 10 precincts and eight party splits per precinct. It included 20 contests and 65 choices. Ballots included one bi-lingual ballot style consisting of English and Burmese. The ICE, ICP2, ICXs, and MBP were programmed to support the entire election in all languages. Ballots were seventeen inch which is the medium size possible for the system, and double sided.

Polls were opened and zero tapes printed. The ICX Prime and ICX Classic devices were utilized to mark ballots in all languages, including changing languages midway

through the ballot being voted. Text size and contrast were verified to meet expected criteria. The ability of the ICX to return from the review screen to alleviate any problems was verified. The ICE was utilized to mark and cast ballots in all languages. One complete pre-printed test deck was scanned on the ICE, ICP2, and ICCs and results were as expected. Mobile Ballot Production was used to print ten ballots in each language, and the results were as expected. The ICX and MBP printed ballots were scanned on the ICP2 as well as all ICCs and the results were as expected.

Polls were closed in accordance with California Use Procedures, including printing results from ICE and ICC, removing results media to transfer results back to EMS, and then shutting down devices. Post-Election results were consolidated and reported based on the upload of results to EMS from all tabulating (ICE and ICC) units. All reports were generated and verified including Summary, SOV, SSOV, over-votes, and under-votes.

Recall Election: The Special Recall was conducted in English, Mongolian, Nepali, Tamil, and Telegu. The election consisted of one precinct and one contest. The contest included 135 choices with one write-in in a gubernatorial contest. The election was printed on twenty-two inch ballots, which are the longest ballot size possible for the system. The ICX machine stores the election data in a sandboxed partition in the internal hard drive of the machine. During the recall election, activation card functionality was tested. The ICVA laptop was utilized to create all three types of cards: poll worker, technician, and voter. All three types of cards were tested without incident. Both accessible access and regular voter cards were created and utilized throughout all elections without error.

The entire pre-printed test deck was scanned though each ICC except the IntraScan. The MBP was utilized to print 5 ballots in each language. At this time, it was noted that the election did not contain a fully translated ballot in Bengali. The fully translated Bengali ballot was provided and testing continued. The twenty ballots printed on the MBP were scanned on the ICP2 and ICE. Five ballots in each language were marked and printed on the ICX Prime, and 5 ballots of each language were marked and printed on the ICX Classic. All ICX printed ballots were then scanned on the ICE, and then on the ICP2. All ballots printed on the MBP, as well as all ballots printed on both ICXs were then scanned through all ICCs. Next the ICE was exercised for accessible ballots in each language. It was noted at this time that the accessible sessions on the ICE only contained audio in the correct language for the information screens. The languages displayed correctly, and the audio appeared to be correct.

Polls were closed in accordance with California Use Procedures, including printing results from ICE and ICP2. The results media were utilized to transfer results back to RTR. Post-Election results were consolidated and reported based on upload of results to RTR from all tabulating (ICE, ICP2, and ICC) units. Results included reconciliation of write-ins as well as generation of final reports and verifying Canvass – Summary, SOV, SSOV, over-votes, and under-votes. Backups were taken as if the files would be supplied to the California Secretary of State to meet the "Vote Count" program requirement prior to an election.

3. Additional Functional Testing

On June 12, 2020 Dominion Voting Systems notified the Secretary of State that the styling component had been left out of the ICX polling place device. The styling component allows jurisdictions to add bullets and format the screens presented to voters. As a result, the styling code base for the ICX was returned to the original DS5.10 code base. Pro V&V generated the new trusted build and provided this new firmware for the ICX device on Monday, June 22, 2020. Additional functional testing was required to validate that the ICX component was returned to the original DS5.10 code base.

4. Functional Testing Results

Test results showed that the voting system performed in a manner consistent with California Voting System Standards and all test cases were executed successfully and accurately.

5. Software Review Testing Summary and Findings

Pro V&V conducted the Source Code Review. The Source Code Review took place at Pro V&V in June of 2020.

Within the Dominion DS 5.10A code base, no discrepancies or vulnerabilities were found.

IV. CONCLUSION

The Dominion Democracy Suite 5.10A voting system, in the configuration tested and documented by the Installation and Use Procedures, meets applicable California Voting System Standards and Elections Code Section 14201 requirements.

SECRETARY OF STATE'S STAFF REPORT- DOMINION DEMOCRACY SUITE 5.10A VOTING SYSTEM