Voting System Examination of Election Systems & Software EVS 6.1.0.0

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1 Background

An examination of the Election Systems & Software (ES&S) EVS 6.1.0.0 voting system was conducted at the Texas Secretary of State Elections Division offices on January 15-16, 2020. EVS 6.1.0.0 is a comprehensive voting system which can consist of a subset of the following components [1][2][3]:

- Electionware - a suite of end-to-end election management software applications
- ExpressVote Previewer – a ballot preview utility
- PaperBallot – a ballot layout editor
- Event Log Service – a service which monitors and logs users' interactions with the Election Management System (EMS)
- Removable Media Service - a utility that runs in the background of the Windows operating system used for media validation purposes.
- ExpressTouch - a direct recording electronic (DRE) voting device which supports electronic vote capture (for use in Texas only as a curbside voting device)
- ExpressVote XL (HW 1.0) - a ballot marking device (BMD) that provides a large-format touch screen interface and integrated thermal printer
- ExpressVote (HW 1.0 & 2.1) - a BMD that provides a touch screen interface and printer
- DS200 (HW 1.2 & 1.3) - a digital scanner and tabulator for use in the polling place
- DS450 - a central scanner and tabulator
- DS850 - a central scanner and tabulator with increased speed compared to the DS450
- ExpressLink - a standalone application that interfaces with voter registration (e.g. electronic pollbook) systems and the ExpressVote Activation Card Printer
- ExpressVote Activation Card Printer - a small thermal printer used to print the ballot activation code on the vote summary card
- Toolbox – a software suite run on non-EMS workstations

Configuration options are presented in detail in [3]. The Election Assistance Commission (EAC) certification includes tables that describe in detail the voting system software components, voting system platforms, hardware components, and system limits [2].

The Secretary of State obtained the software and firmware images used in the EAC certification directly from the EAC. ES&S personnel used those same files to perform installation under the supervision of the technical examiners. In [4]-[12], ES&S provides instructions for the identification and verification of the components included in EVS 6.1.0.0.

The examination also consisted of an accessibility test, vendor presentations, a mock election, and a free-form session where examiners could ask follow-up questions and use the voting equipment in an unscripted manner.

I was not present for the accessibility portion of the exam. ADA compliance will be presented in the legal examiners' reports. A detailed description of the Texas Secretary of State examination including my observations, concerns, and recommendations is presented in the sections that follow.

2 Election Management System

The election management system (EMS) is a set of servers, workstations, and software which provides an end-to-end solution for jurisdictions to define, manage, configure, export, and tabulate elections. The following subsections will describe the hardware workstations and servers, media, software, and observations from the exam.

2.1 Hardware

EMS workstations can be standalone or act as a client connected to a server. Client and standalone workstations are all Dell products. The following models have been certified by the EAC for use with EVS 6.1.0.0:

- Latitude 5580
- OptiPlex 5040, 5050, and 7020

The client/standalone workstations run 64-bit Windows 10 Enterprise LTSC SP1 as their operating system (OS). Windows Enterprise optionally includes Microsoft's proprietary disk encryption utility, BitLocker. Windows Enterprise also enables the ability to configure workstation access with two-factor authentication.

Use of BitLocker requires that the motherboard be configured with a Trusted Platform Module (TPM) chip. ES&S only supports BitLocker in a client-server configurations when all client workstations and the server have BitLocker enabled.

The server certified by the EAC for use with EVS 6.1.0.0 can be a Dell PowerEdge T430 or T630. The server hardware runs 64-bit Windows Server 2016 as its OS.

When election hardware is networked together is must be done in a closed network environment. In [13], ES&S defines a closed network environment as consisting of "a stand-alone server used for a

specific purpose, such as an Election Management System (EMS) like Electionware, with restricted access to specific workstations and no connection to any other network. Only EMS components are allowed on this network, and any voting system component at a precinct voting site is forbidden from being connected."

Best practices for physically securing EMS workstation and server hardware are found in [14].

2.2 Media

Full use of the EMS requires some special purpose media. Two-factor authentication is accomplished via an ES&S Security Key USB stick. The Security Key contains encryption keys coped from the TPM chip.

Election qualification codes, election definitions, and in some cases, firmware are stored on Delkin USB sticks that are custom-made for ES&S. While workstations and servers will accept any style of USB storage media, voting devices and scanners will only accept the ES&S Delkin USB stick as storage media.

2.3 Software

Electionware is the suite of ES&S software modules used for administering elections. ES&S divides Electionware into five groups: Define, Design, Deliver, Results, and Manage.

Modules under the Define group are used to create, edit, and manage elections. This is where jurisdictions enter or import election-specific information into the database. Graphics and translations are also managed under this software group.

The Design software group includes the modules used to design paper, touchscreen, and accessible ballots. The PaperBallot and ExpressVote Previewer listed on Form 100 fall into this category.

Modules under the Deliver group are used to configure voting/scanning devices, create election media (such as ES&S Delkin USB sticks), and ballot-on-demand printing.

The Results group manages election results data and produces reports.

The Manage software group allows for the administration and management of user roles and permissions.

Every Electionware software module can generate reports from event logs. This is accomplished via the Event Log Service which runs in the background.

The Removable Media Service is another background application which provides media validation and allows for the safe removal and addition of USB media within the EMS.

Electionware utilizes a PostgreSQL database which can be secured with its own password.

Updates to Electionware in EVS 6.1.0.0 include [16]:

- “Ability to display text formatted with different colors and formatting inline”
- “Ability to configure the system to require users to deselect a currently selected voting target before allowing a new selection in a Vote for One contest. Previous versions always toggled selections”
- Change ExpressVote media volume label to 'XPRSSVOTE' to “make it more consistent with other touchscreen media”
- “Incorporated the ExpressVote audio and translations to the Touch Screen audio spreadsheet so the user only has to maintain one spreadsheet for all Touch Screen equipment.”
- “Removed the ExpressVote import screen definitions menu, as the user will be able to import all screen definitions using the Touch Screen Translations Script.”
- “The Electionware Touch Screen System Audio script and Ballot Audio script now identify .ogg file formats”
- “Electionware now generates ExpressVote PDF ballots in the Accessible Ballot module.”
- “The Touch Screen Ballot module now designs all ExpressVote ballots. All menus, buttons, and the navigator include ExpressVote when ExpressVote ballot styles have been generated in Capture.”
- “Electionware now offers the option to configure ExpressVote for this equipment type to print the text *** Official Ballot *** in the header text area of a vote summary card. This option appears on the settings screens for this equipment type.”
- “Electionware no longer requires Adobe to generate ballot PDF files. The recommended PDF generator is Amyuni.”
- “Electionware no longer requires Adobe to view ballot PDF files. The recommended PDF viewer is Sumatra.”
- “Added a Configure module tab on the ExpressVote settings screen for Absentee/Early. Users can now configure different settings for Election Day and Absentee/Early equipment.”
- “Removed print card size from ExpressVote XL and ExpressVote in Configure module's settings report as this option is now in the Touch Screen Ballot module.”
- “The setting to create and enforce the Review Box option for the ExpressVote will now be independent of Paper Ballot. It is set by the user in Configure Settings.”
- “The setting to create and enforce the ExpressVote Review Box option is now displayed on the ExpressVote settings report.”

2.4 Observations

Examiners observed the installation of Electionware on a standalone workstation. A client-server configuration was not demonstrated during the exam. Installation was straight-forward and typical of what most users who have installed Windows applications have encountered.

There were a few issues with the hash verification procedure for the EMS. The cover page of the verification procedure document [8] implies it is for the Windows 10 OS; however, the same procedure is also recommended by ES&S for Windows Server 2016. A larger issue is that the document describes a procedure where the user creates a set of "golden" hashes after installation. Subsequent checks are only verified against the "golden" set. This procedure, as written, only verifies that the EMS has not been altered since the first installation; it is not traceable to the hashes generated by the EAC. ES&S should document a procedure that jurisdictions can use to verify EMS hashes against those created by the EAC.

The output of the hash verification procedure is a set of text files which contain the paths and names of files that have changed. According to the instructions in [8], the file non_ess_final.txt "identifies those files that have changed and are classified as either Windows system files or third-party files." The documented requirement for successful verification states that "all files listed will be dynamic log files (etl, etvx, log, etc.) or data files (dat, sdf, etc.)." The non_ess_final.txt created during the examination contained a list of over 6,000 files. The reason provided for this was that the laptop hosting EMS had been used in three other certification events since the "golden" hashes were created. After a few elections, it would be nearly impossible for a jurisdiction to be confident that they have met the successful verification requirement in the EMS verification procedure. ES&S should simplify this procedure, or store the output in a form that is more easily verified by humans.

Examiners did not witness extensive use of the Define and Design SW groups since election data was imported and ballots were designed for the mock election prior to the exam. The creation of election media, accumulation, and reporting of results was observed. No issues were observed during the mock election as a result of the EMS. Electionware event logs produced after the mock election were detailed and human readable.

3 Voting Devices

ES&S is requesting certification of four different voting devices (one DRE and three BMDs). All devices employ touchscreens and can be configured with accessibility peripherals.

3.1 ExpressTouch

The ExpressTouch is a DRE intended for use in Texas solely as a curbside voting option. There were no changes made to the ExpressTouch between 6.0.4.0 and 6.1.0.0 [16]. Refer to Section 3.1 of my 6.0.4.0 exam report [17] for a more detailed description of this device.

3.2 ExpressVote XL

The ExpressVote XL is a BMD with a large screen and integrated thermal printer which produces a human-readable vote summary card. The large format allows for multiple contests to be displayed on the screen at once. The ExpressVote XL can be configured to act as both a BMD and tabulator; however, only the marker mode with front eject (i.e. BMD-only) configuration is being considered for certification in Texas.

There were no changes made to the ExpressVote XL between 6.0.4.0 and 6.1.0.0 [16]. Refer to Section 3.2 of my 6.0.4.0 exam report [17] for a more detailed description of this device.

Best practices for physically securing the ExpressVote XL are found in [14].

3.3 ExpressVote HW 1.0

The ExpressVote is a tablet sized BMD with integrated thermal printer for producing vote summary cards. The voter uses the touchscreen (or accessibility controls) to make their selections. After reviewing their choices, the voter prints a vote summary card which they take to the precinct scanner for scanning and tabulation.

Best practices for physically securing the ExpressVote are found in [14]. A more detailed description of the ExpressVote HW 1.0 can be found in Section 3.3 of my 6.0.4.0 exam report [17].

Updates to the ExpressVote HW 1.0 in EVS 6.1.0.0 include [16]:

- “Enabled the ExpressVote to operate using the touchscreen user interface and functionality developed for the ExpressVote XL in EVS6000.” (Electionware related change)
- “Removed Accessible Ballot menu items and functionality to Format ExpressVote Headings, Contests, Contest Summaries and Candidates as these functions are now part of the Touch Screen Ballot module.” (Electionware related change)
- Low battery alerts now work as follows:
    - “At approaching low - warn the user that battery is approaching low levels - alert is dismissible - no actions are suppressed.”
    - “At low level - warn the user that battery is low - allow any current vote session to finish - suppress entering any new vote session.”
    - “At critical level - Force shut down the system.”
- “Updated audible system alarms to mimic ExpressVote XL.”
- “Instituted the ability to calibrate the tabulator double sheet sensor in the paper path.”
- “Incorporated the ability to select precinct and ballot style by scanning an external barcode.”
- “Incorporated the connection status (connected/not connected) for external barcode scanners and accessible keypad to the system readiness report.”

- “Incorporated versioning for the input/output board and Audio Tactile Interface board to the system readiness report.”
- “Incorporated the ability to update the system application and board firmware using an update flash drive.”
- “Updated the ExpressVote welcome screen graphic.”
- “Instituted the ability to export VVSG required voting system validation files to an export flash drive.”

3.4 ExpressVote HW 2.1

The ExpressVote HW 2.1 is an updated version of HW 1.0. There were hardware components on version 1.0 which went end-of-life necessitating the update to 2.1. From the voter’s perspective, ExpressVote HW 1.0 and 2.1 are functionally equivalent. There are some auxiliary ports of the backside of the voting device which are different. Otherwise, the ExpressVote HW 2.1 interfaces and updates are the same as described in Section 3.3.

3.5 Observations

Examiners observed the installation of firmware, Election Qualification Codes (EQCs), and election definitions on all of the voting devices as well as the export of data and logs. There were no issues with this process.

During the mock election, the voting instructions and touchscreen ballots were easy to understand and navigate on all devices.

The ExpressVote XL, HW 1.0, and HW 2.1 all used the same thermal printer/scanner hardware for the vote summary cards. The printer was fast and the feed mechanism was not prone to jamming. For the design used in the mock election, the vote summary card was easy to read. None of the voting devices support a multi-page vote summary card. When using small font and a 19” card, EVS 6.1.0.0 can support up to 104 selections.

Examiners were only provided with audit logs from the ExpressTouch. The log was in csv format and easy for a person with knowledge of the device to understand.

For some of the devices there is a default, unchangeable administrator password that is used to support certain functions. While this is far from ideal from an operational security perspective, a bad actor with knowledge of the password would have to breach physical security measures in order to gain access. Because of this vulnerability, jurisdictions should carefully implement best practices for physical security recommended by ES&S.

The ExpressVote HW 1.0 has an unsecured Ethernet port on the rear side next to a power terminal. The best practices provided by [14] do not recommend securing this open port with seals or port locks. ES&S states that the port is completely inactive and that a user would not be able to use it to interface with the on-board computer. The port was put in place for future use, but functionality has not been

activated and there is no plan to make the port active. Nevertheless, jurisdictions may want to secure the open port with a seal or port lock simply to remove the temptation for tampering.

The large format of the ExpressVote XL touchscreen allows for many, if not all, contests to be displayed to the voter at once. The Electionware ballot designer provides many degrees of freedom with regard to the XL ballot layout. This design flexibility ideally produces a ballot that enables a voter to select their choices quickly and without error. However, there is also greater ability to create a confusing or misleading ballot. Examiners previously voiced this concern in exam reports of the EVS 6.0.4.0 and 6.0.2.0 [17]-[21].

In November 2019, Northampton County Pennsylvania experienced errors in tabulation on the ExpressVote XL due to a ballot design issue [22]. The issue was caused by an attempt to handle a cross-filed race by placing instructional text on the ballot where a candidate's name would normally appear. This caused a misalignment in the XL's tabulation database. The XL in use in Northampton was an older version, but ES&S has not yet fixed this bug in any EAC certified release. Northampton used the XL in its tabulator mode. When ballots were re-scanned on the DS200, the tabulation results were correct.

A similar tabulation error is unlikely in Texas where the XL can only be certified in the BMD configuration. Thorough L&A testing should be performed to mitigate errors caused by ballot design. Jurisdictions must also carefully design ballots paying close attention to feedback from the ballot design software. If an error or warning condition thrown by the EMS is not understood, jurisdictions should seek support from ES&S. ES&S must fix the "Northampton bug" and show a serious, good-faith effort to resolve XL ballot design issues in their next release less they risk a certification denial.

4 Scanners

ES&S presented three scanners for certification. The DS200 which is designed as a precinct scanner, and the DS450 and DS850 which are both central scanners. All scanners are capable of scanning both paper ballots and vote summary cards.

4.1 DS200

This DS200 is a precinct scanner that voters would use to scan their paper ballots or vote summary cards depending on how the polling place is operated. It may also be used as a central scanner for small jurisdictions. For a more detailed description of the DS200, see Section 4.1 of my 6.0.4.0 exam report [17].

Best practices for physically securing the DS200 and ballot boxes are found in [14].

Updates to the DS200 in EVS 6.1.0.0 include [16]:

- “Updated copyright date on DS200 startup/shutdown splash screens”
- “The Write-in Review report has been changed to sort write-ins by precinct”
- “Contests with no entered write-in votes will be suppressed from the Write-in Review report. This will save space on the report and avoid wasting report tape.”
- “Integrated support for Security CF Cards”

4.2 DS450

The DS450 is a central scanner and tabulator. It can scan 85 11-inch ballots per minute. The DS450 can be configured to sort scanned ballots into discrete outstack bins based on user-defined preferences. For a more detailed description of the DS450, see Section 4.2 of my 6.0.4.0 exam report [17]. Best practices for physically securing the DS450 are found in [14].

Updates to the DS450 in EVS 6.1.0.0 include [16]

- “Updated copyright date on DS450 Startup/Shutdown splash screens”
- “Integrated support for Locked CF Cards”

4.3 DS850

The DS850 is a central scanner and tabulator designed for high-speed processing. It can scan 365 11-inch ballots per minute. The DS850 can be configured to sort scanned ballots into discrete outstack bins based on user-defined preferences. For a more detailed description of the DS850, see Section 4.3 of my 6.0.4.0 exam report [17]. Best practices for physically securing the DS850 are found in [14].

Updates to the DS850 in EVS 6.1.0.0 include [16]

- “Updated copyright date on DS850 Startup/Shutdown splash screens”
- “Integrated support for Locked CF Cards”

4.4 Observations

The DS200, DS450, and DS850 were all used to scan and tabulate ballots during the mock election. No issues were observed with scan quality, accuracy, or reliability. They did not appear prone to jams or other slow downs.

In the exam of 6.0.4.0 it was noted that the DS200 takes a few seconds to process an inserted ballot prior to releasing it into the ballot box or rejecting it [17]. In 6.1.0.0, the ballot processing time appeared much shorter. It is unknown whether this was due to the FW update, election definition, or simply unit-to-unit variance. Even with this improvement, the recommendation from the 6.0.4.0 report still stands: poll worker training and voter education are both needed to prevent rejected ballots from being abandoned.

ES&S should consider adding data redundancy to future models of their central scanners. A high-speed scanner loses some of its advantages if users have to regularly pause ballot processing to export or backup results to prevent data loss.

5 ExpressLink and ExpressVote Activation Card Printer

The State of Texas does not certify these components for use in elections and they are not part of the EAC certification.

The ExpressLink is a standalone software application that interfaces with electronic pollbooks and the ExpressVote Activation Card Printer. The ExpressVote Activation Card Printer prints a bar code at the top of a vote summary card that encodes the ballot style that the voter should receive. The voter can then use the pre-printed vote summary card to activate their own session and receive the correct touchscreen ballot on ExpressVote and ExpressVote XL BMDs.

The ExpressVote Activation Card Printer also provides a mechanism for marking a ballot as provisional and preventing it from being prematurely scanned and accepted as a regular ballot by the precinct scanner.

5.1 Observations

Use of the ExpressLink and ExpressVote ActivationCard printer was not observed as part of this exam.

Based on the functionality described in the ES&S technical data package (TDP), large polling places may benefit from these devices since they will likely reduce the cognitive load on already busy poll workers and reduce voter waiting times.

6 Toolbox

The State of Texas does not certify this type of application suite for use in elections nor was the Toolbox part of the EAC certification. However, it was demonstrated during the exam and can be used to implement ES&S best practices for handling removable media. Toolbox is installed on a Windows 10 system separate from the EMS closed network environment.

The Toolbox has four main components [15]:

- Test Deck – used to create test decks for use in L&A testing
- Text to Speech – used to create audio playback files for use with ADA-compliant devices
- Media Restore – used to securely clear data from ES&S Delkin USB media and reformat them to the FAT32 format
- Data Conversion - used to convert exported election data to formats compatible with Electionware

6.1 Observations

The Test Deck, Text to Speech, and Data Conversion modules were not demonstrated during the exam. The Media Restore module was used to clear all media prior FW installation and prior to use in the mock election. No issues with this use of Toolbox were observed.

The TDP does not address how the host running Toolbox should be secured. Since ES&S USB media will necessarily be introduced into this outside system, I recommend precincts physically secure the host computer running Toolbox according to the same best practices outlined by ES&S for Electionware workstations. Furthermore, the hosts running Toolbox should be quarantined within their own closed network environment separate from the closed network environment used to run Electionware.

7 Conclusions

While some serious concerns arose during the exam, none were disqualifying. In future updates, ES&S should:

- Fix the bug that caused ExpressVote XL tabulation errors in Northampton County PA
- Provide stronger warnings to ballot designers when the ExpressVote XL ballot layout may cause errors in interpreting voter intent or ballots that are hard to read/use
- Simplify EMS hash verification procedure including a procedure to perform verification against EAC provided hashes (not just a “golden” hash)
- Eliminate all default, unchangeable passwords on devices
- Add data storage redundancy to the central scanners
- Include detailed security best practices for Toolbox hosts as part of the TDP

The remaining issues observed during the exam can be mitigated with proper training of central election staff and poll workers. Jurisdictions should budget for appropriate levels of training and support when considering use of EVS 6.1.0.0. Similarly, jurisdictions should budget for the added consumables (e.g. ink, paper, USB thumb drives) that are required to operate EVS 6.1.0.0 in an EAC certified configuration.

Overall, EVS 6.1.0.0 is a comprehensive voting system that is secure, well-designed, and user-friendly. ES&S’s responses to Voting System Certification Form 101 are truthful and adequate. The system tallied and reported results accurately during the mock election portion of the exam.

I recommend certification of EVS 6.1.0.0.

8 References

[1] Application for Texas Certification of Voting System – Form 100, Election Systems & Software, ES&S EVS 6.1.0.0

[2] United States Election Assistance Commission Certificate of Conformance, ES&S EVS 6.1.0.0, EAC Certification Number: ESSEVS6100, Sep-24 2019
URL: https://www.eac.gov/voting-equipment/evs-6100

[3] System Overview, ES&S Voting System 6.1.0.0, Document Revision 1.2

[4] Verification Procedure: Verification PC Setup, ES&S Voting System Security, Document Revision 1.1, Document ID ESSSYS_6'1'0'0_D_VERPROC_VERIFICATIONPCSETUP

[5] Verification Procedure: DS200 Precinct Scanner and Tabulator, ES&S Voting System Security, Document Revision 1.2, Document ID ESSSYS_6'1'0'0_D_VERPROC_DS200

[6] Verification Procedure: DS450 High-Throughput Scanner and Tabulator, ES&S Voting System Security, Document Revision 1.2, Document ID ESSSYS_6'1'0'0_D_VERPROC_DS450

[7] Verification Procedure: DS850 High-Speed Scanner and Tabulator, ES&S Voting System Security, Document Revision 1.2, Document ID ESSSYS_6'1'0'0_D_VERPROC_DS850

[8] Verification Procedure: Election Management System, Operating System: Windows 10 Enterprise, ES&S Voting System Security, Document Revision 1.1, Document ID ESSSYS_6'1'0'0_D_VERPROC_EMS

[9] Verification Procedure: ExpressTouch, ES&S Voting System Security, Document Revision 1.1, Document ID ESSSYS_6'1'0'0_D_VERPROC_ETOUCH

[10] Verification Procedure: ExpressVote Hardware 1.0, ES&S Voting System Security, Document Revision 1.0, Document ID ESSSYS_6'1'0'0_D_VERPROC_EVOTE_HW1'0

[11] Verification Procedure: ExpressVote Hardware 2.1, ES&S Voting System Security, Document Revision 1.1, Document ID ESSSYS_6'1'0'0_D_VERPROC_EVOTE_HW2'1

[12] Verification Procedure: ExpressVote XL, ES&S Voting System Security, Document Revision 1.1, Document ID ESSSYS_6'1'0'0_D_VERPROC_EVOTEXL

[13] Electionware Vol. I: Administrator Guide, Software Version 6.0.0.0, Revision 1.2, August 2019

[14] Best Practices for Physically Securing ES&S Equipment, ES&S Voting System 6.1.0.0, Document Revision 1.1, Document ID ESSSYS_6'1'0'0_SPC_SECBESTPRACT

[15] Electionware Toolbox User Guide, Software Version 4.1.0.0, Revision 1.0, Sept 2019

[16] System Change Notes, ES&S Voting System 6.1.0.0, Document Revision 1.2, Document ID ESSSYS_6'1'0'0_D_CHANGENOTES

[17] B. Mechler, “Voting System Examination of Election Systems & Software EVS 6.0.4.0”, July-28 2019, URL: https://www.sos.state.tx.us/elections/forms/sysexam/brian-mechler-evs6040.pdf

[18] J. Sneeringer, “Voting System Examination Election Systems & Software (ES&S)”, July-26 2019, URL: https://www.sos.state.tx.us/elections/forms/sysexam/jim-sneeringer-evs-6040-report.pdf

[19] T. Watson, “ES&S 6040”, July 2019, URL: https://www.sos.state.tx.us/elections/forms/sysexam/tom-watson-ess-6040.pdf

[20] J. Sneeringer, “Voting System Examination Election Systems & Software (ES&S)“, Feb-21 2019, URL: https://www.sos.state.tx.us/elections/forms/sysexam/jim-sneeringer-evs6020.pdf

[21] T. Watson, “ES&S EVS 6.0.2.0”, February 2019, URL: https://www.sos.state.tx.us/elections/forms/sysexam/tom-watson-evs6020.pdf

[22] B. Bartlett, “Report on the Analysis of Voting Machine Issues in Northampton County”, County of Northampton Pennsylvania, Dec-12 2019