Voting System Examination
Dominion Voting Systems
Democracy Suite 5.5-A

Prepared for the
Secretary of State of Texas

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Designee of the Attorney General

This report conveys the findings of the Attorney General's designee from an examination of the equipment listed below.

Examination Date	October 2-3, 2019
Report Date	November 3, 2019

Components Examined

		EAC/NASED Qualification	
	Version	**Number**	**Date**
EMS - Election Management System	5.5.12.1	DVS-DemSuite5.5-A	1/30/2019
ADJ - Adjudication	5.5.8.1	DVS-DemSuite5.5-A	1/30/2019
ICC - ImageCast Central	5.5.3.0002	DVS-DemSuite5.5-A	1/30/2019
ICP - ImageCast Precinct	5.5.3.0002	DVS-DemSuite5.5-A	1/30/2019
ICX - ImageCast X BMD	5.5.10.30	DVS-DemSuite5.5-A	1/30/2019

The Democracy Suite 5.5-A (or D-Suite 5.5-A) is a modern voting system that is new to Texas, although D-Suite is in use in other states. A distinguishing feature is the extensive use of commercial off-the-shelf components, or COTS components, to use the industry parlance. COTS components are standard hardware or software products, as opposed to custom-made components.

For example, the D-Suite voting terminals are commercially available Android tablets that include the stand and the smart-card reader used for voter authentication. Similarly, the PCs, networking gear, hard drives, printers, and some scanners are COTS components.

D-Suite Components

ImageCast X (or ICX) is the name of the line of voting stations, which all share identical software. The *X* in the name highlights the interchangeability of the software and, in one case, even the tablet hardware.

For this examination, Dominion is only seeking certification of one member of the ICX line – the ImageCast X BMD. (BMD stands for ballot-marking device.) When a voter is finished making his or her selections, the BMD prints the ballot on the attached printer but does not save the voter's choices on the device. Since these devices do not tabulate at all, they do not need zero-tapes, precinct tallies, or the like. The printed ballot must then be scanned before it is counted. Each ballot contains the cast-vote record in two formats: a QR code (for use by the scanner) and a

printed, human-readable list (which can be visually verified by the voter). If there should be a question about whether the two match, it can be easily verified by scanning the QR code on the ballot and visually checking that it corresponds to the printed votes.

The voting stations are COTS Android tablets; they must be placed in kiosk mode, which prevents access to the Android features during voting.

Election setup, tabulation, and other related tasks are done with mostly COTS components and the proprietary EMS software. Most of the components are on a LAN (local area network), and no other devices are to be connected to that LAN.

All election data and results are stored on self-encrypting hard drives and are also encrypted by the database software, Microsoft SQL Server. The hard drives are redundant (RAID 10), meaning that each piece of data is stored on two separate hard drives, so nothing is lost even if one hard drive fails. There are two configurations, one that allows multiple client computers connected to a single server computer, and one where everything is on the same computer. We tested only the former, so the single-computer setup is not being certified. These computers run a hardened Windows operating system.

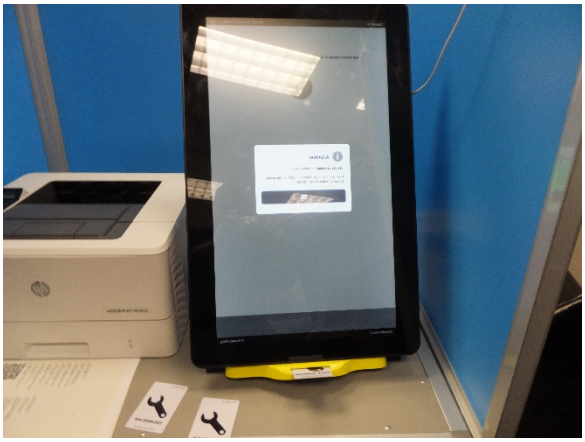
Voting

Election Setup. Election setup (such as entering races and assigning candidates to them) is done using a GUI (graphical user-interface) that is part of the Election Management System.

Authentication for election setup and central-count administration. D-Suite uses two-factor authentication for administration. Access is granted only after both entering the correct PIN and presenting a token, which will be either an iButton (see photos) or a smart card, depending on the device. According to the vendor, an iButton is more durable than a smart card, but they serve the same purpose. In either case, the electronic token is created and encoded on the iButton or smart card using the Election Management System.

Zero-total report. Zero totals are automatically printed by the scanners on paper tape. Note that no zero report is needed for the ballot-marking devices (BMDs).

Ballot selection. Authorization to vote and ballot selection are done using smart cards generated by the Election Management System. A poll worker enters the ballot style, and the software writes it on a smart card in a secure way. The voter then takes the smart card to any voting station to vote. The voter cards are automatically cleared after voting, so they cannot be reused. Also, as a backup, a poll-worker card can be inserted into the voting station to allow manual selection of the ballot style.



Voting. Voting is done on the touch screen of the ImageCast X BMD, or ballots can be marked manually.

Transfer Results. Vote totals are transferred from the ICP precinct scanner to central count using a removable memory device.

Print precinct results. Precinct results are printed by the precinct scanner on paper tape.

Straight party / crossover. Straight-party voting and crossover voting both work properly.

Accessibility. Verification of accessibility is performed independently by the office of the Secretary of State, but the examiners had the opportunity to see the accessibility components.

Comments

The use of many COTS components should reduce the cost of D-Suite significantly. If this savings is passed on to the jurisdictions, then that's a very significant advantage.

The optical scanner has a clever feature that appends to each ballot image an "audit mark" that records in plain text how the ballot was interpreted by the scanner.

Although D-Suite can accommodate jurisdictions of all sizes, the client-server configuration submitted for certification has a minimum of one server and one workstation. We did not examine the single-computer configuration, which would be more appropriate for small counties.

Problems Identified in the Prior Exam on January 16-17, 2019

Crossover Votes. In the January exam we saw a problem with handling crossover votes after a straight-party selection. Dominion has fixed that problem.

Adjudication results can be lost. In the January exam, during adjudication of the ballots in the test election, one of the Dominion representatives made a series of mistakes that caused the entire batch of adjudication results to be lost. We did not see this problem again during this exam, but the adjudication system is unchanged, so this vulnerability is still present.

Recommendation: Certification should be denied.

DRE station failure. Examiner Brian Mechler discovered in January that simply unplugging and reconnecting the cord that supplies power to the VVPAT from the Android tablet will usually cause the tablet to fail. Since Dominion is not submitting their DRE station for certification, this problem is not relevant to this exam.

Voter May have to Start Over. In January the printer tray became ajar during voting, and the system did not notice until the voter attempted to cast his ballot. The system would not accept the ballot and all the voter's choices were lost. A poll worker card was required to clear the problem. In this exam, we were unable to reproduce this problem, so perhaps it was fixed by the software upgrade.

Concerns

1. **Installation is complex, error prone, and tedious.** I counted 184 steps in their installation manual before deciding to estimate the remaining steps. I estimate a total of about 500 steps are required to install the software. I did not count steps that merely said something like "Click OK" or "Click Next." This installation manual is 412 pages long with an additional 23 pages of front matter -- contents, lists of figures, and the like.

Some of these steps were quite simple, but some were lengthy with several "if" clauses. Here is a sample step:

> In the Command Prompt, run the following command, where X is the drive letter of the DVD-ROM drive where the Windows installation media is located:
>
> > Dism /online /enable-feature /featurename:NetFx3 /All /Source:X:nsourcesnsxs /LimitAccess

According to the Dominion representatives, there are eight Windows services that must be started in a certain order; however, the order that steps must be done is not the same as the order they appear on the menus of the Dominion product.

The installation we witnessed took all day. Apparently, a mistake was made (accidently skipping one of the reboot steps) and the Dominion representatives, although clearly knowledgeable, were not able to recover before we broke for lunch. This was despite telephone consultations with other Dominion experts and the use of a troubleshooting guide that Dominion declined to make available to the examiners. Over lunch they decided to start the installation over, and it was successful the second time, finishing before the end of the day. Altogether, the installation took about 8 hours.

Recommendation: Certification should be denied.

2. **Test Voting.** During our voting test, we discovered that some party names and proposition text were not displayed, and one scanner was not accepting some ballots. These all turned out to be errors Dominion made in setting up the standard test election used by the Secretary of State. In the case of the scanner, it had accidently been configured not to accept machine-marked ballots. The other problems were caused by leaving some fields empty during election setup, something that the EMS software should not allow, or at least highlight.

Recommendation: Certification should be denied.

3. **Misleading Message.** The ballot-marking devices incorrectly informed voters that they were *casting* their ballots, when in fact they were only *printing* them. The ballots are not be counted until they were scanned on a different device.

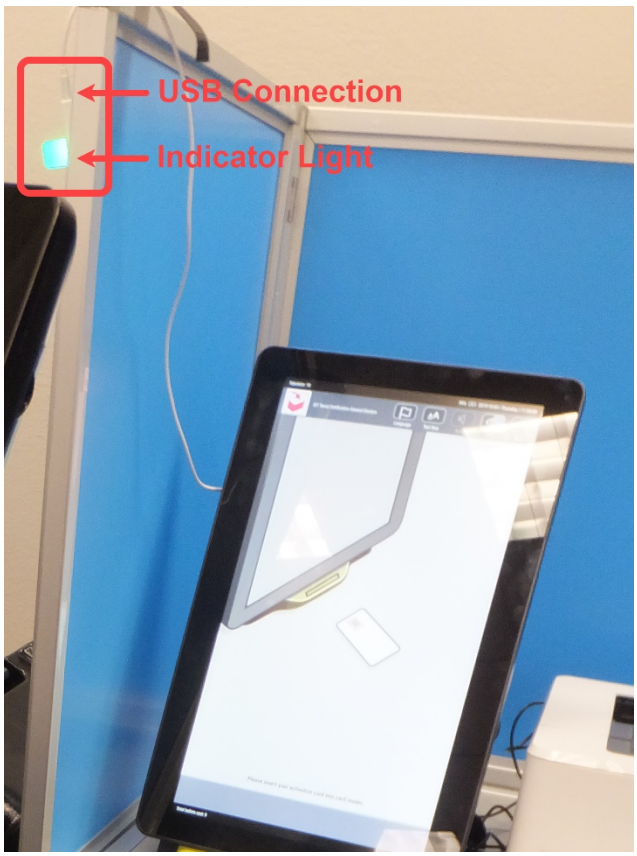
Recommendation: Certification should be denied.

4. **Disappearing Message.** At one point while scanning ballots, something flashed on the display so briefly we could not read it. After several attempts to re-scan the ballot, we were able to discern that it was a message reading "Ambiguous Marks" that was displayed for a second or less. It then reverts to the "System Ready" message. The voter has no way of knowing what, if anything, is wrong since the error message does not persist long enough to read it.

Furthermore, the message is confusing. It would be better to say something like "Cannot read ballot."

Recommendation: Certification should be denied.

5. **USB Port Vulnerability.** The ICX ballot-marking device has an indicator light on top to show poll workers when the station is in use. That light is connected by a USB port.



When Brian Mechler's phone was attached to the USB port, the ICX scanned the files on his phone and did not complain, although Dominion later showed that the event was logged. When a USB drive with files was inserted, the ICX sometimes complained and sometimes did not, apparently according to the content of the USB drive and whether it was present when the ICX was first powered up or inserted later.

Recommendation: Certification should be denied unless either (a) the indicator light is removed from the certified configuration or (b) a way is found to secure the USB connection to the light.

Conclusion

I like the idea of using COTS components to save taxpayer money, and Dominion has done a good job of finding COTS components and minimizing the number of custom components.

Nevertheless, I cannot recommend certification. Computer systems should be designed to prevent or detect human error whenever possible and minimize the consequences of both human mistakes and equipment failure. Instead the Democracy Suite 5.5-A is fragile and error prone. In my opinion it should not be certified for use in Texas.

If certification should be granted, it should be with the condition that all open network and USB ports be sealed.