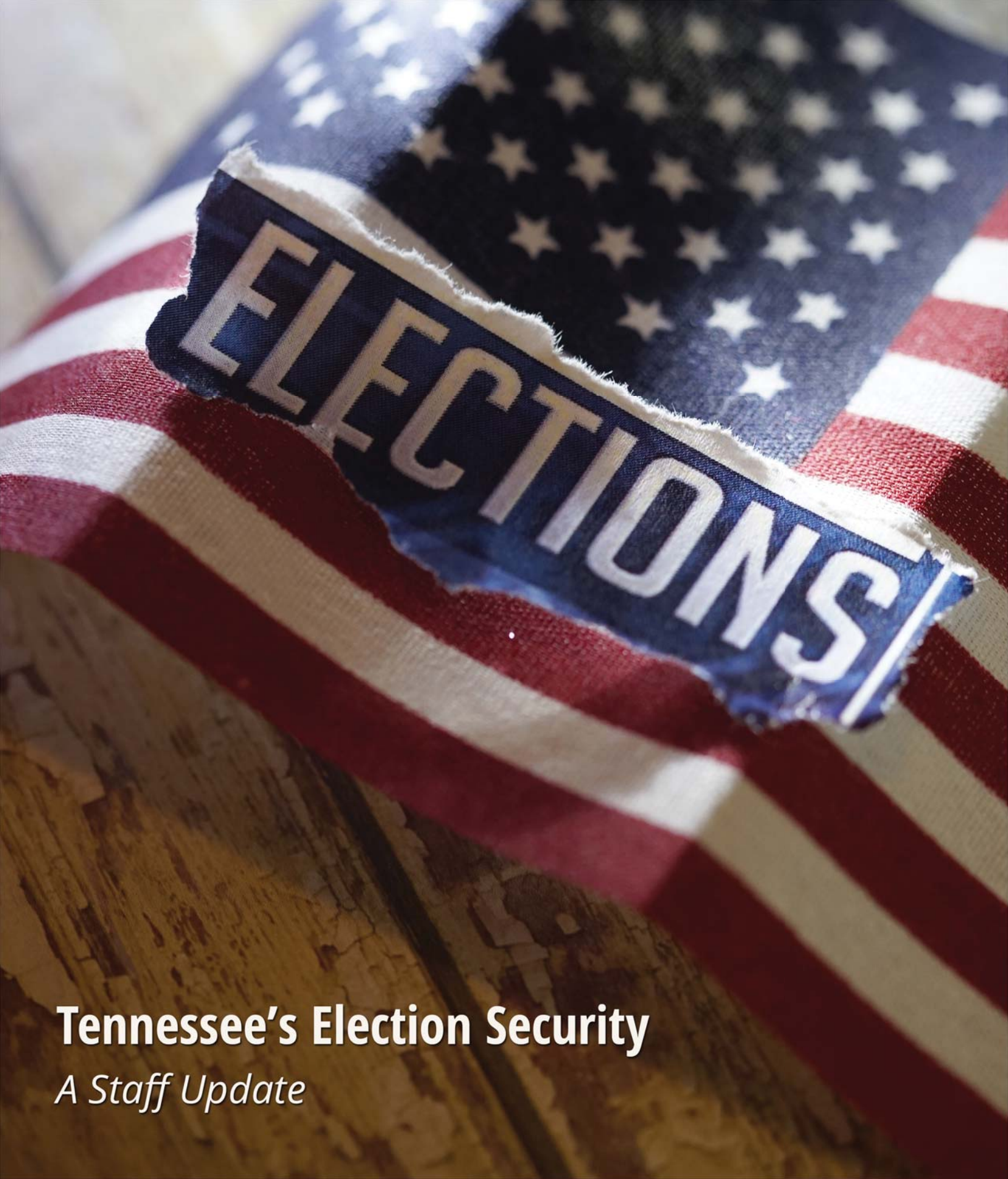

Tennessee's Election Security

A Staff Update

Staff Report to Members of the
Tennessee Advisory Commission on Intergovernmental Relations

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Tennessee's Election Security: A Staff Update

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Staff Report to Members of the
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MEMORANDUM

TO: Commission Members

FROM: Cliff Lippard
Executive Director

DATE: 12 December 2018

SUBJECT: Election Study Update—Information Presentation

In an April 2018 letter to the Commission, Senator Frank Niceley expressed concern about new threats to Tennessee's voting system and requested that the Commission revisit and update its 2007 staff report *Trust but Verify: Increasing Voter Confidence in Election Results,* which examined election security in Tennessee and included several findings and recommendations. He asked the Commission to address two specific topics:

1. The most cost-effective and efficient voter-verified paper audit trail (VVPAT) options for Tennessee counties
2. Opportunities to offset VVPAT costs with the use of secure electronic transfer, a system used by 35 states to ensure that data from all agencies is available to verify the accuracy of voter rolls

Although none of the recommendations in the 2007 TACIR staff report addressed secure electronic transfer, three addressed the use of VVPAT. At that time, staff recommended that Tennessee

- implement voter-verified paper audit trails statewide within a reasonable time frame;
- adopt VVPAT that can be counted by hand, as well as by machine—machine tallies to support prompt reporting of results with hand counting for audit and recount purposes; and
- adopt a standard for VVPAT that would meet federal guidelines then under consideration.

TACIR staff continues to support these recommendations. Further, staff would encourage county election officials not wanting to replace their current non-VVPAT machines to consider adding printers, when they are available, to those machines to make them VVPAT capable. And rather than relying on paper voter registration applications, although the cost savings are not clear, staff encourages the state to continue implementing electronic voter registration processes, making it easier to register, improving accuracy of voter rolls, and potentially saving money.

At the September 2018 Commission meeting, staff updated Commission members with preliminary information addressing Senator Niceley's request. This final staff update provides additional information in response to members' questions.

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UPDATE OF 2007 TACIR STAFF REPORT ON TENNESSEE'S ELECTION SECURITY

In an April 2018 letter to the Commission (appendix A), Senator Frank Niceley expressed concern about new threats to Tennessee's voting system and requested that the Commission revisit and update its 2007 staff report *Trust but Verify: Increasing Voter Confidence in Election Results,* which examined election security in Tennessee and included several findings and recommendations (appendix B). This 2018 staff update provides information addressing his request.

Senator Niceley asked the Commission to address two specific topics:

1) The most cost-effective and efficient voter-verified paper audit trail (VVPAT) options for Tennessee counties
2) Opportunities to offset VVPAT costs with the use of secure electronic transfer, a system used by 35 states to ensure that data from all agencies are available to verify the accuracy of voter rolls

Although none of the recommendations in the 2007 TACIR staff report addressed secure electronic transfer, three addressed the use of VVPAT. **At that time, staff recommended that Tennessee**

- **implement voter-verified paper audit trails statewide within a reasonable time frame;**
- **adopt VVPAT that can be counted by hand, as well as by machine—machine tallies to support prompt reporting of results with hand counting for audit and recount purposes; and**
- **adopt a standard for VVPAT that would meet federal guidelines then under consideration.**[1]

TACIR staff continues to support these recommendations. Further, **staff would encourage county election officials not wanting to replace their current non-VVPAT machines to consider adding printers, when they are available, to those machines to make them VVPAT capable. And rather than relying on paper voter registration applications, although the cost savings are not clear, staff encourages the state to continue implementing electronic voter registration processes, making it easier to register, improving accuracy of voter rolls, and potentially saving money.** The state has recently implemented

[1] Green, Naccarato, and Abdelrazek 2007.

What are voter-verified paper audit trails and secure electronic transfer?

Machines with **voter-verified paper audit trails (VVPAT)**—sometimes also called verified paper records, voter-verified audit records, or voter-verified paper ballots—offer voters a chance to verify paper copies of their votes before casting their ballot. The ballots are securely stored and used for audits and recounts. Current VVPAT options include using optical scanners to count hand- or machine-marked paper ballots and adding printers to direct-recording electronic voting machines (DREs) to create an auditable paper record of each ballot.

Secure electronic transfer—sometimes also called automated or electronic registration—digitally transmits voter registration data from state agencies that process voter registration applications to county election commissions, which use the data to verify and update voter rolls. Of the six state agencies in Tennessee that accept voter registration applications, the driver services division of the Department of Safety accepts the most.

Note: The six agencies listed on the Tennessee Secretary of State's website that accept voter registration applications are the Departments of Health, Human Services, Intellectual and Developmental Disabilities, Mental Health and Substance Abuse Services, Safety and Homeland Security, and Veterans Services.

Sources: Green, Naccarato, and Abdelrazek 2007; Maluk, Perez, and Zhou 2015; Tennessee Secretary of State 2017a; and email correspondence with Mark Goins, coordinator of elections, Division of Elections, Tennessee Secretary of State, August 28, 2018.

some electronic processes that securely transfer registration data, but it continues to use paper applications during many voter registration transactions.

The Risk to Election Security has Changed since 2007

Although ensuring that elections are safe and secure is not a new challenge, as technology and election systems have evolved, so has the risk to security. The 2016 election cycle brought the potential vulnerabilities of electronic election infrastructure to the attention of national, state, and local officials, the media, and the general public. In response to cyber activity detected by state officials, the US Senate Select Committee on Intelligence conducted an investigation into Russian targeting of election infrastructure during the 2016 election, revealing evidence that cyber actors attempted to intrude into election systems and, in a small number of cases, successfully accessed voter registration databases. In its May 8, 2018, summary of initial findings and recommendations, the Senate Committee called the events "an unprecedented, coordinated cyber campaign against state election infrastructure," and said "this activity was part of a larger campaign to prepare to undermine confidence in the voting process."[2] Several of the Committee's findings and recommendations concern election-voting equipment and are similar to TACIR's 2007 findings and recommendations, including a strong recommendation for VVPAT (appendix C).

Several of the 2018 findings and recommendations of the US Senate Select Committee on Intelligence concern election-voting equipment and are similar to TACIR's 2007 findings and recommendations, including a strong recommendation for voter-verified paper audit trail (VVPAT).

Tennessee's election system is not immune to security threats, as a recent event in Knox County illustrates. On May 1, 2018, as unofficial results for the Knox County primary election were coming in that evening, the Knox County Election Commission's website crashed, delaying reporting of results.[3] The *Root Cause Analysis* report of the event found that computers from about 65 countries accessed the website in a three-hour period, and an active attack was made on the server, most likely causing the website to crash on election night. Although the intention of the attack was not determined, official election data was not and could not have been compromised because the election equipment is not connected through a network, and "all data that goes into the isolated master system can be validated back to each polling station and to each polling machine."[4] The weakness in the system was repaired, but the lingering concern is that the website crash and delay in election results create the image that elections are being hacked and are not secure, potentially eroding people's confidence and trust in the election system and democratic process.[5] And because Knox County uses direct-recording electronic (DRE) voting machines without VVPAT, like most other Tennessee counties, there is no paper record of votes that could be used for an audit or recount if necessary.

[2] US Senate Select Committee on Intelligence 2018.
[3] Lakin 2018; and Sainz 2018.
[4] Sword & Shield Enterprise Security Inc. 2018.
[5] Lakin 2018; Parks 2018; and Sainz 2018.

Security of election systems, including voting machines, websites, and registration databases, has continued to be a major focus and concern in Tennessee and at the national level.

Legislative Changes Regarding VVPAT from 2008 through 2018

Although provisions in the Tennessee Voter Confidence Act, passed by the General Assembly in 2008, mandated the use of VVPAT in Tennessee,[6] subsequent changes have ultimately returned state law regarding the use of VVPAT to the status quo that existed at the time of TACIR's 2007 staff report. At that time, county election commissions—which, under the supervision of the state coordinator of elections, are responsible for conducting all federal, state, and local elections in Tennessee, including city elections[7]—were authorized to use DRE machines, on which ballots are cast and counted electronically, optical scan voting systems, which count paper ballots and are a type of VVPAT, or hand-counted paper ballots. All but Hamilton and Pickett counties were using DREs in 2007.[8]

Security of election systems, including voting machines, websites, and registration databases, has continued to be a major focus and concern in Tennessee and at the national level.

The 2008 Voter Confidence Act mandated VVPAT through the use of precinct-based optical scanners and voter-verified paper ballots[9] on or before the November 2010 general election. But in 2010, the Act was amended to delay implementation of its VVPAT mandate until no later than the 2012 general election because of concerns about cost and compliance with federal standards for testing and certifying voting equipment.[10] Public Chapter 301, Acts of 2011, eliminated the VVPAT mandate entirely, though counties are still authorized to use precinct-based optical scanners, as they were in 2007.[11] Those counties that use precinct-based optical scanners are required to conduct automatic audits of randomly selected voter-verified paper ballots cast in certain elections.[12]

Two bills that would have restored the VVPAT mandate were introduced in 2018 but did not pass. Senate Bill 2438 by Senator Yarbro and House Bill 2567 by Representative Stewart (appendix D) would have required each county election commission to use precinct-based optical scanners no later than January 1, 2020. Senate Bill 2090 by Senator Niceley and House Bill 2300 by Representative Beck (appendix E), would have required every precinct using DRE machines in Tennessee to, by January 1, 2020, create a VVPAT for each ballot cast in future elections by adding a device that prints a voter-verifiable record at the time a voter casts a ballot.

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[6] Public Chapter 1108, Acts of 2008.
[7] Tennessee Code Annotated, Sections 2-11-202; 2-12-109; 2-12-116; and 6-53-101.
[8] Green, Naccarato, and Abdelrazek 2007.
[9] See Tennessee Code Annotated, Section 2-20-101, for definitions of "precinct-based optical scanner" and "voter-verified paper ballot."
[10] Public Chapter 612, Acts of 2010.
[11] Public Chapter 301, Acts of 2011.
[12] Tennessee Code Annotated, Section 2-20-103.

Topic 1: VVPAT Options for Tennessee Counties

Several types of voting equipment systems are currently available for local jurisdictions to use in the US. Table 1 briefly describes the equipment and whether it produces a VVPAT, and appendix F provides photos and additional descriptions about each system.

Table 1. Types of Voting Equipment Systems

System	Description	Produces VVPAT
direct-recording electronic (DRE) machine without VVPAT	voter electronically votes using machine that records and tabulates votes	No
direct-recording electronic (DRE) machine with VVPAT	voter electronically votes using machine that records and tabulates votes and creates a paper record that voter can review before casting ballot	Yes
ballot marking device and optical scan (hybrid)	voter marks blank paper ballot using electronic ballot marking device that prints marked ballots, and optical scanner scans marked ballots and tabulates votes	Yes
optical scan	voter marks pre-printed paper ballot by hand, and optical scanner scans marked ballots and tabulates votes	Yes
hand count	voter marks paper ballot by hand, and each race on each ballot is counted by hand without the use of a machine	Yes

Source: US Election Assistance Commission 2018b.

Tennessee is among 38 states that voluntarily follow the US Election Assistance Commission's Voluntary Voting System Guidelines for testing and certifying voting systems.

The US Election Assistance Commission (EAC) develops standards for testing and certifying voting systems, called Voluntary Voting System Guidelines (VVSG).[13] According to its website, the EAC has certified 18 vendors and 47 different voting systems that meet the functionality, accessibility, and security requirements of the 2005 VVSG.[14] Although states are not required to follow the guidelines, Tennessee is among 38 states that do, requiring that voting systems are tested to ensure they meet the federal VVSG standards.[15]

The Tennessee Secretary of State's website lists the vendors and equipment currently certified according to federal standards, field tested by the Tennessee State Election Commission, and available for county election

[13] US Election Assistance Commission 2018c; and National Conference of State Legislatures 2018b.
[14] US Election Assistance Commission 2018a.
[15] Interview with Mark Goins, coordinator of elections, and Andrew Dodd, elections attorney, Division of Elections, Tennessee Secretary of State, August 23, 2018; and National Conference of State Legislatures 2018b.

commissions to use in Tennessee.[16] The options, provided by five different vendors, include optical scanners to count hand- or machine-marked paper ballots that create a VVPAT and DRE machines with no VVPAT. Although not listed on the Secretary of State's website, counties may also hand-count paper ballots. Table 2 shows the 14 counties in Tennessee that as of August 2018, are using systems that produce a VVPAT and when they started using the equipment.[17] The other counties use DRE systems without VVPAT. A list of vendors and voting systems for all Tennessee counties is included as appendix G.

Table 2. Tennessee Counties using VVPAT as of August 2018

County	Year*	Type of Equipment
Benton	2008	optical scan
Chester	2018	ballot marking device and optical scan
Coffee	2018	ballot marking device and optical scan
Decatur	2018	ballot marking device and optical scan
Hamilton	has always used paper ballots	optical scan
Hardin	2016	ballot marking device and optical scan
Lincoln	2018	ballot marking device and optical scan
McNairy	2016	ballot marking device and optical scan
Moore	2018	ballot marking device and optical scan
Pickett	has always used paper ballots	optical scan
Polk	2013	optical scan
Sevier	2018	ballot marking device and optical scan
Weakley	2018	ballot marking device and optical scan
Wilson	2016	ballot marking device and optical scan

*Some years listed are approximated because a few election administrators were not sure exactly when the county started using the equipment.

Sources: Interviews with county election administrators, June and July 2018; Interview with Mark Goins, coordinator of elections, and Andrew Dodd, elections attorney, Division of Elections, Tennessee Secretary of State, June 20, 2018; and Tennessee Secretary of State 2018.

As of August 2018, 14 Tennessee counties use voting systems that create a voter-verified paper audit trail.

Opinions about voting equipment and VVPAT options vary among Tennessee county election administrators. In interviews with TACIR staff, election administrators whose counties use equipment that produce a paper trail said they chose to replace their DRE equipment with optical scan

[16] Tennessee Secretary of State 2017c.
[17] Interviews with county election administrators, June and July 2018; and Tennessee Secretary of State 2018.

equipment because they see the national trend moving towards VVPAT.[18] They think the equipment is more secure than systems without a paper trail, and it is the best choice going forward. They say systems are easy to use, they have received positive feedback from voters, poll workers, and elected officials, and ballot storage has not been an issue or cost burden. Several counties, including Cheatham, Davidson, Maury, and Shelby counties,[19] are considering or are in the process of replacing their voting equipment with equipment that produces a VVPAT. The state coordinator of elections, Mark Goins, speaking at the Tennessee Association of County Election Officials conference in June 2018, recommended that counties delay purchasing DREs or move to VVPAT when they are ready to replace their equipment. His recommendation is based on the current legislative environment and vendor focus on systems with VVPAT.

The state coordinator of elections, Mark Goins, speaking at the Tennessee Association of County Election Officials conference in June 2018, recommended that counties delay purchasing DREs or move to VVPAT when they are ready to replace their equipment.

While 14 counties have chosen to use voting equipment that produces a VVPAT, most counties have not. In interviews with TACIR staff, several county election administrators across the state said they and their election commissions feel confident and satisfied with the DREs they use that do not produce a VVPAT and do not want to replace their equipment with VVPAT equipment. Although some said that the cost of replacing equipment is a major concern, others said that even if funding were provided for VVPAT by the state or federal government, they would prefer to keep their current systems because they believe they are secure, reliable, and efficient. Some also said that if VVPAT were mandated, they would prefer to use add-on equipment available for DREs, such as printers that create VVPATs, because it is cheaper and easier to implement than optical scan systems, particularly systems that use pre-printed ballots. Two administrators also mentioned that storing the new equipment would be an issue and an additional cost in their counties because they would need to lease or build additional secure storage space.[20]

State and local elections officials agree that it is difficult to compare voting equipment costs because counties' needs vary, each county negotiates

[18] Hamilton and Pickett counties have always used paper ballots. Interviews with Mark Goins, coordinator of elections, and Andrew Dodd, elections attorney, Division of Elections, Tennessee Secretary of State, June 20, 2018; and election administrators in Benton, Chester, Coffee, Decatur, Hardin, Lincoln, McNairy, Moore, Pickett, Polk, Sevier, Weakley, and Wilson counties, June and July 2018.

[19] Interviews with Pam Frejosky, election administrator, Cheatham County, June 28, 2018; Jeff Roberts, election administrator, Davidson County, August 7, 2018; Todd Baxter, election administrator, Maury County, September 25, 2018; and Linda Phillips, election administrator, Shelby County, May 30, 2018.

[20] Interviews with election administrators in Campbell, Cocke, Fentress, Henry, Obion, Rhea, Rutherford, Trousdale, and Unicoi counties, September 2018.

its own contract with the vendor,[21] and various factors affect initial and ongoing costs, such as whether ballots are pre-printed or blank before voting. For example, when comparing simple optical scan systems that use hand-marked ballots to hybrid optical systems that use machine-marked ballots, the simple optical scan systems might be less expensive initially because counties need fewer machines per precinct than hybrid systems that use both ballot marking devices and optical scan machines. However, because simple optical scan systems require pre-printed paper ballots for each election, the ongoing costs for these systems might be higher than hybrid systems that use blank paper ballots.[22] The National Conference of State Legislatures agrees that election costs vary widely and provides some ideas to consider when evaluating the purchase and cost of an election system, including the quantity needed or required, licensing, support and maintenance costs, financing options, transportation, and printing (appendix H). In Tennessee, election administrators in counties using or considering VVPAT systems are confident that the security created by VVPAT and increased voter confidence are important regardless of the extra cost.[23]

All but four states are using some type of paper ballot system in at least some jurisdictions, although not all require it by law. Thirty states require either paper ballots or VVPATs for DREs, 14 don't require either, and six require a permanent paper record but don't specify whether it has to be voter-verified. Several states are considering or are in the process of replacing their non-VVPAT equipment with equipment that produces a VVPAT.[24] Table 3 shows what the law requires in each state and the type of equipment each state uses.

Several county election administrators across Tennessee said they and their election commissions feel confident and satisfied with the DREs they use that do not produce a VVPAT and do not want to replace their equipment with VVPAT equipment.

In Tennessee, election administrators in counties using or considering VVPAT systems are confident that the security created by VVPAT and increased voter confidence are important regardless of the extra cost.

[21] In the past, the Secretary of State's office has negotiated a maximum cost of equipment with voting equipment vendors; however, the office interprets a 2010 US EAC Office of the Inspector General audit finding to mean that it should not negotiate with vendors and that each county should use a formal bid process unless it is a sole source contract. The audit finding was in "Administration of Payments Received Under the Help America Vote Act by the Tennessee Secretary of State's Division of Elections April 23, 2003 through June 30, 2009." Email correspondence with Mark Goins, coordinator of elections, Division of Elections, Tennessee Secretary of State, November 26, 2018; and US Election Assistance Commission 2010.

[22] For information about equipment costs, see National Conference of State Legislatures 2018a.

[23] Interviews with county election administrators, June, July, and August 2018.

[24] Email correspondence with Dylan Lynch, policy associate, National Conference of State Legislatures, November 9, 2018; and Verified Voting Foundation, Inc. 2017i.

Table 3. Summary of Paper Ballots and DRE Systems Used and Required in Other States

Type of System Used		Statutory Requirement			
		Statutorily require paper ballots (13)	Statutorily require either paper ballots or VVPATs for DREs (17)	Statutorily require permanent paper record, but voter-verified not specified (6)	No statutory requirement for paper ballots or VVPATs for DREs (14)
All paper or DREs with VVPAT (36)	Paper ballots (18)	**9 states** Iowa, Michigan, Minnesota, Montana, New Hampshire, New Mexico, Rhode Island, South Dakota, Vermont	**4 states** Connecticut, Maine, Maryland, New York	**1 state** Alabama	**4 states** Massachusetts, Nebraska, North Dakota, Virginia
	Vote by mail (3)	**3 states** Colorado, Oregon, Washington			
	Mix of paper ballots and DREs with VVPAT (15)		**12 states** Alaska, Arizona, Arkansas, California, Hawaii, Idaho, Nevada, North Carolina, Ohio, Utah, West Virginia, Wisconsin	**1 state** Illinois	**2 states** Missouri, Wyoming
Mix of paper, VVPAT, and no VVPAT (10)	Mix of paper ballots and DREs with and without VVPAT (2)			**2 states** Kansas, Mississippi	
	Mix of paper ballots and DREs without VVPAT (7)	**1 state** Florida*		**2 states** Indiana, Pennsylvania	**4 states** Kentucky, Oklahoma, **Tennessee**, Texas
	DREs with and without VVPAT (1)		**1 state** New Jersey*		
No paper ballot or DREs with VVPAT (4)					**4 states** Delaware, Georgia, Louisiana, South Carolina

*Although required, New Jersey hasn't had the funding to replace equipment, and the law suspends the requirement until funding is allotted. Florida requires paper ballots, but four counties use a mix of paper ballots and DREs without VVPAT.

Sources: Email correspondence with Dylan Lynch, policy associate, National Conference of State Legislatures, November 9, 2018; and Verified Voting Foundation, Inc. 2017i.

Topic 2: Opportunities to Offset VVPAT Costs with the Use of Secure Electronic Transfer

It remains unclear how much money, if any, secure electronic transfer or online registration would save state and local governments over time and how much of the cost of VVPAT could be offset in Tennessee. Secure electronic transfer, sometimes called automated or electronic registration, digitally transmits voter registration data from state agencies that process voter registration applications to county election commissions, which use the data to verify and update voter rolls. Making the process electronic, rather than relying on paper application forms, could make it easier to register, improve accuracy of voter rolls, and potentially save money.[25] In addition to implementing online voter registration through the Secretary of State's website in 2017,[26] Tennessee implemented a secure method to electronically transfer voter registration data from the Department of Safety, driver services division, in 2018.[27] The system is in place for transactions conducted online through e-Services and at self-service kiosks in driver services centers located in 19 counties.[28] Paper voter registration applications, not secure electronic transfer, continue to be used when in-person transactions are conducted at the counter of driver service centers. In these instances, the completed paper forms are mailed or hand-delivered to the county election commissions, which process the voter registrations.[29]

Making the voter registration process electronic, rather than relying on paper application forms, could make it easier to register, improve accuracy of voter rolls, and potentially save money.

Examples from other states show that state and local governments can save costs with secure electronic transfer. In 2017, the Brennan Center for Justice found that at least 35 states "currently or will soon have fully or substantially electronic voter registration" at motor vehicle departments.[30] Of these 35 states, 29 measured their cost savings and reported that both electronic and online registration resulted in savings for state and local governments, most commonly because of reduced staff time for data entry at the county level.[31] For example, Arizona reported spending a total of $100,000 on an online voter registration system in 2002 and an additional $30,000 in 2005 to implement electronic registration at motor vehicle departments. As a result, Maricopa County reported saving over

[25] Maluk, Perez, and Zhou 2015.
[26] Public Chapter 936, Acts of 2016. See also Tennessee Secretary of State "GoVoteTN" and Tennessee Secretary of State 2017b.
[27] Several state agencies are required to provide for voter registration procedures. Tennessee Code Annotated, Section 2-2-201 et seq.; and Tennessee Secretary of State 2017a.
[28] Interviews with Mark Goins, coordinator of elections, and Andrew Dodd, elections attorney, Division of Elections, Tennessee Secretary of State, June 20 and August 23, 2018; interview with Michael Hogan, director, Driver Services Division, Tennessee Department of Safety and Homeland Security, October 2, 2018; and Tennessee Department of Safety and Homeland Security 2018.
[29] Interview with Michael Hogan, director, Driver Services Division, Tennessee Department of Safety and Homeland Security, October 2, 2018.
[30] Brennan Center for Justice 2017.
[31] Maluk, Perez, and Zhou 2015.

$450,000 in 2008 on printing and processing paper forms.[32] In addition to launching online registration in 2006, Delaware spent $600,000 setting up an e-signature program in 2009, eliminating the need to register with paper forms at the department of motor vehicles and reportedly saving $200,000 in annual labor cost.[33]

A January 2018 survey of Tennessee election officials found that moving away from paper-based voter registration could reduce costs both for state and local governments while improving security, based on responses from 22 of all 95 counties.[34] Although the survey data showed that counties' savings in labor cost per registration application would be small—an average $0.23—the estimated total savings of the 22 survey respondents would be over $400,000, suggesting that the savings would be even greater for all 95 counties.

Of the approximately $28 million that Tennessee has not yet spent from the 2002 federal Help America Vote Act (HAVA), almost $15 million is designated for new voting equipment and $13 million for voter registration system updates, administration, accessibility, and training expenditures.

But in a June 2018 interview with TACIR staff, State Coordinator of Elections Mark Goins said implementing the secure system to electronically transfer data would increase costs for state government because of the setup cost. The director of the driver services division estimates that the Department of Safety spent approximately $422,000 on the system to electronically transmit voter registration applications through the website and at self-service kiosks.[35]

Federal Government Action on Election Security

In 2002, Congress enacted the Help America Vote Act (HAVA), which provided over $3 billion to states to replace punch card and lever voting systems with new technology and mandated statewide voter registration systems.[36] Tennessee received over $57 million[37] and, as mandated, used the funds to replace voting equipment and implement a statewide voter registration system. Of the approximately $28 million that Tennessee has not yet spent, almost $15 million is designated for new voting equipment and $13 million for voter registration system updates, administration, accessibility, and training expenditures.[38] The division of elections granted HAVA funding to each county for voting system purchases, leases, and voting machine training. Appendix I shows how much each county received and which counties have funds remaining as of November

[32] Brennan Center for Justice 2018a.
[33] Brennan Center for Justice 2018b.
[34] Chapin and Daniels 2018; and email correspondence with Doug Chapin, director, Program for Excellence in Election Administration, Humphrey School of Public Affairs, August 8, 2018.
[35] Email correspondence with Michael Hogan, director, Driver Services Division, Tennessee Department of Safety and Homeland Security, October 31 and November 13, 2018.
[36] US Election Assistance Commission 2017.
[37] Including interest earned, the total is approximately $65 million.
[38] Interviews with Mark Goins, coordinator of elections, and Andrew Dodd, elections attorney, Division of Elections, Tennessee Secretary of State, June 20 and August 23, 2018.

2018.[39] While both houses of Congress are considering elections security legislation, in March 2018, President Trump signed the Consolidated Appropriations Act of 2018, which includes $380 million in grants for states to improve and secure the election system, in addition to the funds approved in 2002.[40] Among other authorized actions to improve security, states may use the funds to replace non-VVPAT equipment with VVPAT equipment. Tennessee was eligible for and has received $7.6 million of these funds.[41] The Tennessee Secretary of State's "2018 HAVA Election Security Grant Program Narrative" provides more detail about how the state plans to spend these HAVA funds (appendix J).

The US Department of Homeland Security (DHS) has taken action recently to support election security. In January 2017, the Department designated elections as "critical infrastructure" to more formally make election infrastructure "a priority for cybersecurity assistance and protections" and allow DHS to provide cybersecurity assistance to state and local election officials who request it. However, many state and local election officials question and oppose the designation because of concerns and uncertainty about what the designation means.[42] Convened in October 2017, the first Government Coordinating Council for the new Election Infrastructure Subsector—a collaboration between DHS, the EAC, the National Association of Secretaries of State, and state and local election officials—met to provide "a well-tested mechanism for sharing threat information between the federal government and council partners, advancing risk management efforts, and prioritizing focus of services available to sector partners in a trusted environment."[43] Tennessee's coordinator of elections, Mark Goins, is a member of the Council. Since its first meeting, the Council has helped DHS to deliver services and training to state and local election officials, including onsite risk and vulnerability assessments, and has participated in classified briefings.[44] DHS also launched its Elections Infrastructure Information Sharing and Analysis Center (EI-ISAC) in March 2018,[45] which provides elections-focused cyber defense assistance to state and local elections offices nationwide. Over 450 local election offices and all 50 states are members.[46] And in August 2018, DHS Secretary Kirstjen Nielsen called on "all state and local election officials to make certain that by the 2020 presidential election, every American votes on a verifiable and auditable ballot."[47]

In August 2018, US Department of Homeland Security Secretary Kirstjen Nielsen called on "all state and local election officials to make certain that by the 2020 presidential election, every American votes on a verifiable and auditable ballot."

[39] Email correspondence with Mark Goins, coordinator of elections, Division of Elections, Tennessee Secretary of State, November 26, 2018.
[40] US Election Assistance Commission 2018d.
[41] Including the 5% state match, the total award available to Tennessee is $7.9 million.
[42] US Department of Homeland Security 2017b; and US Department of Homeland Security 2018b.
[43] US Department of Homeland Security 2017a.
[44] Lawson et al. 2018.
[45] US Department of Homeland Security 2018a.
[46] National Association of Counties 2018.
[47] Beavers 2018.

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APPENDIX A: APRIL 2018 LETTER FROM SENATOR NICELEY

April 16, 2018

Honorable Mark Norris
702 Cordell Hull Building

Honorable Jeff Yarbro
762 Cordell Hull Building

Dear Colleagues:

I am writing to request your assistance as members of the Tennessee Advisory Commission on Intergovernmental Relations in addressing an issue of immediate concern to the people of Tennessee.

In 2007, TACIR presented to the General Assembly a staff report entitled *Trust But Verify.* Included among the report's findings was a recommendation that Tennessee's election system adopt a voter-verified paper audit trail (VVPAT) as a way of protecting the integrity of our voting process in the event electronic voting machines were intentionally or unintentionally compromised.

While the 2007 TACIR recommendation regarding VVPAT was never implemented, new threats to our voting system have emerged that make it timely to revisit and update the 2007 study. In particular, the federal Department of Homeland Security has warned that 21 states were the focus of efforts by foreign governments to penetrate their voter data bases with the goal of weakening public confidence in the election process. There is further evidence in recent months that hostile nations, including North Korea, have developed the ability to gain access to voting machines not connected to the internet.

Given the greatly increased security risks to our voting system, along with the need to address these risks in a thoughtful and fiscally responsible manner, I am requesting that TACIR update the section of the 2007 report that addresses two topics related to a voter-verified paper audit trail. Specifically, these topics should include:

1) The most cost-effective and efficient VVPAT options for Tennessee counties
2) Opportunities to offset VVPAT costs with the use of Secure Electronic Transfer, a system used by 35 states to ensure that data from all state agencies is available to verify the accuracy of voter roles

I am aware of the numerous tasks that TACIR will undertake this year, and do not feel we need a comprehensive study--only a staff report to update a narrow section of the 2007 study. I feel the

risk to public confidence in Tennessee's election process makes this request worthy of consideration.

I very much appreciate your consideration of this request. I appreciate all you do for Tennessee.

Sincerely,
Frank Niceley

C: Cliff Lippard, Executive Director, TACIR

APPENDIX B: *TRUST BUT VERIFY: INCREASING VOTER CONFIDENCE IN ELECTION RESULTS,* 2007 REPORT BRIEF

A Publication of the Tennessee Advisory Commission on Intergovernmental Relations

TACIR STAFF RESEARCH BRIEF

Number 17 January 2008 www.state.tn.us/tacir

"There is a better way to do it. Find it."

—Thomas Edison

TRUST BUT VERIFY: TOWARD INCREASING VOTER CONFIDENCE IN ELECTION RESULTS

by Harry A. Green and Rose Naccarato

INTRODUCTION

In December 2006, the Tennessee Advisory Commission on Intergovernmental Relations began a review of the entire election process, including an examination of the advantages and disadvantages of voting machines currently used in Tennessee. This first report focuses on issues related to voting machines because any changes to voting systems will take time to implement. Subsequent reports will examine other aspects of the electoral process, including ensuring voter eligibility and regularly auditing compliance with election rules and procedures.

This brief reports the findings and recommendations related to voting machines.

FINDINGS

- There are no formal requirements or methods for reporting voting problems in Tennessee or nationally.
- Voter verified paper audit trails (VVPAT) reassure voters that their vote is being counted accurately and can be audited or recounted.
- Many experts and advocates believe the direct recording electronic machines (DREs) are especially

Representative Randy Rinks ◆ Chairman Harry A. Green ◆ Executive Director

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vulnerable to tampering and fraud because most do not physically document votes so that they can be independently recounted or audited.

- Vulnerability in all electronic or computerized systems can stem from computer codes that are subject to tampering, connections to other computers that can allow hacking, and weak data encryption.
- Governmental entities and private corporations are routinely audited regardless of whether problems are suspected. With so much at stake, the same should be true for elections.
- In Tennessee, nearly 50% of the statewide November 2006 vote was cast early.

TACIR STAFF RECOMMENDATIONS

- Implement VVPAT statewide within a reasonable time frame.
- Adopt VVPAT that can be counted by hand, as well as by machine—machine tallies to support prompt reporting of results with hand counting for audit and recount purposes.
- Adopt a standard for VVPAT that would meet federal guidelines.
- Request a review by the Election Assistance Commission to find out how much of Tennessee's remaining Help America Vote Act (HAVA) funds would be available to purchase new voting machines.
- Require voting machine vendors to escrow all of their proprietary software so that it can be reviewed by experts as recommended by the Commission on Federal Election Reform and secured for further analysis if vote-counting problems should arise.
- Strengthen audit requirements to ensure that a random sample of machines is routinely tested.
- Consider making early voting and voting by mail more accessible.
- Implement a Vote by Mail pilot program that would allow the state to assess the advantages and disadvantages of this type of voting in Tennessee.
- Strengthen security and pre-test requirements and make them consistent for all voting systems.
- Implement election day parallel voting machine tests to detect any hidden programs that are triggered by election day conditions and are erased so that they cannot be detected later.
- Allow government employees to serve as poll workers, with restrictions on those who work directly for a candidate on the ballot.
- Extend the minimum age for poll workers to 16 and ensure students receive an excused absence from school on election day to work at the polls.
- Encourage counties to partner with high schools and colleges to set up programs that would motivate students to work at the polls.

Tennessee Advisory Commission on Intergovernmental Relations, Authorization No. 316379; 1,000 copies, January 2008. This document was promulgated at a cost of $.70 per copy.

APPENDIX C: US SENATE SELECT COMMITTEE ON INTELLIGENCE MAY 8, 2018, FINDINGS AND RECOMMENDATIONS

Russian Targeting of Election Infrastructure During the 2016 Election: Summary of Initial Findings and Recommendations

May 8, 2018

Overview

In 2016, cyber actors affiliated with the Russian Government conducted an unprecedented, coordinated cyber campaign against state election infrastructure. Russian actors scanned databases for vulnerabilities, attempted intrusions, and in a small number of cases successfully penetrated a voter registration database. This activity was part of a larger campaign to prepare to undermine confidence in the voting process. The Committee has not seen any evidence that vote tallies were manipulated or that voter registration information was deleted or modified.

- The Committee has limited information about whether, and to what extent, state and local officials carried out forensic or other examination of election infrastructure systems in order to confirm whether election-related systems were compromised. It is possible that additional activity occurred and has not yet been uncovered.

Summary of Initial Findings

- Cyber actors affiliated with the Russian government scanned state systems extensively throughout the 2016 election cycle. These cyber actors made attempts to access numerous state election systems, and in a small number of cases accessed voter registration databases.
    - At least 18 states had election systems targeted by Russian-affiliated cyber actors in some fashion.[1] Elements of the IC have varying levels of confidence about three additional states, for a possible total of at least 21. In addition, other states saw suspicious or malicious behavior the IC has been unable to attribute to Russia.
    - Almost all of the states that were targeted observed vulnerability scanning directed at their Secretary of State websites or voter registration infrastructure. Other scans were broader or less specific in their target.
    - In at least six states, the Russian-affiliated cyber actors went beyond scanning and conducted malicious access attempts on voting-related websites.[2]
      In a small number of states, Russian-affiliated cyber actors were able to gain access to restricted elements of election infrastructure. In a small number of states, these cyber actors were in a position to, at a minimum, alter or delete voter

[1] These numbers only account for state or local government targets. DHS did not include states which may have witnessed attacks on political parties, political organizations, or NGOs. In addition, the numbers do not include any potential attacks on third-party vendors.
[2] In the majority of these instances, Russian government-affiliated cyber actors used Structure Query Language (SQL) injection - a well-known technique for cyberattacks on public-facing websites.

registration data; however, they did not appear to be in a position to manipulate individual votes or aggregate vote totals.

- The Committee found that in addition to the cyber activity directed at state election infrastructure, Russia undertook a wide variety of intelligence-related activities targeting the U.S. voting process. These activities began at least as early as 2014, continued through Election Day 2016, and included traditional information gathering efforts as well as operations likely aimed at preparing to discredit the integrity of the U.S. voting process and election results.

- The Committee's assessments, as well as the assessments of the Department of Homeland Security (DHS) and the Federal Bureau of Investigation (FBI), are based on self-reporting by the states. DHS has been clear in its representations to the Committee that the Department did not have perfect insight into these cyber activities. It is possible that more states were attacked, but the activity was not detected. In light of the technical challenges associated with cyber forensic analysis, it is also possible that states may have overlooked some indicators of compromise.

- The Committee saw no evidence that votes were changed and found that, on balance, the diversity of our voting infrastructure is a strength. Because of the variety of systems and equipment, changing votes on a large scale would require an extensive, complex, and state or country-level campaign. However, the Committee notes that a small number of districts in key states can have a significant impact in a national election.

Actors and Motive

- The Committee concurs with the IC that Russian government-affiliated actors were behind the cyber activity directed against state election infrastructure.

- While the full scope of Russian activity against the states remains unclear because of collection gaps, the Committee found ample evidence to conclude that the Russian government was developing capabilities to undermine confidence in our election infrastructure, including voter processes.

- The Committee does not know whether the Russian government-affiliated actors intended to exploit vulnerabilities during the 2016 elections and decided against taking action, or whether they were merely gathering information and testing capabilities for a future attack. Regardless, the Committee believes the activity indicates an intent to go beyond traditional intelligence collection.

DHS Efforts to Bolster Election Security

- The Committee found that DHS's initial response was inadequate to counter the threat. In the summer of 2016, as the threat to the election infrastructure emerged, DHS attempted outreach to the states, seeking to highlight the threat for information technology (IT) directors without divulging classified information. By the fall of 2016, as the threat

became clearer, DHS attempted a more extensive outreach to the states with limited success.

  - At the outset, DHS was not well-positioned to provide effective support to states confronting a hostile nation-state cyber actor.
  - In addition, members of the Obama administration were concerned that, by raising the alarm, they would create the very impression they were trying to avoid—calling into question the integrity of election systems.

- DHS and FBI alerts to the states in the summer and fall of 2016 were limited in substance and distribution. Although DHS provided warning to IT staff in the fall of 2016, notifications to state elections officials were delayed by nearly a year. Therefore, states understood that there was a cyber threat, but did not appreciate the scope, seriousness, or implications of the particular threat they were facing.

  - Many state election officials reported hearing for the first time about the Russian attempts to scan and penetrate state systems from the press or from the public Committee hearing on June 21, 2017. DHS's notifications in the summer of 2016 and the public statement by DHS and the ODNI in October 2016 were not sufficient warning.
  - It was not until September of 2017, and only under significant pressure from this Committee and others, that DHS reached out directly to chief election officials in the targeted states to alert the appropriate election officials about the scanning activity and other attacks and the actor behind them. (However, the Committee notes that in the small number of cases where election-related systems had been compromised, the federal government was in contact with senior election officials at the time the intrusion was discovered.)

- The Committee found that DHS is engaging state election officials more effectively now than in the summer of 2016. Although early interactions between state election officials and DHS were strained, states now largely give DHS credit for making tremendous progress over the last six months.

  - States have signed up for many of the resources that DHS has to offer, and DHS has hosted meetings of the Government Coordinating Council and Sector Coordinating Council, as required under the critical infrastructure designation. Those interactions have begun to increase trust and communication between federal and state entities.
  - DHS hosted a classified briefing for state chief election officials and is working through providing security clearances for those officials.
  - An Election Infrastructure Information Sharing and Analysis Center has been established, focused on sharing network defense information with state and local election officials.

Ongoing Vulnerabilities:

Despite the progress on communication and improvements to the security of our election process, the Committee remains concerned about a number of potential vulnerabilities in election infrastructure.

- Voting systems across the United States are outdated, and many do not have a paper record of votes as a backup counting system that can be reliably audited, should there be allegations of machine manipulation. In addition, the number of vendors selling machines is shrinking, raising concerns about supply chain vulnerability.
    - Paperless Direct Recording Electronic (DRE) voting machines—machines with electronic interfaces that electronically store votes (as opposed to paper ballots or optical scanners)—are used in jurisdictions in 30 states and are at highest risk for security flaws. Five states use DREs exclusively.
- Many aspects of election infrastructure systems are connected to and can be accessed over the internet. Furthermore, systems that are not connected to the internet, such as voting machines, may still be updated via software downloaded from the internet.
    - These potentially vulnerable systems include some of the core components of U.S. election infrastructure, including systems affiliated with voter registration databases, electronic poll books, vote casting, vote tallying, and unofficial election night reporting to the general public and the media. Risk-limiting audits are a best practice to mitigate risk.
- Vendors of election software and equipment play a critical role in the U.S. election system, and the Committee continues to be concerned that vendors represent an enticing target or malicious cyber actors. State local, territorial, tribal, and federal government authorities have very little insight into the cyber security practices of many of these vendors, and while the Election Assistance Commission issues guidelines for Security, abiding by those guidelines is currently voluntary.

Summary of SSCI Recommendations

The Senate Select Committee on Intelligence has examined evidence of Russian attempts to target election infrastructure during the 2016 U.S. elections. The Committee has reviewed the steps state and local election officials have taken to ensure the integrity of our elections and agrees that U.S. election infrastructure is fundamentally resilient. The Department of Homeland Security, the Election Assistance Commission, state and local governments, and other groups have already taken beneficial steps toward addressing the vulnerabilities exposed during the 2016 election cycle, including some of the measures listed below, but more needs to be done. The Committee recommends the following steps to better defend against a hostile nation-state who may seek to undermine our democracy:

1. **Reinforce States' Primacy in Running Elections**
    - States should remain firmly in the lead on running elections, and the Federal government should ensure they receive the necessary resources and information.

2. **Build a Stronger Defense, Part I: Create Effective Deterrence**
   - The U.S. Government should clearly communicate to adversaries that an attack on our election infrastructure is a hostile act, and we will respond accordingly.
   - The Federal government, in particular the State Department and Defense Department, should engage allies and partners to establish new international cyber norms.

3. **Build a Stronger Defense, Part II: Improve Information Sharing on Threats**
   - The Intelligence Community should put a high priority on attributing cyberattacks both quickly and accurately. Similarly, policymakers should make plans to operate prior to attribution.
   - DHS must create clear channels of communication between the Federal government and appropriate officials at the state and local levels. We recommend that state and local governments reciprocate that communication.
   - Election experts, security officials, cybersecurity experts, and the media should develop a common set of precise and well-defined election security terms to improve communication.
   - DHS should expedite security clearances for appropriate state and local officials.
   - The Intelligence Community should work to declassify information quickly, whenever possible, to provide warning to appropriate state and local officials.

4. **Build a Stronger Defense, Part III: Secure Election-Related Systems**
   - Cybersecurity should be a high priority for those managing election systems.
   - The Committee recommends State and Local officials prioritize the following:
     - Institute two-factor authentication for state databases.
     - Install monitoring sensors on state systems. One option is to further expand DHS's ALBERT network.
     - Identify the weak points in the network, including any under-resourced localities, and prioritize assistance towards those entities.
     - Update software in voter registration systems. Create backups, including paper copies, of state voter registration databases. Include voter registration database recovery in state continuity of operations plans.
     - Consider a voter education program to ensure voters check registration well prior to an election.
     - Undertake intensive security audits of state and local voter registration systems, ideally utilizing an outside entity.
     - Perform risk assessments for any current or potential third-party vendors to ensure they are meeting the necessary cyber security standards in protecting their election systems.

   - The Committee recommends DHS take the following steps:
     - Working closely with election experts, develop a risk management framework that can be used in engagements with state and local election infrastructure owners to document and mitigate risks to all components of the electoral process.
     - Create voluntary guidelines on cybersecurity best practices and a public awareness campaign to promote election security awareness, working through the U.S. Election Assistance Commission (EAC), the National Association of

Secretaries of State (NASS), and the National Association of State Election Directors (NASED).
    - Maintain and more aggressively promote the catalog of services DHS has available for states to help secure their systems, and update the catalog as DHS refines their understanding of what states need.
    - Expand capacity to reduce wait times for DHS cybersecurity services.
    - Work with GSA to establish a list of credible private sector vendors who can provide services similar to those provided by DHS.

5. **Build a Stronger Defense, Part IV: Take Steps to Secure the Vote Itself**
    - States should rapidly replace outdated and vulnerable voting systems. At a minimum, any machine purchased going forward should have a voter-verified paper trail and no WiFi capability. If use of paper ballots becomes more widespread, election officials should re-examine current practices for securing the chain of custody of all paper ballots and verify no opportunities exist for the introduction of fraudulent votes.
    - States should consider implementing more widespread, statistically sound audits of election results. Risk-limiting audits, in particular, can be a cost-effective way to ensure that votes cast are votes counted.
    - DHS should work with vendors to educate them about the potential vulnerabilities of both voting machines and the supply chains.

6. **Assistance for the States**
    - States should use federal grant funds to improve cybersecurity by hiring additional Information Technology staff, updating software, and contracting vendors to provide cybersecurity services, among other steps. Funds should also be available to defray the costs of instituting audits.

###

APPENDIX D: SENATE BILL 2438 BY YARBRO AND HOUSE BILL 2567 BY STEWART

SENATE BILL 2438
By Yarbro

HOUSE BILL 2567

By Stewart

AN ACT to amend Tennessee Code Annotated, Title 2, Chapter 20, relative to precinct-based optical scanners.

BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF TENNESSEE:

SECTION 1. Tennessee Code Annotated, Section 2-20-101, is amended by deleting subsection (a) and substituting instead the following:

(a) Notwithstanding any state law to the contrary, and no later than January 1, 2020, each county election commission shall utilize precinct-based optical scanners.

SECTION 2. This act shall take effect upon becoming a law, the public welfare requiring it.

APPENDIX E: SENATE BILL 2090 BY NICELEY AND HOUSE BILL 2300 BY BECK

HOUSE BILL 2300
By Beck

SENATE BILL 2090

By Niceley

AN ACT to amend Tennessee Code Annotated, Title 2, Chapter 9, relative to records of votes.

BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF TENNESSEE:

SECTION 1. Tennessee Code Annotated, Title 2, Chapter 9, is amended by adding the following as a new section:

(a) As used in this section:

(1) "DRE system" means a direct recording electronic voting system; and

(2) "VVPAT" means a voter-verifiable paper audit trail, which is a record contemporaneously printed at the time a voter casts a ballot using a DRE system.

(b) Before January 1, 2020, each precinct using a DRE system must have the capability to create a VVPAT for each ballot cast.

(c) VVPATs must be preserved as paper ballots pursuant to § 2-8-108.

(d) At the request of a county election commission, the state coordinator of elections shall provide to the commission necessary assistance and guidance in the selection or upgrade of a DRE system pursuant to the requirements of this section. To the extent federal funding through the Help America Vote Act (HAVA), compiled generally in 52 U.S.C. § 20901 et seq., remains available for the cost of purchasing, leasing, or upgrading any DRE systems, the coordinator shall provide financial assistance for purchasing or leasing such systems.

SECTION 2. This act shall take effect upon becoming a law, the public welfare requiring it.

APPENDIX F: DESCRIPTIONS OF VOTING EQUIPMENT

The US Election Assistance Commission (EAC) defined voting system categories in its 2016 Election Administration and Voting Survey (EAVS).[48] Several types of systems are currently used in the US: direct recording electronic (DRE) voting machines with and without VVPAT, hybrid or electronic vote selection (optical scan with ballot marking device), optical scan, and hand-counted paper ballots.

Direct recording electronic (DRE) voting machines without a voter-verified paper audit trail (VVPAT)

"A voting system (push-button or touch screen) that records votes by means of a ballot display provided with mechanical or electro-optical components activated by the voter, where voting data are stored in a removable memory component. DRE is also referred to as an 'electronic' voting system." DREs record and save votes electronically and do not create a paper record or use paper ballots.

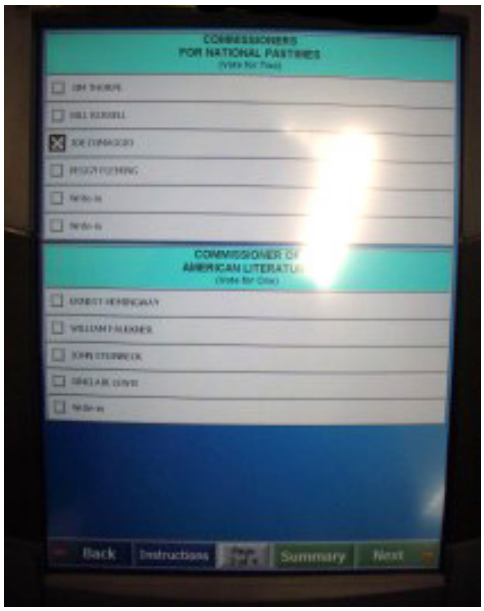

Photo Source: Verified Voting Foundation, Inc. 2017g; and Verified Voting Foundation, Inc. 2017h.

[48] The equipment definitions that are included in quotes in this appendix are found at: US Election Assistance Commission 2018a.

Direct recording electronic (DRE) voting machines with a voter-verified paper audit trail (VVPAT)

"A voting system (push-button or touch screen) that records votes by means of a ballot display provided with mechanical or electro-optical components activated by the voter, where voting data are stored both in a removable memory component and on a paper document that the voter can review before officially casting his or her ballot." A printer that prints and displays the voter's choices before the ballot is submitted, recorded, and saved electronically can be added to some DRE machines. The printed record is securely stored and used later for recounts and auditing purposes.

Photo Source: Verified Voting Foundation, Inc. 2017d.

Photo source: Verified Voting Foundation, Inc. 2017f.

Hybrid or electronic vote selection (optical scan with ballot marking device)

"A vote selection system (push-button or touch screen) in which the voter selects candidate choices by means of a ballot display provided with mechanical or electro-optical components activated by the voter, but no voting data is stored in the system. Instead, a paper ballot is printed that contains marks in voting response fields that are read by an optical scanner or similar sensor." This system is often called the hybrid system because it uses two machines—one is the ballot marking device that marks blank ballots and prints the marked ballots and the other is the machine that scans the marked ballot and tallies the votes. The scanned ballots are securely stored and used later for recounts and auditing purposes.

Photo source: Verified Voting Foundation, Inc. 2017c; and Verified Voting Foundation, Inc. 2017b.

Optical scan

"A system of recording votes by marks in voting response fields on ballot cards that are read by an optical scanner or similar sensor. These are also referred to as 'mark-sense' voting systems." The optical scan system uses pre-printed ballots that voters mark by hand then insert into the machine to be scanned. The marked ballots are securely stored and used later for recounts and auditing purposes.

Photo source: Verified Voting Foundation, Inc. 2017e; and Verified Voting Foundation, Inc. 2017a.

Hand-counted paper ballots

"A system where voters mark a paper ballot by hand and then each race on each ballot is counted by hand, without the use of a scanner, tabulator, or sensor." Voters mark ballots by hand, and no electronic machines are used. The marked ballots are securely stored and used later for recounts and auditing purposes.

Photo source: Verified Voting Foundation, Inc. 2017j.

APPENDIX G: VOTING SYSTEMS BY COUNTY, TENNESSEE SECRETARY OF STATE

Tennessee Secretary of State
Secretary of State Tre Hargett

Division of Elections
Mark Goins, Coordinator of Elections

Voting Systems by County

County	Manufacturer	System
Anderson	Hart	eSlate
Bedford	MicroVote	Infinity
Benton	Hart	Verity Scan
Bledsoe	Hart	eSlate
Blount	Hart	eSlate
Bradley	MicroVote	Infinity
Campbell	Hart	eSlate
Cannon	MicroVote	Infinity
Carroll	Hart	eSlate
Carter	MicroVote	Infinity
Cheatham	Hart	eSlate
Chester	ES&S	ExpressVote
Claiborne	Hart	eSlate
Clay	MicroVote	Infinity
Cocke	MicroVote	Infinity
Coffee	ES&S	ExpressVote
Crockett	MicroVote	Infinity
Cumberland	MicroVote	Infinity
Davidson	ES&S	iVotronic
Decatur	ES&S	ExpressVote
DeKalb	MicroVote	Infinity
Dickson	Hart	eSlate
Dyer	MicroVote	Infinity
Fayette	MicroVote	Infinity
Fentress	MicroVote	Infinity
Franklin	MicroVote	Infinity
Gibson	MicroVote	Infinity
Giles	MicroVote	Infinity
Grainger	Hart	eSlate
Greene	ES&S	iVotronic

County	Manufacturer	System
Grundy	MicroVote	Infinity
Hamblen	MicroVote	Infinity
Hamilton	Dominion	ImageCast Optical Scan
Hancock	Hart	eSlate
Hardeman	Hart	eSlate
Hardin	ES&S	ExpressVote
Hawkins	MicroVote	Infinity
Haywood	Hart	eSlate
Henderson	Hart	eSlate
Henry	MicroVote	Infinity
Hickman	Hart	eSlate
Houston	Hart	eSlate
Humphreys	Hart	eSlate
Jackson	MicroVote	Infinity
Jefferson	MicroVote	Infinity
Johnson	MicroVote	Infinity
Knox	Hart	eSlate
Lake	ES&S	iVotronic
Lauderdale	MicroVote	Infinity
Lawrence	MicroVote	Infinity
Lewis	Hart	eSlate
Lincoln	ES&S	ExpressVote
Loudon	Hart	eSlate
Macon	MicroVote	Infinity
Madison	Hart	eSlate
Marion	Hart	Verity Touch
Marshall	MicroVote	Infinity
Maury	ES&S	iVotronic
McMinn	Hart	eSlate
McNairy	ES&S	ExpressVote
Meigs	MicroVote	Infinity
Monroe	Hart	eSlate
Montgomery	MicroVote	Infinity
Moore	ES&S	ExpressVote

County	Manufacturer	System
Morgan	Hart	eSlate
Obion	Hart	Verity Touch
Overton	MicroVote	Infinity
Perry	MicroVote	Infinity
Pickett	ES&S	Optical Scan
Polk	Unisyn	OpenElect Optical Scan
Putnam	MicroVote	Infinity
Rhea	Hart	eSlate
Roane	Hart	eSlate
Robertson	MicroVote	Infinity
Rutherford	MicroVote	Infinity
Scott	MicroVote	Infinity
Sequatchie	MicroVote	Infinity
Sevier	ES&S	ExpressVote
Shelby	ES&S	AccuVote TSX
Smith	MicroVote	Infinity
Stewart	MicroVote	Infinity
Sullivan	Hart	eSlate
Sumner	MicroVote	Infinity
Tipton	MicroVote	Infinity
Trousdale	MicroVote	Infinity
Unicoi	MicroVote	Infinity
Union	MicroVote	Infinity
Van Buren	MicroVote	Infinity
Warren	MicroVote	Infinity
Washington	MicroVote	Infinity
Wayne	MicroVote	Infinity
Weakley	ES&S	ExpressVote
White	Hart	eSlate
Williamson	ES&S	iVotronic
Wilson	ES&S	ExpressVote

Last updated July 20, 2018

APPENDIX H: NATIONAL CONFERENCE OF STATE LEGISLATURES COST CONSIDERATIONS FOR ELECTION VOTING SYSTEMS

To determine the cost of an election system, the original purchase price is only one element. Additionally, costs for transportation, printing and maintenance must be considered. Costs vary widely depending on the number of units requested, which vendor is chosen, whether or not maintenance is included, etc. Recently, jurisdictions have also taken advantage of financing options available from vendors, so costs can be spread out over a number of years. Here are some things to consider when evaluating the potential cost of a new voting system:

Quantity needed/required. For polling place units (DREs, precinct scanners, or BMDs) sufficient machines must be provided to keep voter traffic flowing. Some states also have statutory requirements for the number of machines that must be provided per polling place. For central count scanners, the equipment must be sufficient to be able to consistently process ballots and provide results in a timely manner. Vendors provide different options for central count scanners, some of which process ballots faster than others.

Licensing. The software that accompanies any voting system usually comes with annual licensing fees, which affects the long-term cost of the system.

Support and maintenance costs. Vendors often provide a variety of support and maintenance options at different price points throughout the life of a voting system contract. These contracts are a significant portion of the overall cost of the system.

Financing options. In addition to an outright purchase, vendors may offer lease options to jurisdictions looking to acquire a new system.

Transportation. Transporting machines from a warehouse to voting locations must be considered with machines that are used at polling places, but is usually not a concern with a central count system that stays at the elections office year-round.

Printing. Paper ballots must be printed. If there are several different ballot styles and/or language requirements, printing costs can add up. Some jurisdictions use ballot-on-demand printers that allow jurisdictions to print paper ballots with the correct ballot style as needed and avoid overprinting. DREs can provide as many different ballot styles as necessary and provide ballots in other languages, so no printing is required.

Source: National Conference of State Legislatures 2018a.

APPENDIX I: 2002 HAVA FUNDS ALLOCATED TO TENNESSEE COUNTIES AND FUNDS REMAINING AS OF NOVEMBER 2018

County	Type of Voting System (as of August 2018)	Amount Spent	Funds Remaining	Total Amount Allocated
Anderson	DRE without VVPAT	$ 405,575	$ 290,000	$ 695,575
Bedford	DRE without VVPAT	288,005	0	288,005
Benton	optical scan	264,625	0	264,625
Bledsoe	DRE without VVPAT	166,995	130,000	296,995
Blount	DRE without VVPAT	503,905	380,000	883,905
Bradley	DRE without VVPAT	565,540	0	565,540
Campbell	DRE without VVPAT	313,840	230,000	543,840
Cannon	DRE without VVPAT	135,639	0	135,639
Carroll	DRE without VVPAT	255,575	210,000	465,575
Carter	DRE without VVPAT	412,738	0	412,738
Cheatham	DRE without VVPAT	191,683	110,000	301,683
Chester	ballot marking device and optical scan	297,040	0	297,040
Claiborne	DRE without VVPAT	236,405	190,000	426,405
Clay	DRE without VVPAT	115,674	0	115,674
Cocke	DRE without VVPAT	231,819	0	231,819
Coffee	ballot marking device and optical scan	538,402	0	538,402
Crockett	DRE without VVPAT	196,409	0	196,409
Cumberland	DRE without VVPAT	381,729	0	381,729
Davidson	DRE without VVPAT	2,393,900	1,710,000	4,103,900
Decatur	ballot marking device and optical scan	291,828	0	291,828
DeKalb	DRE without VVPAT	188,258	0	188,258
Dickson	DRE without VVPAT	260,575	190,000	450,575
Dyer	DRE without VVPAT	345,612	0	345,612
Fayette	DRE without VVPAT	331,621	0	331,621
Fentress	DRE without VVPAT	216,237	0	216,237
Franklin	DRE without VVPAT	301,628	0	301,628
Gibson	DRE without VVPAT	473,742	0	473,742
Giles	DRE without VVPAT	217,693	0	217,693
Grainger	DRE without VVPAT	134,370	120,000	254,370
Greene	DRE without VVPAT	374,195	420,000	794,195
Grundy	DRE without VVPAT	174,577	0	174,577
Hamblen	DRE without VVPAT	377,977	0	377,977
Hamilton	optical scan	1,636,032	0	1,636,032
Hancock	DRE without VVPAT	92,488	80,000	172,488
Hardeman	DRE without VVPAT	208,290	150,000	358,290
Hardin	ballot marking device and optical scan	381,138	0	381,138

County	Type of Voting System (as of August 2018)	Amount Spent	Funds Remaining	Total Amount Allocated
Hawkins	DRE without VVPAT	498,899	0	498,899
Haywood	DRE without VVPAT	204,125	120,000	324,125
Henderson	DRE without VVPAT	203,915	170,000	373,915
Henry	DRE without VVPAT	298,087	0	298,087
Hickman	DRE without VVPAT	236,150	140,000	376,150
Houston	DRE without VVPAT	92,545	80,000	172,545
Humphreys	DRE without VVPAT	153,750	90,000	243,750
Jackson	DRE without VVPAT	175,866	0	175,866
Jefferson	DRE without VVPAT	233,056	0	233,056
Johnson	DRE without VVPAT	176,544	0	176,544
Knox	DRE without VVPAT	1,260,075	930,000	2,190,075
Lake	DRE without VVPAT	67,831	40,000	107,831
Lauderdale	DRE without VVPAT	278,545	0	278,545
Lawrence	DRE without VVPAT	372,983	0	372,983
Lewis	DRE without VVPAT	145,460	100,000	245,460
Lincoln	ballot marking device and optical scan	452,242	0	452,242
Loudon	DRE without VVPAT	259,760	180,000	439,760
Macon	DRE without VVPAT	194,441	0	194,441
Madison	DRE without VVPAT	588,060	360,000	948,060
Marion	DRE without VVPAT	233,940	220,000	453,940
Marshall	DRE without VVPAT	264,121	0	264,121
Maury	DRE without VVPAT	440,514	230,000	670,514
McMinn	DRE without VVPAT	251,225	170,000	421,225
McNairy	ballot marking device and optical scan	388,519	0	388,519
Meigs	DRE without VVPAT	115,628	0	115,628
Monroe	DRE without VVPAT	256,360	150,000	406,360
Montgomery	DRE without VVPAT	676,788	0	676,788
Moore	ballot marking device and optical scan	83,874	0	83,874
Morgan	DRE without VVPAT	145,588	110,000	255,588
Obion	DRE without VVPAT	354,800	0	354,800
Overton	DRE without VVPAT	226,624	0	226,624
Perry	DRE without VVPAT	136,958	0	136,958
Pickett	optical scan	203,630	0	203,630
Polk	optical scan	327,075	0	327,075
Putnam	DRE without VVPAT	367,432	0	367,432
Rhea	DRE without VVPAT	234,830	140,000	374,830
Roane	DRE without VVPAT	233,700	270,000	503,700
Robertson	DRE without VVPAT	351,950	0	351,950
Rutherford	DRE without VVPAT	1,203,985	0	1,203,985

County	Type of Voting System (as of August 2018)	Amount Spent	Funds Remaining	Total Amount Allocated
Scott	DRE without VVPAT	254,336	0	254,336
Sequatchie	DRE without VVPAT	160,955	0	160,955
Sevier	ballot marking device and optical scan	737,587	0	737,587
Shelby	DRE without VVPAT	3,397,860	2,330,000	5,727,860
Smith	DRE without VVPAT	208,753	0	208,753
Stewart	DRE without VVPAT	172,562	0	172,562
Sullivan	DRE without VVPAT	418,445	300,000	718,445
Sumner	DRE without VVPAT	763,448	0	763,448
Tipton	DRE without VVPAT	417,388	0	417,388
Trousdale	DRE without VVPAT	125,193	0	125,193
Unicoi	DRE without VVPAT	165,563	0	165,563
Union	DRE without VVPAT	187,205	0	187,205
Van Buren	DRE without VVPAT	121,549	0	121,549
Warren	DRE without VVPAT	300,738	0	300,738
Washington	DRE without VVPAT	475,985	0	475,985
Wayne	DRE without VVPAT	209,783	0	209,783
Weakley	ballot marking device and optical scan	304,452	0	304,452
White	DRE without VVPAT	204,710	120,000	324,710
Williamson	DRE without VVPAT	843,645	460,000	1,303,645
Wilson	ballot marking device and optical scan	637,350	0	637,350
Total		**$ 36,399,141**	**$ 10,920,000**	**$ 47,319,141**

Note: Approximately $4 million that is not included in the table is available for voting equipment but not allocated to specific counties.

Sources: Email correspondence with Mark Goins, coordinator of elections, Division of Elections, Tennessee Secretary of State, November 26, 2018; interview with Mark Goins, coordinator of elections, and Andrew Dodd, elections attorney, Division of Elections, Tennessee Secretary of State, June 20, 2018; interviews with county election administrators, June and July 2018; and Tennessee Secretary of State 2018.

APPENDIX J: TENNESSEE SECRETARY OF STATE "2018 HAVA ELECTION SECURITY GRANT PROGRAM NARRATIVE"

2018 HAVA Election Security Grant

Program Narrative

Award and Match

The Consolidated Appropriations Act of 2018 provided additional Help America Vote Act (HAVA) Section 101 funds to "improve the administration of elections for Federal office, including to enhance election technology and make election security improvements."

Tennessee has received $7,565,418 from the Election Assistance Commission (EAC). We understand that a $378,271 (5%) state match is required by March 22, 2020. Rather than seek an appropriation during the upcoming state budget, these funds will be provided by departmental cost savings in the 2017-2018 state fiscal year. We acknowledge that the funds must be used by March 22, 2023.

Voting Equipment Replacement and Upgrades

In Tennessee, county election commissions decide which voting system to use in their jurisdiction. Counties may purchase any system that has been approved for use in the state by the State Election Commission and Coordinator of Elections. We have used and will continue to use existing HAVA dollars to provide subgrants to assist counties in the purchase of approved voting systems. These new funds will supplement that ongoing effort.

We anticipate continuing to distribute funds based on the number of precincts and early voting sites in each county and have budgeted $4,342,000 to address needs in this category.

Voting Registration Systems and Management

The Division of Elections oversees the statewide voter registration database, which is managed by one system administrator. In 2017, we implemented an online voter registration system, and with our continued focus on securing our system and systems at the county level, it may become necessary to employ an additional staff member to assist in providing technical support to county election commissions.

Additionally, we are considering upgrading our current statewide voter registration system, which would require new software and infrastructure.

We have budgeted $2,000,000 to address needs in this category.

Cyber Vulnerabilities & Training

The Division of Elections has engaged with a leading cybersecurity vendor to offer on-site scans to each county election commission office prior to the November 2018 general election at a cost of approximately $260,000. The Division of Elections will use the results of these scans to

determine if further mitigation measures are needed and will use these funds as necessary to make improvements.

We plan to explore offering remote scans on a regular basis going forward. Based on one estimate, quarterly scans of each of Tennessee's 95 county election commissions would cost $744,000 annually.

The Division of Elections will also provide state and county election officials with online security training curriculum on an annual basis and will provide additional in-person and online training opportunities regarding timely subjects.

We have budgeted $1,601,689 toward needs in this category.

Summary

As detailed on the attached Budget Narrative, our proposed budget to implement the goals stated above is as follows:

Category	Federal	State	Total
Voting Equipment	$4,124,900	$217,100	$4,342,000
Voter Registration Systems	$1,900,000	$100,000	$2,000,000
Cyber Security	$1,540,518	$61,718	$1,601,689
Total	**$7,565,418**	**$378,271**	**$7,943,689**

2018 HAVA ELECTION SECURITY GRANT

Budget Information — CFDA # 90.404 — Non-Construction Program

Name of Organization: Tennessee Department of State

Budget Period Start: 3/23/2018

Budget Period End: 3/22/2023

SECTION A - BUDGET SUMMARY
FEDERAL & NON-FEDERAL FUNDS (Match)

(Consolidated Budget for total project term-- up to 5 years as defined by grantee)

	PROGRAM CATEGORIES								
BUDGET CATEGORIES	(a) Voting Equipment	(b) Election Auditing	(c) Voter Registration Systems	(d) Cyber Security	(e) Communications	(f) Other _____	(g) Other _____	TOTALS	% Fed Total
1. PERSONNEL (including fringe)			$ 300,000.00					$ 300,000.00	4%
2. EQUIPMENT			$ 1,600,000.00					$ 1,600,000.00	21%
3. SUBGRANTS- to local voting jurisdictions	$ 4,124,900.00							$ 4,124,900.00	55%
4. TRAINING				$ 100,000.00				$ 100,000.00	1%
5. All OTHER COSTS				$ 1,440,518.00				$ 1,440,518.00	19%
6. TOTAL DIRECT COSTS (1-6)	$ 4,124,900.00	$ -	$ 1,900,000.00	$ 1,540,518.00	$ -	$ -	$ -	$ 7,565,418.00	
7. INDIRECT COSTS (if applied)								$ -	0%
8. **Total Federal Budget**	$ 4,124,900.00	$ -	$ 1,900,000.00	$ 1,540,518.00	$ -	$ -	$ -	$ 7,565,418.00	
11. Non-Federal Match	$ 217,100.00		$ 100,000.00	$ 61,171.00				$ 378,271.00	
12. Total Program Budget	$ 4,342,000.00	$ -	$ 2,000,000.00	$ 1,601,689.00	$ -	$ -	$ -	$ 7,943,689.00	
13. Percentage By Category	55%	0%	25%	20%	0%	0%	0%		

Proposed State Match	5.0%
A. Do you have an Indirect Cost Rate Agreement approved by the Federal government or some other non-federal entity? If yes, please provide the following information:	No
B. Period Covered by the Indirect Cost Rate Agreement (mm/dd/yyyy-mm/dd/yyy):	
C. Approving Federal agency:	
D. If other than Federal agency, please specify:	
E. The Indirect Cost Rate is:	