Voting System Examination
Hart Verity

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 technical designee from an examination of the equipment listed, pursuant to Title 9, Chapter 122 of the Texas Election Code, section 122.036(b).

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Component	Version	EAC Cert. Num.
Verity Build	1.0.3	HRT-Verify-1.0
Verity Central	1.0.3	HRT-Verify-1.0
Verity Count	1.0.3	HRT-Verify-1.0
Verity User Management	1.0.3	HRT-Verify-1.0
Verity Election Management	1.0.3	HRT-Verify-1.0
Verity Desktop	1.0.3	HRT-Verify-1.0
Verity Scan	1.0.3	HRT-Verify-1.0
Verity TouchWriter	1.0.3	HRT-Verify-1.0

These version numbers of the equipment examined matched those above.

System Summary

Overview. The Verity system comprises equipment for the polling place (Verity Scan and TouchWriter), software components that run under Windows 7 (the remaining components listed above), and commercial-off-the-shelf (COTS) components (such as computers and utility software).

Security

Image Verification. To verify that the Build, Central, Count, User Management, Election Management, and Desktop software we tested is exactly the same as that certified by the Election Assistance Commission (EAC), the Secretary of State obtained the software images directly from the EAC. It was then decompressed, loaded, and configured by Hart personnel under the supervision of the technical examiners, thus maintaining the chain of custody. This software is normally delivered to customers on hard drives that are pre-installed in the machines.

There is also a procedure that allows the customer to verify that the software has not been tampered with. This is done by creating a manifest containing hashes of the files that comprise the system. Then the hashes are compared with those on a manifest downloaded from the National Software Reference Library. If the hashes are the same, the files are also.

Verity Keys are USB drives used to control access to various parts of the Verity system. They contain no election data, and are used solely to restrict access to people who have the appropriate Verity Key. To gain access, people must insert the Verity Key and also enter their passwords. Verity Keys are not used in polling places, where only a user id and password are needed.

Election Setup

Election Definition. An election definition (containing races, candidates, etc.) is created with a separate, uncertified program, which outputs the election setup in XML. XML is a widely-used and standard way of representing structured data like an election definition. XML is plain text, so it can be read or edited with almost any text editing program. Someone with sufficient time and patience could create an election definition with such a text editing program, but in practice, election definitions are created by Hart with an uncertified Hart tool that provides a graphical user interface (GUI) and writes the XML file with the election definition.

Verity Build. The XML election definition is then read by the Verity Build program, which allows the county to (a) proof the election, (b) proof layout ballots, (c) print ballots or create PDF files to send to a printer, (d) create Verity Keys, and (e) create vDrives. To prevent possibly corrupt data, Verity Build verifies that the election definition being read from XML is correctly formatted and consistent.

The election definition is carried from Verity Build to other components on *vDrives*, which are USB drives that are easily distinguishable from Verity Keys by color. All vDrives contain the entire election definition and any vDrive for the election can be used to convey the election definition to any Verity device. For example, vDrives are used in polling places to initialize devices such as the TouchWriter.

When voting is over, the vDrives convey any cast-vote records and logs to the location where they will be counted.

Verity User Management manages users – their passwords and the parts of the Verity system they have access to. For the more sensitive parts of the system, a Verity Key is required in addition to a username and password.

Verity Desktop has three functions that it performs on central-count computers, such as Verity Build. It sets the system clock, exports file hashes to a removable drive for verification that the files have not been tampered with, and allows Hart personnel to have access to the operating system using a pass code, in case it is needed for maintenance. One example is installing device drivers. (For security, Verity computers used in the central-count office are run in *kiosk mode,* denying access to the operating system to anyone who does not have the pass code.)

Voting

TouchWriter. Voting may be done either by hand-marking a paper ballot, or using the Hart TouchWriter. The latter allows the voter to make selections and then prints a marked ballot. The TouchWriter does not record the votes, except (of course) on the marked ballot that it prints. There will be a paper ballot for every voter, either hand-marked or created by the TouchWriter. At present, the Verity system does not support direct-recording electronic (DRE) voting stations.

Voting on the TouchWriter can be done using the touch screen, but there is also support for disabled voters, such as audio, paddles, and sip-and-puff. Support for disabled voters was tested by the Secretary of State, and was not covered by this report.

The TouchWriter seemed well-designed and easy to use. It presents one race at a time to the voter, which in my opinion is the best method. It does, however, have one behavior which I found confusing. See item 1 under 'Concerns.'

Each voter who wants to vote on a TouchWriter must be authorized by a poll worker who physically walks to the TouchWriter, enters a password to gain access, and then selects the voter's precinct. In my opinion, this awkward procedure makes it impractical to have many TouchWriters in use at the polls. For that scenario, Hart plans to have a DRE in the next release of the Verity System. I think TouchWriters are suitable primarily for those who are unable to mark a paper ballot, although they are not limited to that use.

Each TouchWriter is paired with an OKI model B431d printer. This is a duplex (two-sided) printer that prints the user's ballot along with his choices. As with most duplex printers, the paper comes almost all the way out of the printer during the printing of the first side. Then it is pulled back in for printing of the second side. We observed that every examiner who tested the TouchWriter would instinctively reach to receive the half-printed ballot from the printer, so we tested forcibly pulling the half-printed ballot completely out. The TouchWriter responded to this event exactly as it should. It (1) showed the voter an error message, (2) waited for a poll worker to retrieve the spoiled ballot and clear the error, and finally (3) automatically re-printed the ballot. It responded equally well to other unusual events, such as the printer's losing power or running out of paper.

Verity Scan. Hart also offers Verity Scan, which can be used to scan ballots in the polling place and store cast-vote records for later tabulation.

Components. Verity Scan and TouchWriter share many common components. For example, they both close into almost identical units that look like small suitcases. Although they are identical in size they are easily distinguishable from each other. They also fit on identical stands. Most importantly, they share identical *tablets*, which is what Hart calls the component that contains the touch screens. Any tablet can be mated with either a TouchWriter or a Verify Scan.

Access to these components is controlled with user names and passwords created and maintained by Verity User Management.

Tabulation, Reporting, and other Central Activities

Verity Central does ballot scanning, resolving ballot issues, processing write-in and provisional votes, producing reports, and auditing data. It can resolve issues and process write-ins, both for ballots it scanned and for those scanned in the precinct and then transported on a vDrive. Verity Central does not tabulate votes.

Verity Count actually tabulates the votes (stored in cast-vote records on a vDrive) and produces reports. It can also resolve issues and process write-ins.

Concerns

1. Multi-select Overvote. The TouchWriter has one behavior which I found confusing. Consider a race where one can vote for multiple candidates – say the voter can choose three of seven. If the voter has selected three candidates and tries to select a fourth, the TouchWriter will automatically deselect the first candidate selected. There is no message or warning, and no reason to think the deselected candidate is the one the voter would have deselected. I found this confusing and disorienting. I believe many voters will have a similar experience, and the TouchWriter should instead give a message to the effect that the voter must deselect a candidate before selecting another.

2. Invalid vDrive Format. During the examination, a bug was uncovered that prevented a vDrive from being read by Verity Count. The error message read "Status: Rejected. vDrive format is invalid. Please remove the inserted drive." The audit log contained additional technical information, including that the problem was an "invalid column length."

Hart investigated the problem and discovered that it was caused by a mismatch in a column length between different software components of the Verity system, specifically the length of the write-in data. They say this can only happen if there is a straight-party selector and write-ins are resolved in Verity Central.

They have fixed this problem since the exam with a change to the installation scripts that has been approved by the EAC as *de minimis*. This is a satisfactory resolution.

Conclusion

I believe the Hart Verity system is one of the best we have examined. It's unfortunate that is marred by Concern 1, Multi-select Overvote, and I highly recommend to Hart that they fix this. However, it is acceptable for now.

I recommend certification of this system.