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Report to Congressional Requesters

April 2018

ELECTIONS

Observations on Voting Equipment Use and Replacement

Accessible Version

GAO-18-294

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GAO Highlights

Highlights of GAO-18-294, a report to congressional requesters

Why GAO Did This Study

Much of the voting equipment acquired with federal funds after the enactment of the Help America Vote Act in 2002 may now be reaching the end of its life span, and some states and local election jurisdictions—which number about 10,300 and generally have responsibility for conducting federal elections—have or are considering whether to replace their equipment. GAO was asked to examine voting equipment use and replacement.

This report addresses (1) the types of voting equipment jurisdictions used for the 2016 general election and their perspectives on the equipment; (2) factors considered when deciding whether to replace equipment and replacement approaches in selected jurisdictions; and (3) stakeholder perspectives on how federal voting system guidelines affect replacing and developing equipment.

GAO surveyed officials from a nationwide generalizable sample of 800 local jurisdictions (68 percent weighted response rate) and all 50 states and the District of Columbia (46 responded) to obtain information on voting equipment use and replacement. GAO also interviewed officials from (1) five jurisdictions, selected based on population size and type of voting equipment used, among other things, to illustrate equipment replacement approaches; and (2) seven voting system vendors, selected based on prevalence of jurisdictions' use of equipment, type of equipment manufactured, and systems certified, to obtain views on federal voting system guidelines. These interviews are not generalizable, but provide insights into jurisdictions' and vendors' experiences.

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What GAO Found

Local election jurisdictions primarily used optical scan and direct recording electronic (DRE), also known as touch screen, equipment during the 2016 general election and were generally satisfied with voting equipment performance. Specifically, on the basis of GAO's nationwide generalizable survey of local election jurisdictions, GAO estimated that jurisdictions with 63 percent (from 54 to 72 percent) of the population nationwide used optical or digital scan equipment as their predominant voting equipment during the election, while jurisdictions with 32 percent (from 23 to 41 percent) of the population nationwide used DREs. In addition, the survey results indicated that accurate vote counting and efficiency of operation were top benefits experienced by jurisdictions for both types of equipment, and storage and transportation costs were a top challenge. Further, GAO estimated that jurisdictions with 93 percent (from 88 to 96 percent) of the population nationwide did not experience equipment errors or malfunctions on a very or somewhat common basis and jurisdictions with 96 percent (from 94 to 98 percent) of the population were very or generally satisfied with the performance of their equipment during the 2016 general election.

GAO identified four key factors that jurisdictions and states consider when deciding whether to replace voting equipment—(1) need for equipment to meet federal, state, and local voting system standards and requirements; (2) cost to acquire new equipment and availability of funding; (3) ability to maintain equipment and receive timely vendor support; and (4) overall performance and features of equipment. When replacing equipment, the five jurisdictions GAO selected for interviews used varying approaches based on their specific needs and resources. For example, Los Angeles County, California, which has a large and diverse electorate, is self-designing its own voting equipment and, according to officials, has incorporated a user-centered approach that prioritizes the needs and expectations of its voters. Lafayette County, Florida, which has a small population, joined a consortium of other small counties to help obtain funding and pool purchasing power to replace its equipment.

The state election officials we surveyed and the seven selected voting system vendors we interviewed, among other stakeholders, had varying perspectives on how the current voluntary federal voting system guidelines affected the replacement and development of voting equipment. These guidelines can be used to test and certify equipment to verify that it meets baseline functionality, accessibility, and security requirements. The stakeholders we surveyed or interviewed generally indicated that the guidelines and their associated testing processes provide helpful guidance for equipment developers, cost savings for states that do not have to duplicate federal testing, and assurance that certified equipment meets certain requirements. However, some of these stakeholders stated that aspects of the guidelines could discourage the development of innovative equipment and limit the choices of voting equipment on the market. The Election Assistance Commission (EAC), which is responsible for developing the federal guidelines, is updating them with stakeholder input and plans to issue a new version in late summer 2018.

GAO incorporated technical comments provided by the EAC and election officials from the selected local jurisdictions and their respective states as appropriate.

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Abbreviations

BMD	ballot marking device
COTS	commercial off-the-shelf
DRE	direct recording electronic
EAC	Election Assistance Commission
HAVA	Help America Vote Act
MCD	Minor Civil Division
NIST	National Institute of Standards and Technology
RFP	request for proposal
RUCC	Rural-Urban Continuum Code
SBE	State Board of Elections
STAR	Secure, Transparent, Auditable, and Reliable
TGDC	Technical Guidelines Development Committee
VVSG	Voluntary Voting System Guidelines
VVPAT	voter-verified paper audit trail
VSAP	Voting Systems Assessment Project

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Congressional Requesters

The voting equipment that is used to cast and count the ballots of millions of voters nationwide is essential to our nation's electoral process.[1] Challenges experienced during the 2000 presidential election with the effectiveness and accuracy of some voting equipment for casting and counting votes raised questions about existing voting equipment and highlighted the need to replace aging equipment. To help address some of the issues identified in the 2000 election, the Help America Vote Act (HAVA) was enacted in 2002 and authorized over $3 billion in federal funding over several fiscal years to assist state and local governments in making improvements in election administration, such as replacing aging voting equipment.[2] Further, to help promote effective state and local administration of federal elections, HAVA established the Election Assistance Commission (EAC) as an independent federal commission and, among other things, directed the Commission to develop voluntary voting system guidelines against which voting equipment can be tested and certified.[3] According to HAVA, participation in the EAC testing and certification program is optional but states may, by law or practice, require some participation in this program, such as by formally adopting the voluntary guidelines and making these guidelines mandatory in their jurisdictions or requiring equipment to be tested by a federally accredited laboratory. If vendors choose to have their voting equipment tested and certified against the voluntary guidelines, their equipment must meet the guidelines' requirements in order to receive federal certification.

[1]For the purpose of this report we define voting equipment as the method or machine used to create ballots, cast and count votes, report election results, and maintain and produce audit trail information. It does not include other voting-related systems, such as those used for voter registration.

[2]See Pub. L. No. 107-252, 116 Stat. 1666 (codified as amended at 52 U.S.C. §§ 20901-21145).

[3]See 52 U.S.C. §§ 20921-20972. In accordance with HAVA, the EAC is to serve as a national clearinghouse and resource for the compilation of information and review of procedures with respect to the administration of federal elections by carrying out duties such as developing and adopting voluntary guidance and providing for the testing, certification, and decertification of voting system hardware and software by accredited laboratories. HAVA specifies that the EAC's four commissioners are to be nominated by the President on recommendations from Congress and confirmed by the U.S. Senate.

After the enactment of HAVA and the subsequent distribution of federal funds to replace voting systems, many local election jurisdictions and states acquired new voting equipment. Many states also incorporated the use of the EAC's voluntary voting system guidelines or its testing and certification program into their own state-level requirements for approving the use of equipment. However, studies have reported that much of the voting equipment that was procured by state and local election administrators with federal funds more than 10 years ago is now at or approaching the end of its designed service life.[4] Some state and local election officials have noted that the use of aging equipment can potentially affect how efficiently and accurately elections are carried out and can require administrators to devote increasingly more resources and effort to keep the equipment operational. Some states and local election jurisdictions are considering whether they need to replace their voting equipment and others have recently replaced their equipment or are in the process of doing so.

The process for replacing voting equipment exists within an administrative and regulatory framework in which the authority to regulate and carry out elections is shared by federal, state, and local officials. For example, states are responsible for administering elections; however, the local election jurisdictions within each state are largely responsible for managing, planning, and conducting elections, with about 10,300 local election jurisdictions nationwide performing these duties. With respect to voting equipment, this decentralization of the responsibility for administering elections has led to the use of a diverse variety of equipment, as well as different processes and approaches for carrying out the responsibilities related to the selection, funding, implementation, and maintenance of the equipment.

Since 2001, GAO has issued a number of reports on various aspects of the election process describing the types of voting equipment used in federal elections, how the performance of the equipment is measured,

[4]Presidential Commission on Election Administration, *The American Voting Experience: Report and Recommendations of the Presidential Commission on Election Administration* (January 2014); Brennan Center for Justice, New York University School of Law, *America's Voting Machines at Risk* (New York, New York: September 2015).

and the federal voting system certification process, among other issues.[5] Given the potential challenges that can result from the use of aging voting equipment, you asked us to obtain and examine information about the voting equipment being used across the country, plans by states and local election officials to replace voting equipment, and the EAC's efforts to update the voluntary voting system guidelines, among other things. This report addresses the following questions:

1. What types of voting equipment did local election jurisdictions use for the 2016 general election, and what are jurisdiction perspectives on equipment use and performance?
2. What factors are considered when deciding whether to replace voting equipment and what approaches have selected jurisdictions taken to replace their equipment?
3. What are selected stakeholders' perspectives on how federal voting system guidelines affect the replacement and development of voting equipment, and what actions has the EAC taken to update the guidelines?

To address our first objective, we conducted a web-based survey of officials from a stratified random sample of 800 local election jurisdictions nationwide. In total, we received 564 completed questionnaires for a weighted response rate of 68 percent.[6] In stratifying our nationwide sample, we used a two-level stratified sampling method in which the sample units, or jurisdictions, were broken out into rural and non-rural strata.[7] We surveyed the officials about the types of voting equipment they used, various characteristics of the equipment used, their

[5]For example, GAO, *Elections: Perspectives on Activities and Challenges Across the Nation*, GAO-02-3 (Washington, D.C.: Oct. 15, 2001); *Elections: The Nation's Evolving Election System as Reflected in the November 2004 General Election*, GAO-06-450 (Washington, D.C.: June 6, 2006); and *Elections: States, Territories, and the District Are Taking a Range of Important Steps to Manage Their Varied Voting System Environments*, GAO-08-874 (Washington, D.C.: Sept. 25, 2008).

[6]We conducted our survey from March 27, 2017, through July 14, 2017. To calculate our response rate, we used a standard definition, known as RR2, from the American Association for Public Opinion Research. See American Association for Public Opinion Research, *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys,* 9th edition (2016).

[7]To do this, we used the U.S. Department of Agriculture's Economic Research Service's Rural-Urban Continuum Code (RUCC) system which classifies counties into a nine-category continuum based on their characteristics and location relative to metropolitan areas.

perspectives on the benefits and challenges they experienced while using the equipment, and how satisfied they were with its performance during the election.[8] Unless noted otherwise, the point estimates we report are national-level point estimates representing the experiences, views, and opinions of all local election jurisdictions nationwide with populations greater than 2,500.[9] We also provide some point estimates for jurisdiction population subgroups, such as large jurisdictions (greater than 100,000 persons), medium jurisdictions (25,001 to 100,000 persons), and small jurisdictions (2,501 to 25,000 persons), and jurisdictions that used a particular type of voting equipment, in cases where statistically significant differences exist between the subgroups that may be of interest. The jurisdictions we surveyed were selected with probability proportionate to population size, so rather than expressing the point estimates in terms of the percentage of jurisdictions nationwide that had a specified characteristic, we express the point estimates for the survey responses in terms of *the percentage of the population nationwide that resides within jurisdiction*s that had a specified characteristic. Similarly, in instances where we report point estimates for jurisdiction subgroups, we express the point estimate in terms of *the percentage of the population that resides within jurisdictions of that respective subgroup* that had a specified characteristic.

To address our second objective, we used our local election jurisdiction survey described above to obtain information from jurisdictions about the factors they consider when determining whether to replace their voting equipment. In addition to the local election jurisdiction survey, we also conducted a web-based survey of the state-level election offices in the 50 states and the District of Columbia about issues pertaining to the states' roles in selecting and acquiring voting equipment, including the factors

[8]As discussed below, we also conducted a survey of the state-level election offices in the 50 states and the District of Columbia. Although this survey was primarily used to obtain information for our second objective, we used some results from the state survey to provide additional context for the information from local election jurisdictions presented in the first objective, where appropriate.

[9]During our analysis of the responses, we found that due to a higher level of nonresponse by very small jurisdictions of 2,500 persons or less, some national level estimates that included responses from jurisdictions of all sizes had wider than desired confidence intervals. To improve the precision of these national level estimates, we subsequently excluded the very small jurisdictions of 2,500 persons or less from our analysis.

considered when determining whether to replace voting equipment.[10] We obtained responses from 46 of these offices, while 5 did not respond (a 90 percent response rate). For additional perspectives and context on the factors considered when replacing voting equipment, we also reviewed reports and studies about voting equipment and elections and interviewed nine selected election subject matter experts, including representatives from nongovernmental research and other organizations involved in the field of election administration and voting equipment. We selected these subject matter experts based on our review of reports and studies related to voting equipment and their expertise and work in this area. Further, we interviewed election officials from five local jurisdictions—Los Angeles County, California; Travis County, Texas; Anne Arundel County, Maryland; Lafayette County, Florida; and Beaver County, Utah—that replaced their voting equipment between 2012 and 2016 or plan to replace their equipment in time for the 2020 general election to learn about the approaches and practices they used and obtain their perspectives on the replacement process. We selected these jurisdictions to obtain variation in, to the extent possible, population size, type of voting equipment replaced and selected, state involvement in selecting and funding voting equipment, and particular practices used to replace equipment (e.g., self-designing equipment, leasing equipment), among other factors.[11] For each jurisdiction, we interviewed—on site or by phone—local election officials, state election officials in the jurisdiction's state, and individuals who have served as poll workers at the jurisdiction's

[10]When reporting state survey results, we use the term "states" in reference to the 50 states and the District of Columbia. For the purposes of this report, this survey of the 50 states and the District of Columbia will be referred to as the "state survey" or "survey of states." We conducted our state survey from April 6, 2017, through May 19, 2017.

[11]We obtained information on factors related to voting equipment replacement from our local election jurisdiction and state surveys.

polling locations if applicable.[12] While these five jurisdictions are not representative of all local election jurisdictions nationwide that replaced or plan to replace their voting equipment, they provide examples of various approaches for replacing voting equipment and perspectives on key issues related to replacing equipment. We corroborated various information we obtained through these interviews by reviewing relevant state statutes and documentation that these jurisdictions provided to us, such as postelection reports, voting system studies, expenditure summaries, and solicitations for vendor proposals to provide voting equipment and services.

To address our third objective, we used responses to our survey of state election officials and interviews with seven selected voting system vendors and the nine selected subject matter experts mentioned above to obtain perspectives on how federal voting system guidelines and their associated testing and certification processes affect the replacement and development of voting equipment. We selected the seven vendors based on the prevalence of jurisdictions' use of their equipment, type of voting equipment manufactured, and systems certified, among other criteria.[13] The perspectives of the seven voting system vendors and nine subject matter experts are not generalizable but provide examples of views on the federal guidelines and their associated testing and certification processes from a range of stakeholders. We also reviewed EAC and National Institute of Standards and Technology (NIST) documents on actions taken to update the guidelines and interviewed officials from the EAC and NIST and the seven voting system vendors about their

[12]The local and state offices that administer or oversee elections can be organized in different ways, and in some cases offices with primary responsibility for elections may have responsibility for other areas of government as well. For example, local election offices may include a Board of Elections that is specifically responsible for elections, or a county clerk's office that may also have responsibility for public records, licenses, or other activities. Similarly, state election offices may include a Board of Elections that is responsible for overseeing elections in the state or a Secretary of State's office that oversees an Elections Division, as well as other divisions and offices responsible for public records, business filings, state archives, and other services. Jurisdictions call their poll workers by different titles, including election judges, inspectors, clerks, wardens, captains, and precinct officers. On Election Day, poll workers have a number of responsibilities, including setting up the voting machines or voting booths, testing equipment, checking in and assisting voters, and securing equipment and ballots after the polls close.

[13]We obtained information from our local election jurisdiction survey on who manufactured jurisdictions' predominant voting equipment and based our selections in part on prevalence of use.

involvement in and perspectives on these actions.[14] See appendix I for additional information on our scope and methodology.

We conducted this performance audit from June 2016 to April 2018 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Overview of Election Administration

In the United States, election authority is shared by federal, state, and local officials, and election administration is highly decentralized and varies among state and local jurisdictions. Congressional authority to regulate elections derives from various constitutional sources, depending upon the type of election. Federal election laws have been enacted that include provisions pertaining to voter registration, protecting the voting rights of certain minority groups, and other areas of the elections process. States regulate various election activities, including some requirements related to these federal laws, but generally delegate election administration responsibilities to local jurisdictions.[15]

Federal Roles and Responsibilities

Congress has passed legislation in major functional areas of the voting process. For example, HAVA includes a number of provisions related to voting equipment and other election administration activities, including, for instance, requiring at least one voting system equipped for persons with disabilities at each polling place in federal elections.[16] After HAVA was enacted, Congress appropriated more than $3 billion for the EAC to

[14]NIST provides technical assistance to the EAC on the development of the voluntary guidelines, among other things.

[15]States primarily delegate election responsibilities to counties, but some delegate responsibilities to subcounty governmental units, such as townships or municipalities.

[16]See 52 U.S.C. § 21081(a)(3).

distribute to states to make election administration improvements, such as the replacement of punch card and mechanical lever voting equipment.

In addition to HAVA, federal laws have been enacted in other areas of the voting process. For example, the Voting Rights Act of 1965, as amended, contains, among other requirements, provisions designed to protect the voting rights of U.S. citizens of certain ethnic groups whose command of the English language may be limited.[17] In accordance with the act, covered states and jurisdictions must provide written materials—such as ballots or registration forms—in the language of certain "language minority groups" in addition to English, as well as other assistance, such as bilingual poll workers.[18]

State and Local Roles and Responsibilities

The responsibility for the administration of elections resides at the state and local levels. States regulate various election activities, such as absentee and early voting requirements and Election Day procedures, but generally delegate election administration responsibilities to local jurisdictions. Some states have mandated statewide election administration guidelines and procedures that foster uniformity in the ways local jurisdictions conduct elections, including the types of voting equipment used. Other states have guidelines that generally permit local election jurisdictions considerable autonomy and discretion in the way they run elections. Although some states bear some election costs, including those associated with voting equipment, local jurisdictions generally pay for most aspects of election administration. Unless states require otherwise, local jurisdictions generally have discretion over activities such as training election officials and, in most states, over the

[17]Pub. L. No. 89-110, 79 Stat. 437 (codified as amended at 52 U.S.C. §§ 10301-10508).

[18]Collectively known as the language minority provisions of the Voting Rights Act, sections 203 and 4(f)(4) are to enable members of applicable language minority groups to participate effectively in the electoral process. 52 U.S.C §§ 10503, 10303. On the basis of 2010 Census results, 248 jurisdictions are covered under section 203 of the Voting Rights Act. The status of section 4(f)(4) is unclear as it relies on a coverage formula struck down by the Supreme Court in 2013. Shelby Co. v. Holder, 133 S. Ct. 2612 (2013).

selection and purchase of voting technology.[19] Among other things, local election officials register eligible voters; design ballots; educate voters on how to use voting technology; provide information on the candidates and ballot measures; arrange for polling places; recruit, train, organize, and mobilize poll workers; prepare and test voting equipment for use; and count ballots.

The Voting Process

Voting before Election Day

States have established alternatives for voters to cast a ballot other than at the polls on Election Day, including absentee voting and early voting. All states and the District of Columbia have provisions allowing voters to cast their ballots before Election Day by voting absentee, with variations on who may vote absentee, whether the voter needs to provide an excuse for requesting an absentee ballot, and the time frames for applying for and submitting absentee ballots.[20] Some states also permit registered voters to apply for an absentee ballot on a permanent basis so that those voters automatically receive an absentee ballot in the mail prior to every election without providing an excuse or reason for voting absentee.[21] In addition to absentee voting, some states allow early in-person voting.[22] In general, early voting allows voters from any precinct in the jurisdiction to cast their vote in person without providing an excuse, before Election Day either at one specific location or at one of several locations. Further, three states and a number of local election jurisdictions

[19]For example, according to the results of our state survey, out of 46 respondents, 30 indicated that local jurisdictions have discretion over the selection of the voting equipment they use. Specifically, 26 indicated that the state maintains a list of approved voting equipment from which local jurisdictions are required to select, 3 indicated that the state approves the use of voting equipment following selection by the local jurisdiction, and 1 indicated that the state was not involved in the selection of voting equipment.

[20]According to the National Conference of State Legislatures, as of August 2017, 27 states and the District of Columbia permit any qualified voter to vote absentee without having to provide an excuse, while 20 states require the voter to provide an excuse in order to vote absentee. Three states conduct vote-by-mail elections, wherein ballots are automatically sent to every eligible voter.

[21]According to the National Conference of State Legislatures, as of August 2017, eight states and the District of Columbia permit voters to join a permanent absentee voting list.

[22]According to the National Conference of State Legislatures, as of August 2017, 34 states and the District of Columbia offer some sort of early in-person voting.

in other states conduct vote-by-mail elections, wherein ballots are automatically sent to every eligible voter.

In-Person Voting on Election Day

For in-person voting on Election Day, election authorities subdivide local election jurisdictions into precincts. Voters generally cast their ballots at the polling places for the precincts to which they are assigned by election authorities. In addition, some states provide jurisdictions the discretion to allow voters to cast their ballots at vote centers, which are polling places at which any registered voter in the local election jurisdiction may vote on Election Day, regardless of the precinct in which the voter resides.

Within the polling place, poll workers check in voters and determine their eligibility to vote by verifying their registration using voter lists or poll books—a list of individuals eligible to vote within the voting precinct or local jurisdiction. After checking the voters in, poll workers direct them to a voting booth to mark their electronic or paper ballots, and then voters submit the ballots for counting.[23] The manner in which votes are cast and counted can vary depending on the voting method and technology employed by the jurisdiction.

Postelection Activities

Following the close of the polls on Election Day, election officials and poll workers complete steps such as securing equipment and ballots, transferring paper ballots or electronic records of vote counts to a central location for counting, and determining the outcome of the election. Votes counted include those cast on Election Day, absentee ballots, early votes (where applicable), and valid provisional ballots.[24] While preliminary

[23]Electronic ballots are submitted in the voting booth and stored on a memory device using a form of electronic voting equipment.

[24]Provisional ballots are those cast by voters at the polls whose eligibility to vote is unclear and to be determined later. HAVA requires states to provide a provisional ballot process for voters in certain circumstances. See 52 U.S.C. § 21082. One such circumstance is when an individual voter declares that such individual is (1) registered in the jurisdiction for which the individual desires to vote and (2) is eligible to vote in a federal election but (3) whose name does not appear on the official list of eligible voters for the polling place. Another example is where a voter does not have the requisite identification at the polls. A valid provisional ballot is one for which the eligibility of the voter to cast a ballot is subsequently confirmed and therefore is to be counted.

results are available usually by the evening of Election Day, the certified results are generally not available until a later date.

EAC Voluntary Voting System Guidelines and Testing and Certification Program

Overview of Voluntary Guidelines and Testing and Certification Program

The EAC has responsibility for developing the voluntary voting system guidelines and overseeing the testing and certification of voting systems based on these guidelines. The EAC works in conjunction with NIST and the Technical Guidelines Development Committee (TGDC) to develop the voluntary guidelines.[25] According to the EAC, these guidelines are a set of specifications and requirements against which voting systems, including hardware and software, can be tested to receive a certification from the EAC. According to NIST, the guidelines are intended to ensure that federal testing provides assurance to state and local election officials that the voting systems meet a defined set of requirements. The EAC testing and certification program verifies that voting systems comply with basic functionality, accessibility, and security capabilities established by the voluntary guidelines. Typically, voting system vendors submit their systems to the EAC for testing and certification and the systems are evaluated by EAC-accredited voting system test laboratories against the guidelines. These laboratories make recommendations regarding certification to the EAC. According to the EAC, an EAC-certified voting system means that the voting system has been tested by a federally accredited test laboratory and complies with the guidelines.

Establishment of Federal Voting System Guidelines and Updates

According to the EAC, prior to its establishment and the creation of its voluntary voting system guidelines, the first set of federal voluntary Voting System Standards were adopted in 1990 by the Federal Election

[25]NIST provides technical assistance to the EAC on the development of the voluntary guidelines, among other things. The TGDC is composed of election officials, voting system vendor representatives, and other key election stakeholders. In accordance with HAVA, the EAC tasked the TGDC to assist with the development of the voluntary guidelines with input from various stakeholders, including the director of NIST (who shall serve as its chair) and a group of 14 other individuals with technical and scientific expertise relating to voting systems appointed jointly by the EAC and the director of NIST.

Commission.[26] The National Association of State Election Directors voluntarily assumed the role of accrediting voting system test laboratories and certifying voting systems to the federal standards.[27] In 2002, the Federal Election Commission adopted a new version of the federal standards.

After the EAC's creation, in 2005, the EAC developed and adopted the third iteration of federal standards, in accordance with HAVA, and the standards were renamed the Voluntary Voting System Guidelines (VVSG). This third iteration of federal voting system guidelines was referred to as the 2005 VVSG or VVSG 1.0, as it is called today. According to the EAC, VVSG 1.0 increased security requirements for voting systems and were intended to expand access, including opportunities to vote privately and independently, for individuals with disabilities. In 2006, the National Association of State Election Directors terminated its voting system testing program and subsequently, in 2007, the EAC launched its own testing and certification program. In March 2015, a fourth iteration of the voluntary guidelines was adopted by the EAC, referred to as VVSG 1.1. According to the EAC, VVSG 1.1 clarified the guidelines to improve testability by testing laboratories, among other updates, and focused on areas that could be improved without requiring significant changes to the testing and certification process. In January 2016, the EAC adopted an implementation plan for VVSG 1.1 whereby all new voting systems being tested for certification would be required to be

[26]In 1974, Congress established the Federal Election Commission to administer and enforce the Federal Election Campaign Act. Pub. L. No. 93-443, tit. II, § 208, 88 Stat. 1280 (codified as amended at 52 U.S.C. § 30106). Among other duties, the commission was to serve as a national clearinghouse for the compilation of information and review of procedures with respect to the administration of federal elections. As the clearinghouse for information, the commission had responsibility for activities such as voting system standards, election legislation, and voting accessibility. HAVA transferred the commission's national clearinghouse functions, including developing voluntary voting system standards, to the EAC. See Pub. L. No. 107-252, subtit. A, 116 Stat. at 1725; see also 52 U.S.C. § 20922.

[27]The National Association of State Election Directors is a nongovernmental organization whose mission is to promote accessible, accurate, and transparent elections in the United States and U.S. territories. Its purpose is to serve as a venue for the exchange of election best practices and ideas.

tested against the VVSG 1.1 beginning on July 6, 2017.[28] As of November 2017, no voting systems have been certified using VVSG 1.1.

The EAC, NIST, and TGDC are in the process of developing the next iteration of the voluntary guidelines (known as VVSG 2.0), and these guidelines are expected to be issued in late summer 2018. Typically, a lag exists between when guidelines are issued and when they are used for testing and certification. EAC officials stated that it has generally taken about 18 months before the guidelines are ready for use for testing voting systems. This is due in part to the need for the voting system test laboratories to be reaccredited to test to the new voluntary guidelines by the EAC.[29] According to EAC officials, after the guidelines are approved for use, it typically takes 2 to 4 years before voting system vendors can develop voting systems that are ready for testing and certification.

States' Participation in the EAC Testing and Certification Program

Participation in the EAC testing and certification program is voluntary. Each state determines its own standards for voting systems in statute or administrative regulation, which can be based on the voluntary guidelines established by the EAC. Specifically, most states require some level of participation in the EAC testing and certification program as mandated by their state laws or regulations. As of December 2017, 13 states require federal certification of their voting systems, 24 states and the District of Columbia require testing by a federally accredited laboratory or require testing to federal voting system standards, and 13 states have no federal

[28]According to the EAC, modifications or upgrades to existing systems that were originally certified using a specific version of the VVSG can generally continue to be certified using that version.

[29]Generally, the EAC considers for accreditation those laboratories evaluated and recommended by NIST. The NIST National Voluntary Laboratory Accreditation Program conducts test laboratory reviews to ensure laboratories are capable of performing tests of voting systems and components against federal standards to meet the requirements of HAVA.

requirements.[30] Some states have their own voting system standards and conduct their own testing and certification to these standards, either in addition to or as an alternative to the federal voluntary guidelines. Vendors that want to supply their voting systems to local jurisdictions and states must comply with state requirements. See appendix II for federal certification and testing requirements by state, including the associated statutes and regulations we reviewed.

Local Election Jurisdictions Primarily Used Two Types of Voting Equipment, Monitored Such Equipment, and Were Generally Satisfied with Equipment Performance

Local Election Jurisdictions Primarily Used Optical/Digital Scan and Direct Recording Electronic Equipment during the 2016 General Election

According to our analysis of the predominant type of equipment used to process the largest number of ballots during the 2016 general election, jurisdictions using optical/digital scan equipment represented the largest estimated share of the population nationwide, followed by jurisdictions

[30]See appendix II. We reviewed state statutes and regulations regarding the testing and certification of voting systems to describe the extent to which state laws reference the federal voting system certification or testing standards and the extent to which states require the use of these standards. We grouped the state laws into three categories for the purposes of this report: (1) requires full federal certification; (2) requires testing by a federally accredited laboratory and/or testing to federal voting system standards; and (3) no federal requirements. Category 2 includes states that use some aspect of the federal testing and certification program but do not require full certification. A number of states in this category require both testing by a federally accredited laboratory and testing to federal standards, but we included in this category states that had either requirement in state law or regulation. Category 3 includes some states that utilize the federal certification or testing standards to some extent but that do not require certification or testing to meet federal standards by law or regulation. We then sent our categorization to state officials in the 50 states and D.C. and incorporated changes that we received from those officials.

using direct recording electronic (DRE) equipment.[31] Specifically, on the basis of our local election jurisdiction survey, we estimate that jurisdictions with about 63 percent of the population nationwide used optical/digital scan equipment as their predominant voting equipment during the election, while jurisdictions with an estimated 32 percent of the population nationwide used DREs.[32] Jurisdictions with less than 1 percent of the population nationwide used paper hand-counted ballots.[33] See figure 1.

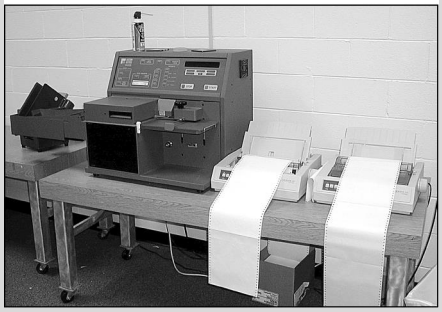
Types of Predominant Voting Equipment

Optical or digital scanner: An optical/digital scan system consists of computer-readable paper ballots, marking devices, privacy booths, and a computerized tabulation device. Voters mark ballots using a writing instrument to fill in boxes or ovals next to a candidate's name or an issue, and the ballots are fed into a scanner for counting. If ballots are counted using central count optical scan equipment, voters deposit their ballots in a sealed box for later scanning at a central location. If ballots are counted using precinct count optical scan equipment, voters or election officials feed ballots into the scanner immediately after voters mark their ballots. Digital scanners capture and store images of the paper ballots that are cast.

[31]For the purposes of our survey and analysis of survey results, we defined "predominant voting equipment" as the equipment used by a jurisdiction to process the largest number of in-person ballots, or vote-by-mail ballots for jurisdictions that conduct all vote-by-mail or mail-ballot elections, during the 2016 general election. In our survey, if a jurisdiction used more than one type of equipment to process an equal number of ballots, we asked it to identify the equipment type that was the older of the two equipment types as its "predominant voting equipment." See app. III for the results for the questions in our local election jurisdiction survey on voting equipment.

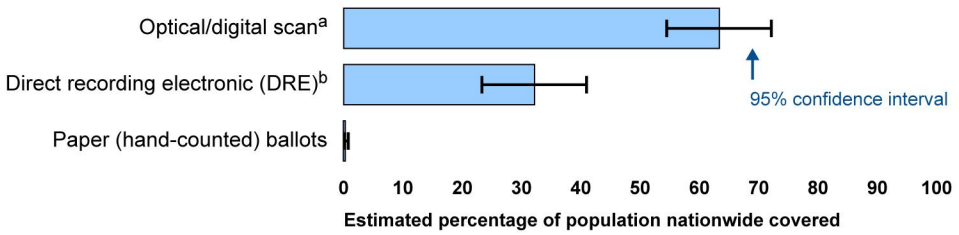
[32]The 95 percent confidence intervals for these estimates are (54, 72) and (23, 41) respectively.

[33]The 95 percent confidence interval for this estimate is (0, 1).



Source: GAO. | GAO-18-294

Figure 1: Type of Voting Equipment Predominantly Used by Jurisdictions to Process the Most Ballots during the 2016 General Election



Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: In addition to the types above, jurisdictions with about 2 percent (0, 4) of the population nationwide used an "other" unspecified predominant type of voting equipment in the 2016 election and jurisdictions with 3 percent (1, 7) of the population nationwide did not know what type of equipment was predominantly used. The numbers in parentheses are the values for the 95 percent confidence interval for the estimate.

[a]This category includes central count and precinct count optical/digital scan equipment.

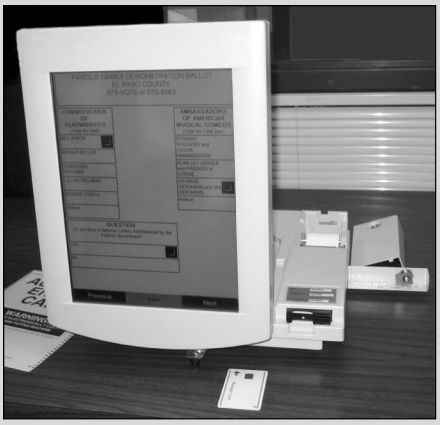
[b]This category includes DREs both with and without a voter-verified paper audit trail.

Within the optical/digital scan equipment category, the most widely used model of optical/digital scan equipment was the precinct count optical/digital scan, with jurisdictions having an estimated 46 percent of the population nationwide using it as their predominant voting equipment.[34] Figure 2 shows the predominant types of voting equipment that were used by jurisdictions during the 2016 general election, broken out by model of equipment used.

[34]The 95 percent confidence interval for this estimate is (37, 56).

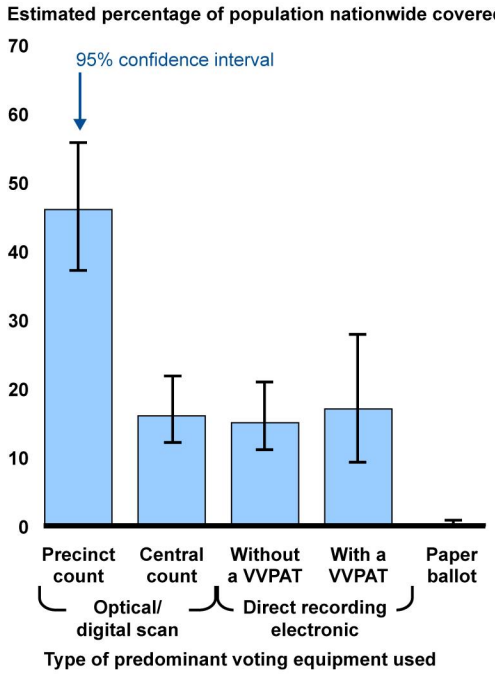
Types of Predominant Voting Equipment

Direct recording electronic (DRE) machine: Voters mark ballots electronically using a touch screen or push-button interface, and their ballot selections are stored in the machine's memory. Some jurisdictions use DRE machines with a voter-verified paper audit trail, which prints out a paper record of the voter's ballot.



Source: GAO. | GAO-18-294

Figure 2: Predominant Voting Equipment Used in the 2016 General Election, by Equipment Type and Model



VVPAT Voter-verified paper audit trail

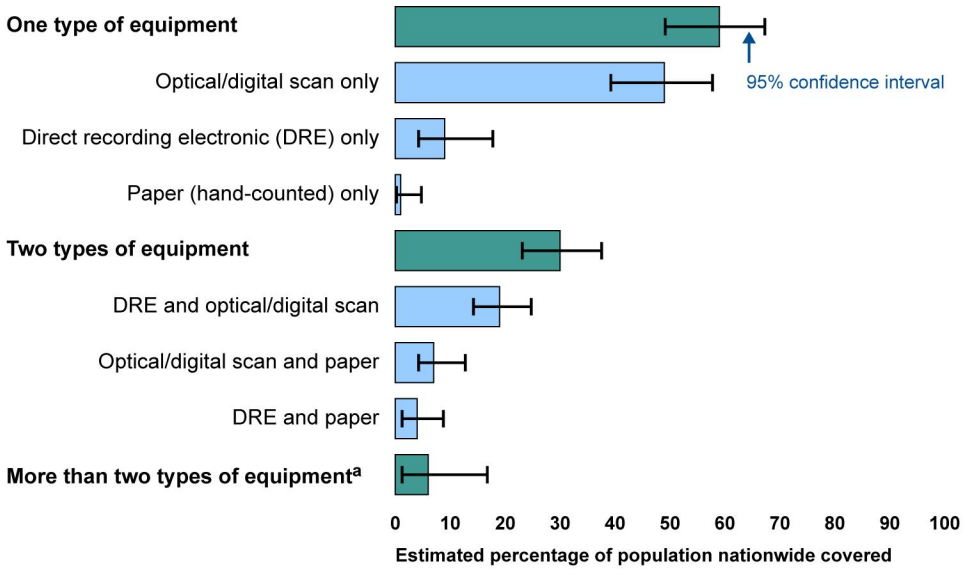
Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

While many jurisdictions predominantly used one type of voting equipment, some reported using multiple types. Jurisdictions may choose to use more than one type of equipment as a means to process different types of ballots such as absentee or provisional or to provide accessibility options for voters with disabilities. Overall, we estimate that jurisdictions with about 59 percent of the population nationwide used only one type of equipment during the 2016 general election, while jurisdictions with about 37 percent of the population nationwide used multiple types of equipment during the election.[35] Jurisdictions that used two types of equipment are estimated to have about 30 percent of the population nationwide, while

[35]The 95 percent confidence intervals for these estimates are (50, 67) and (28, 45) respectively. Some jurisdictions also use what are called ballot marking devices which employ electronic technology to mark an optical scan ballot at voter direction and print a voter-verified ballot. These devices can accommodate voters who prefer to vote in an alternate language or require other methods to make their vote selections. Because these devices are used only for marking ballots but do not count or tabulate ballots, for the purposes of our review, we did not include them within our analysis as a type of voting equipment.

those that used more than two types of voting equipment had approximately 6 percent of the population nationwide.[36] See figure 3 for the types of voting equipment used.

Figure 3: Types of Voting Equipment Used by Local Election Jurisdictions during the 2016 General Election



Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: Jurisdictions with 1 percent (0, 2) of the population nationwide used a type of voting equipment other than DRE, optical/digital scan, or paper hand-counted ballots or some combination of another type of equipment with optical/digital scan, DRE, or paper hand-counted ballots. Due to question nonresponse, we do not know the type of equipment used by jurisdictions covering 4 percent (1, 9) of the population nationwide. The numbers in parentheses are the values for the 95 percent confidence interval for the estimate.

[a]Any combination of three or more types of equipment (i.e., DRE, optical/digital scan, paper, or another type of equipment).

Local Election Jurisdictions Monitored Equipment Performance in Various Ways

According to results from our survey of local election jurisdictions, jurisdictions monitored the performance of their voting equipment during the 2016 general election through a variety of methods, such as

[36]The 95 percent confidence intervals for these estimates are (23, 38) and (1, 17) respectively. Estimates for jurisdictions using two types and more than two types of equipment do not add to 37 percent due to rounding.

equipment testing, performance measurement and tracking of malfunctions, and postelection audits and recounts. Such monitoring can provide information to jurisdictions about how their equipment is functioning and help ensure the accuracy of the outcomes of elections and address any identified issues or problems.

Testing of Voting Equipment

Results from our survey of local election jurisdictions indicate that the extent to which jurisdictions tested their voting equipment varied by test type. Key types of voting equipment testing include acceptance testing, logic and accuracy testing, and parallel testing. Acceptance testing verifies that new equipment or any equipment that has been outside election administrators' control (e.g., for repair) conforms to the purchase agreements and is identical to equipment that was tested and certified by state or federal testing organizations. According to our local jurisdiction survey results, jurisdictions with an estimated 49 percent of the population nationwide conduct acceptance testing of their equipment.[37] Logic and accuracy (also known as functional or readiness) testing is performed in advance of an election to determine whether voting equipment will function properly, such as displaying the correct ballot, collecting votes, and tabulating results. Parallel testing is performed on Election Day by running test votes cast with known results, then comparing the actual and expected results.[38] Of these two types of testing, according to our local jurisdiction survey results, logic and accuracy testing was the most widely performed type of testing as jurisdictions with 99 percent of the population nationwide conducted such testing for the 2016 general election.[39] Jurisdictions with an estimated 37 percent of the population nationwide conducted parallel testing.[40]

[37]The 95 percent confidence interval for this estimate is (40, 59).

[38]According to the EAC, parallel testing is the act of duplicating, as nearly as possible, a portion of the election under conditions that are identical to the conditions that occur in a polling place. EAC guidance states that parallel testing should ensure that (1) ballots used for the parallel test are identical to the ballots used in the actual election; (2) the test takes place during the hours of the election, using software and hardware that is to be used in the election; and (3) a video record is created of all voting to determine whether or not any discrepancies in the results were caused by data entry errors.

[39]The 95 percent confidence interval for this estimate is (97, 99).

[40]The 95 percent confidence interval for this estimate is (28, 45).

Performance Measures and Reported Errors and Malfunctions

According to our local jurisdiction survey results, jurisdictions monitored the performance of their predominant voting equipment during the 2016 general election using a variety of measures. Accuracy of the equipment in counting votes was tracked, measured, or assessed by jurisdictions having an estimated 87 percent of the population nationwide.[41] Another widely monitored aspect of voting equipment performance was the accuracy of the equipment in recording voter selections before counting—jurisdictions with 78 percent of the population nationwide tracked, measured, or assessed that aspect.[42] Overvotes and undervotes were also widely used measures, with jurisdictions having about 63 and 64 percent of the population nationwide, respectively, tracking, measuring, or assessing those measures.[43]

According to the results of our local jurisdiction survey, most jurisdictions did not experience extensive or widespread errors or malfunctions with their equipment during the 2016 general election. We estimate that jurisdictions with 93 percent of the population did not experience equipment errors or malfunctions on a "somewhat" or "very" common basis during the election.[44] Of those that did experience equipment errors or malfunctions of some type on a "somewhat" or "very" common basis, the error or malfunction most frequently encountered was jams or misfeeds. We estimate that this error or malfunction was experienced on a "very common" basis by jurisdictions with about 1 percent of the population nationwide and on a "somewhat common" basis by jurisdictions with about 3 percent of the population nationwide.[45] The next most frequent error or malfunction experienced as a "very" or "somewhat" common occurrence was that equipment response was sluggish or

[41]The 95 percent confidence interval for this estimate is (81, 92).

[42]The 95 percent confidence interval for this estimate is (69, 85).

[43]The 95 percent confidence intervals for these estimates are (53, 72) and (54, 73) respectively. The federal voluntary voting system guidelines define an overvote as voting for more than the maximum number of selections allowed in a contest (e.g., for more than one candidate in a single race). An undervote is defined by the guidelines as occurring when the number of choices selected by a voter in a contest is less than the maximum number allowed for that contest or when no selection is made for a single-choice contest.

[44]The 95 percent confidence interval for this estimate is (88, 96).

[45]The 95 percent confidence intervals for these estimates are (0, 4) and (2, 5) respectively.

slower than acceptable, which was experienced by jurisdictions with an estimated 3 percent of the population nationwide.[46]

Postelection Audits and Recounts

State and local election officials also determined how their voting equipment performed and verified election results by conducting postelection audits and recounts. According to 35 out of 46 respondents to our state survey, the state election agency or local election jurisdictions in their states conducted postelection audits or targeted recounts of results from the 2016 general election. On the basis of our local jurisdiction survey, we estimate that jurisdictions with approximately 45 percent of the population nationwide conducted postelection audits or targeted recounts.[47] Among jurisdictions of different size, large jurisdictions had a higher estimated share of their population within jurisdictions that conducted postelection audits or recounts than did medium or small jurisdictions. Specifically, jurisdictions with 82 percent of the population within large jurisdictions conducted postelection audits or recounts.[48] In contrast, an estimated 55 percent and 37 percent of the population within medium and small jurisdictions, respectively, was represented by jurisdictions that conducted postelection audits or recounts.[49]

Local Election Jurisdictions Experienced Various Benefits and Challenges with Voting Equipment and Were Generally Satisfied or Very Satisfied with Equipment Performance

Benefits and Challenges of Predominant Equipment Used

According to the results of our local election jurisdiction survey, jurisdictions using the two main types of voting equipment (DRE or optical/digital scan) experienced mostly similar benefits as a result of

[46]The 95 percent confidence interval for this estimate is (1, 8).

[47]The 95 percent confidence interval for this estimate is (36, 55).

[48]The 95 percent confidence interval for this estimate is (77, 87).

[49]The 95 percent confidence intervals for these estimates are (46, 64) and (24, 51) respectively.

using their respective type of predominant equipment.[50] Table 1 shows the top benefits experienced by jurisdictions according to the type of predominant voting equipment used.

Table 1: Most Frequently Experienced Benefits Provided by Predominant Voting Equipment, by Equipment Type

Equipment	Most frequently experienced benefits		
Direct recording electronic (DRE)	Producing an accurate count of votes cast 94 percent (89, 97)	Efficiency of operation 92 percent (86, 96)	Ease of conducting routine maintenance 78 percent (65, 88)
Optical/digital scan	Producing an accurate count of votes cast 83 percent (75, 89)	Efficiency of operation 77 percent (67, 84)	Customer support and problem resolution assistance from vendor 74 percent (65, 82)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The table contains estimated percentages of the population represented by jurisdictions that experienced this benefit while using their predominant voting equipment. The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. With the exception of the differences between "producing an accurate count of votes cast" and "ease of conducting routine maintenance" for jurisdictions predominantly using DREs, the differences between the estimates of these experienced benefits by type of equipment were not statistically significant.

In addition to the benefits mentioned above, jurisdictions experienced other benefits associated with using their respective type of predominant voting equipment. For example, jurisdictions that had an estimated half or more of the population within jurisdictions using each of the different types of voting equipment also experienced the following benefits from using their equipment:[51]

- *Jurisdictions predominantly using DREs*: accessibility for individuals with disabilities or impairments, timely election night reporting, ease of presenting lengthy ballots in a clear and understandable way, protection and preservation of votes cast against potential non-

[50]In our local election jurisdiction survey, we asked jurisdictions to indicate how much of a benefit or challenge to their jurisdiction 23 different pre-identified issue areas were during the 2016 general election on a response scale (i.e., "major benefit," "minor benefit," "neither a benefit nor a challenge," "minor challenge," "major challenge," and "don't know"). For this analysis, we consolidated the "major benefit" and "minor benefit" responses into a single "benefit" category and the "major challenge" and "minor challenge" responses into a single "challenge" category.

[51]These were benefits for which the lower bound of the 95 percent confidence interval was greater than 50 percent but less than the point estimate of the third most frequently identified benefit for that equipment type shown in table 1. We did not include the point estimates for these results because the margins of error for many exceeded 15 percentage points and therefore were outside our acceptable reporting standard.

cybersecurity related threats, and customer support and problem resolution assistance from vendor.

- *Jurisdictions predominantly using optical/digital scan equipment:* timely election night reporting, ease of troubleshooting or resolving equipment malfunctions during Election Day, preventing or alerting voters of any overvotes or undervotes before ballot is cast, ability to facilitate a postelection audit, security of equipment against outside electronic hacking or intrusion, and ease of conducting routine maintenance.

Jurisdictions also experienced challenges while using their predominant voting equipment, although to a lesser extent overall than they experienced benefits. Table 2 shows the top challenges experienced by jurisdictions according to the type of predominant voting equipment used.

Table 2: Most Frequently Experienced Challenges with Predominant Voting Equipment, by Equipment Type

Equipment	Most frequently experienced challenges		
Direct recording electronic	Availability of replacement parts 14 percent (7, 25)	Ease of setting up voting equipment by poll workers 14 percent (7, 23)	Costs to store and transport voting equipment 13 percent (7, 22)
Optical/digital scan	Costs to store and transport voting equipment 21 percent (14, 30)	Cost to maintain voting equipment 17 percent (12, 24)	Proper storage of unit when not in use 15 percent (7, 27)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The table contains estimated percentages of the population represented by jurisdictions that experienced this challenge while using their predominant voting equipment. The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. None of the differences between the estimates for these challenges by type of equipment were statistically significant.

The next most frequently experienced challenges by jurisdictions were the following (estimates with the values for the 95 percent confidence intervals are shown in parentheses):[52]

- *Jurisdictions predominantly using DREs:* cost to maintain voting equipment (an estimated 12 percent; 6, 19); cost to operate voting equipment (8 percent; 3, 14); and ease of conducting routine maintenance (7 percent; 2, 14).

[52]The differences between the estimates of these challenges by type of equipment were not statistically significant.

- *Jurisdictions predominantly using optical/digital scan equipment:* cost to operate voting equipment (an estimated 11 percent; 7, 15); preventing or alerting voters of any overvotes or undervotes before ballot is cast (9 percent; 2, 23), and ease of connectivity with other election administration systems (e.g., voter registration, election night reporting) (9 percent; 2, 23).

Satisfaction with Predominant Voting Equipment

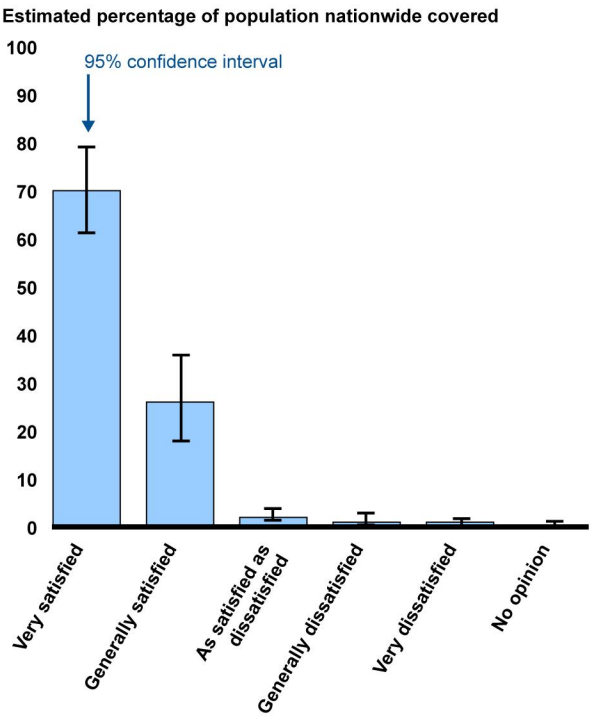
On the basis of our local election jurisdiction survey, we estimate that jurisdictions with approximately 96 percent of the population nationwide were very satisfied or generally satisfied with the performance of their predominant voting equipment during the 2016 general election.[53] Specifically, we estimate that jurisdictions with approximately 70 percent of the population nationwide were very satisfied with their voting equipment's performance and 26 percent were generally satisfied (see fig. 4).[54] Jurisdictions with about 2 percent of the population nationwide were generally dissatisfied or very dissatisfied with the performance of their predominant voting equipment.[55]

[53]The 95 percent confidence interval for this estimate is (94, 98).

[54]The 95 percent confidence intervals for these estimates are (61, 79) and (18, 36) respectively.

[55]The 95 percent confidence interval for this estimate is (1, 4).

Figure 4: Satisfaction with Performance of Predominant Voting Equipment Used in 2016 General Election



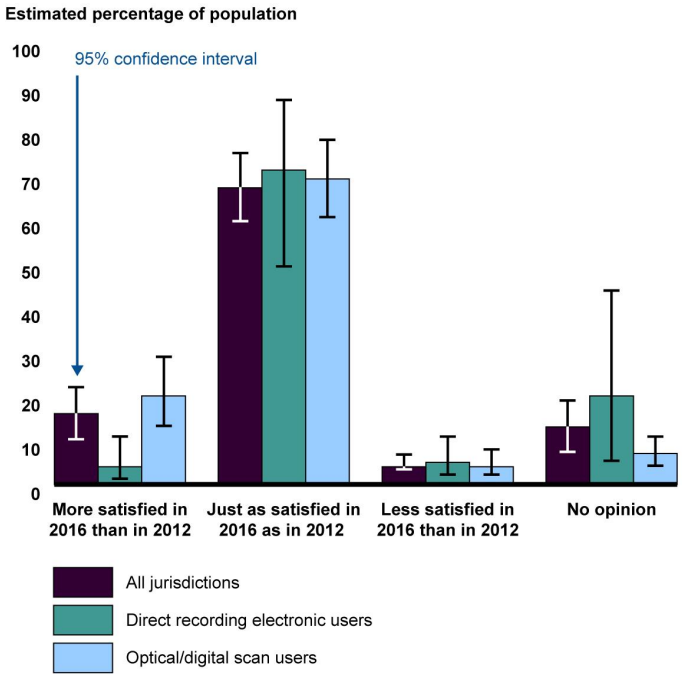
Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

When comparing satisfaction with the performance of their predominant voting equipment used in the 2016 general election against the performance of their predominant equipment used in the 2012 general election, we estimate that jurisdictions with 67 percent of the population nationwide were just as satisfied with their equipment's performance in 2016 as in 2012, while 16 percent reported they were more satisfied (see fig. 5).[56] Among jurisdictions that used different predominant types of equipment, jurisdictions that predominantly used optical/digital scan equipment that were more satisfied with their equipment's performance in 2016 had a larger estimated share of their population (20 percent)

[56]This question was asked of all respondents regardless of whether their jurisdictions used the same or different equipment in the 2012 and 2016 general elections. The 95 percent confidence intervals for these estimates are (59, 75) and (10, 22) respectively.

compared to jurisdictions that predominantly used DRE equipment (4 percent).[57]

Figure 5: Satisfaction with Performance of Predominant Voting Equipment Used in 2016 General Election Relative to Predominant Voting Equipment Used in 2012 General Election



Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

[57]The 95 percent confidence intervals for these estimates are (13, 29) and (1, 11) respectively.

Local Election Jurisdictions and States Consider Multiple Factors and Selected Jurisdictions Have Varying Approaches When Replacing Voting Equipment

Local Election Jurisdictions and States Consider Multiple Factors When Deciding Whether to Replace Voting Equipment

On the basis of our review of literature and studies, interviews with election subject matter experts, and analysis of our local election jurisdiction and state surveys, we identified four key factors and related issue areas within them that jurisdictions and states consider when deciding whether to replace voting equipment. After considering the factors, jurisdictions may decide to replace their equipment or continue using their existing equipment. The four key factors we identified are: (1) the need for voting equipment to meet federal, state, and local voting system standards and requirements; (2) the cost to acquire new equipment and availability of funding; (3) the ability to maintain equipment and receive timely vendor support; and (4) the overall performance and features of voting equipment.[58] In our local election jurisdiction and state surveys, we asked election officials to rate issue areas related to each of these factors as to how important they were when determining whether to replace voting equipment and then rank the issue areas in terms of which

[58]The issue areas within these factors are presented with their respective factor below.

were “most important” in making the determination.[59] Analysis of the results of our surveys indicates that the 24 issue areas within the four factors vary in their relative importance to jurisdictions and states when determining whether to replace voting equipment.

Need for Voting Equipment to Meet Federal, State, and Local Voting System Standards and Requirements

The need for voting equipment to meet applicable federal, state, and local voting system standards and requirements is a factor considered by local election jurisdictions and states when determining whether to replace equipment. At the federal level, HAVA generally requires that voting equipment be accessible to individuals with disabilities.[60] As discussed earlier, HAVA also established the EAC which developed and maintains the voluntary guidelines that voting equipment can be tested against to receive federal certification. In turn, many states have established requirements that voting equipment be federally certified or meet some or all of the standards established by the federal guidelines.[61] According to election subject matter experts we spoke with, in addition to federal requirements and standards, some states have imposed additional requirements that voting equipment must meet or satisfy such as having

[59]In our local election jurisdiction and state surveys, we asked survey respondents to rate issue areas on a scale of “very important,” “somewhat important,” “not very important,” “not important at all,” “not applicable,” and “don’t know.” Of those issue areas that respondents rated as “very important” (or “somewhat important” if the state or jurisdiction did not rate any issue areas as “very important”), we then asked respondents to rank what they consider to be the three most important issue areas. In analyzing these ranking responses, for each issue area, we summed the number of states in the state survey and the estimates of the population percentage represented by jurisdictions in the local survey that indicated the issue area was one of the three most important to consider. For state respondents, we asked them to rate and rank issue areas only if the state has a role in determining whether to replace voting equipment (i.e., if the state determines whether to replace voting equipment or the state and jurisdictions jointly make the determination). Of the 46 state survey respondents, 25 indicated that they have such a role (13 indicated that the determination to replace equipment is made jointly with local jurisdictions while 12 indicated that only they make the determination to replace). See app. IV for the results for each question in our state survey on voting equipment.

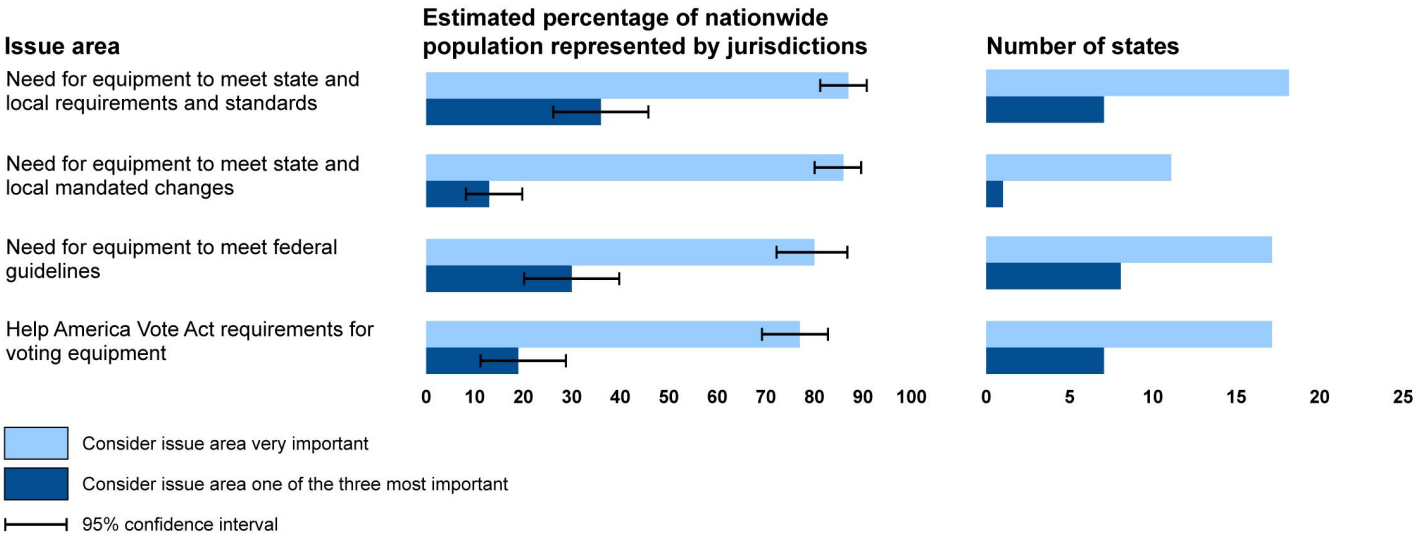
[60]See 52 U.S.C. § 21081(a)(3), which requires that voting systems used in federal elections be accessible for individuals with disabilities in a manner that provides the same opportunity for access and participation as for other voters and provides that this requirement can be satisfied through the use of at least one direct recording electronic voting system or other voting system equipped for individuals with disabilities at each polling place.

[61]See appendix II.

the capability to present all ballot issues and candidates on one page or presenting ballots in multiple languages, for example.[62]

We identified four issue areas related to this factor. Figure 6 shows the importance local jurisdictions and state election officials attributed to the various issue areas within this factor when determining whether to replace voting equipment. For example, the need for equipment to meet state and local requirements and standards was considered "very important" by jurisdictions with 87 percent of the population nationwide and as one of the three "most important" issue areas overall by jurisdictions with 36 percent of the population nationwide.[63] Among the states, this issue area was considered as "very important" by 18 out of the 25 states that indicated having a role in determining whether to replace voting equipment and as one of the three "most important" issue areas overall by 7 out of the 25 states.

Figure 6: Importance of Issue Areas within the Factor "Need for Voting Equipment to Meet Federal, State, and Local Voting System Standards and Requirements," for Jurisdictions and States



Source: GAO analysis of 2017 state and local election jurisdiction survey results. | GAO-18-294

[62]Additionally, according to EAC officials, in many cases local jurisdictions are prohibited, by law, from using voting equipment that is not state-certified.

[63]The 95 percent confidence intervals for these estimates are (81, 91) and (26, 46) respectively.

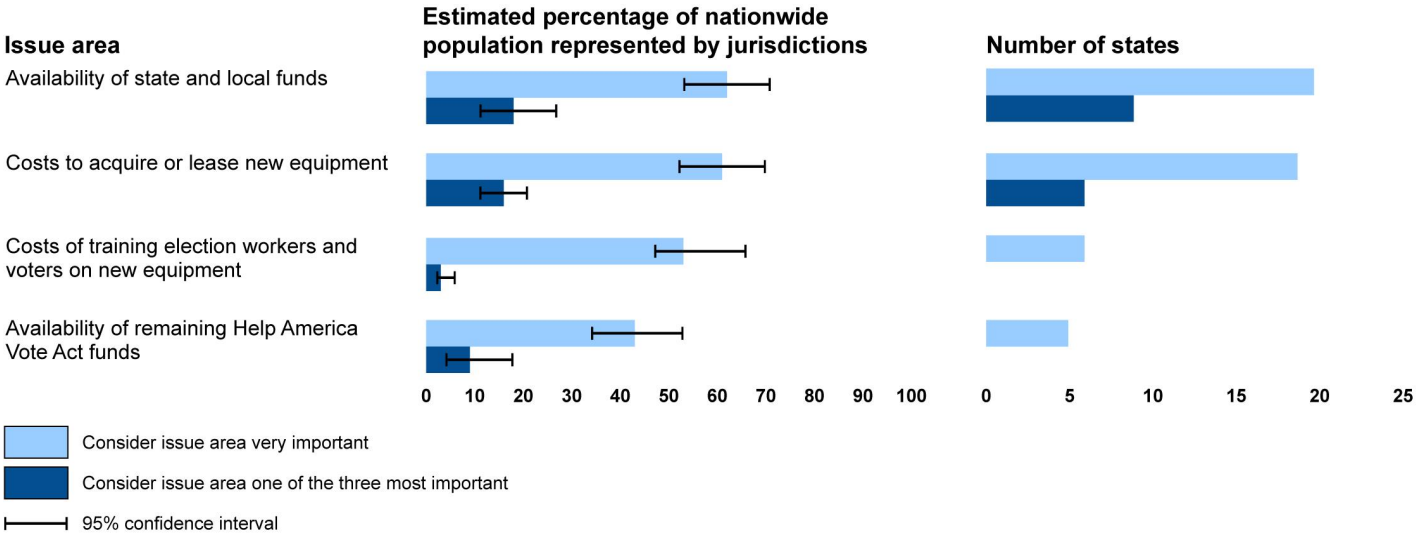
Cost to Acquire New Equipment and Availability of Funding

According to election subject matter experts we spoke with, the costs to acquire new equipment and the availability of funding to pay those costs is a key factor that jurisdictions and states consider when determining whether to replace voting equipment. Acquiring new voting equipment involves a variety of costs and expenses. For example, in addition to the cost of the equipment itself, there can be other associated costs, such as training for poll workers and elections staff on the new equipment and voter outreach and education about the change in equipment, that may be incurred as existing equipment is replaced. These related acquisition and transition costs and expenses are incurred by the jurisdictions and states, which in turn must obtain or allocate resources to cover those costs.

We identified four issue areas related to this factor. Figure 7 shows the importance local jurisdictions and state election officials attributed to these issue areas when determining whether to replace voting equipment. For example, the availability of state and local funds was considered "very important" by jurisdictions with 62 percent of the population nationwide and as one of the three "most important" issue areas overall by jurisdictions with 18 percent of the population nationwide.[64] Among the states, this issue area was considered as "very important" by 20 out of the 25 states that indicated having a role in determining whether to replace voting equipment and as one of the three "most important" issue areas overall by 9 out of the 25 states.

[64]The 95 percent confidence intervals for these estimates are (53, 71) and (11, 26) respectively.

Figure 7: Importance of Issue Areas within the Factor "Cost to Acquire New Equipment and Availability of Funding," for Jurisdictions and States



Source: GAO analysis of 2017 state and local election jurisdiction survey results. | GAO-18-294

Given the importance of funding for the acquisition of new voting equipment and the assistance federal HAVA grants have previously provided, we asked states and jurisdictions additional questions in our surveys about their funding practices and the extent to which they have HAVA grant funds remaining to acquire voting equipment. The results from our surveys provided the following additional information about these issues:

- *Use of local and state funding sources for acquisition of new voting equipment:* On the basis of our local election jurisdiction survey, we estimate that, among various potential funding sources, jurisdictions with 79 percent of the population nationwide obtain funds to acquire new voting equipment through local general funds or budgets as a direct appropriation.[65] Additionally, we estimate that jurisdictions with 43 percent of the population nationwide use state financial assistance or cost sharing as a source of funds for new equipment.[66] According to the results from our state survey, states have different levels of involvement in providing funds for the acquisition of voting equipment. Over half (24) of the 46 states that responded to our survey indicated

[65]The 95 percent confidence interval for the local jurisdiction estimate is (71, 85).

[66]The 95 percent confidence interval for the local jurisdiction estimate is (33, 54).

that they do not provide any financial assistance or cost sharing to local jurisdictions for equipment acquisition, while 11 indicated that they cover all acquisition costs. Eight states indicated that their state provides some financial assistance or cost sharing with local jurisdictions for equipment acquisition, while 2 states indicated a different type of involvement in funding the acquisition of voting equipment, such as covering only the costs of acquiring accessible voting equipment.[67]

- *Availability of HAVA funds:* On the basis of our local jurisdiction survey, we estimate that jurisdictions with 10 percent of the population nationwide had HAVA funds remaining to apply toward the acquisition of new voting equipment,[68] with jurisdictions representing 6 percent of the population only having enough HAVA funds to acquire a portion of the equipment needed.[69] Additionally, we estimate that jurisdictions with 42 percent of the population nationwide had no HAVA funds remaining while jurisdictions with 46 percent of the population did not know whether they had any HAVA funds remaining.[70]
- *Impact of lack of HAVA funds:* Among jurisdictions that did not have any HAVA funds remaining or only enough to buy a portion of the equipment needed, jurisdictions with an estimated 36 percent of the population indicated that the lack of HAVA funds had affected their decisions regarding the replacement of voting equipment.[71] Further, jurisdictions with an estimated 57 percent of the population in this subgroup (of jurisdictions that indicated that the lack of HAVA funds affected their replacement decisions) delayed the replacement of voting equipment while jurisdictions with 25 percent of the population in this subgroup were not able to acquire the equipment that would best meet their needs.[72]

[67]One state respondent selected “don’t know” in response to this question.

[68]The 95 percent confidence interval for this estimate is (5, 19).

[69]The 95 percent confidence interval for this estimate is (2, 16).

[70]The 95 percent confidence intervals for these estimates are (33, 50) and (36, 56) respectively.

[71]The 95 percent confidence interval for this estimate is (27, 45).

[72]The 95 percent confidence intervals for these estimates are (45, 70) and (15, 37) respectively.

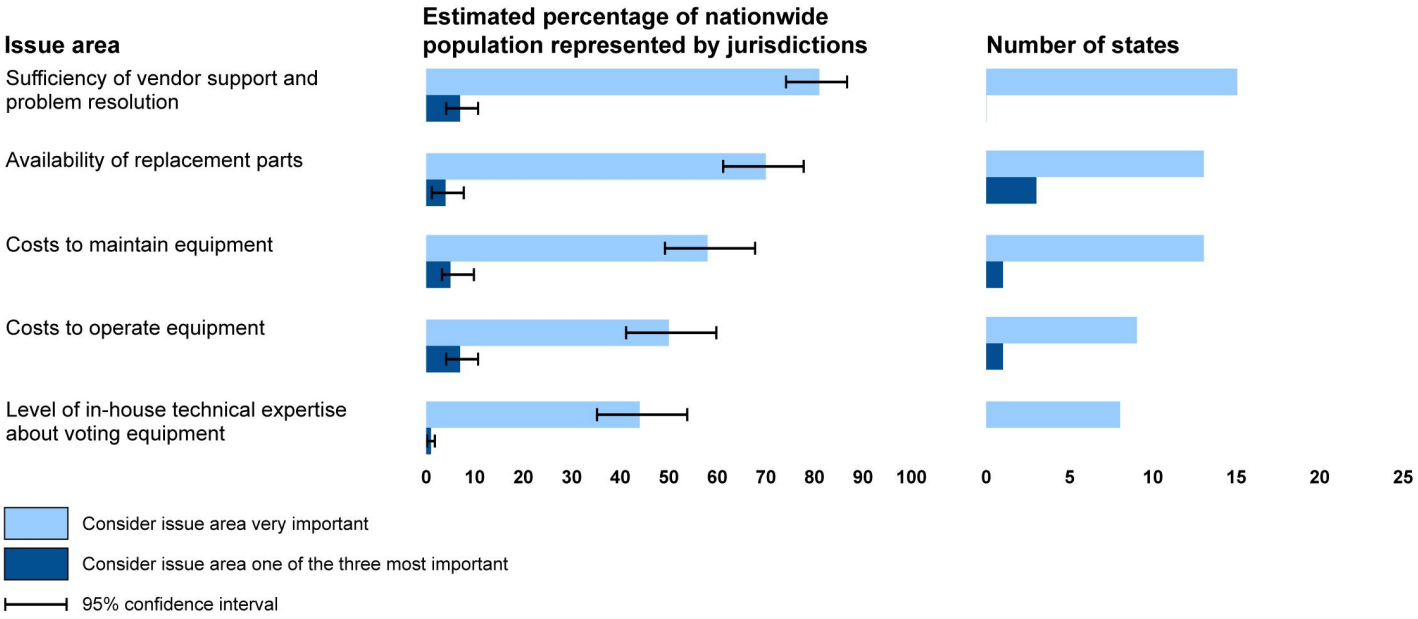
Ability to Maintain Equipment and Receive Timely Vendor Support

The ability of local election jurisdictions and states to maintain voting equipment and receive timely vendor support is a factor considered when determining whether to replace equipment, particularly as the equipment ages. Election subject matter experts we spoke with noted the importance of access to replacement parts for existing voting equipment as something jurisdictions and states may consider when determining whether to replace equipment. Without adequate access to replacement parts and technical service, either from vendors or supplied by in-house expertise, it can be difficult for jurisdictions and states to maintain their current equipment at a satisfactory level.

We identified five issue areas related to this factor. Figure 8 shows the importance local jurisdictions and state election officials attributed to these issue areas when determining whether to replace voting equipment. For example, the sufficiency of vendor support and problem resolution was considered "very important" by jurisdictions with 81 percent of the population nationwide and as one of the three "most important" issue areas overall by jurisdictions with 7 percent of the population nationwide.[73] Among the states, this issue area was considered as "very important" by 15 out of the 25 states that indicated having a role in determining whether to replace voting equipment but no state considered it as one of the three "most important" issue areas overall.

[73]The 95 percent confidence intervals for these estimates are (74, 87) and (4, 11) respectively.

Figure 8: Importance of Issue Areas within the Factor "Ability to Maintain Equipment and Receive Timely Vendor Support," for Jurisdictions and States



Source: GAO analysis of 2017 state and local election jurisdiction survey results. | GAO-18-294

Overall Performance and Features of Voting Equipment

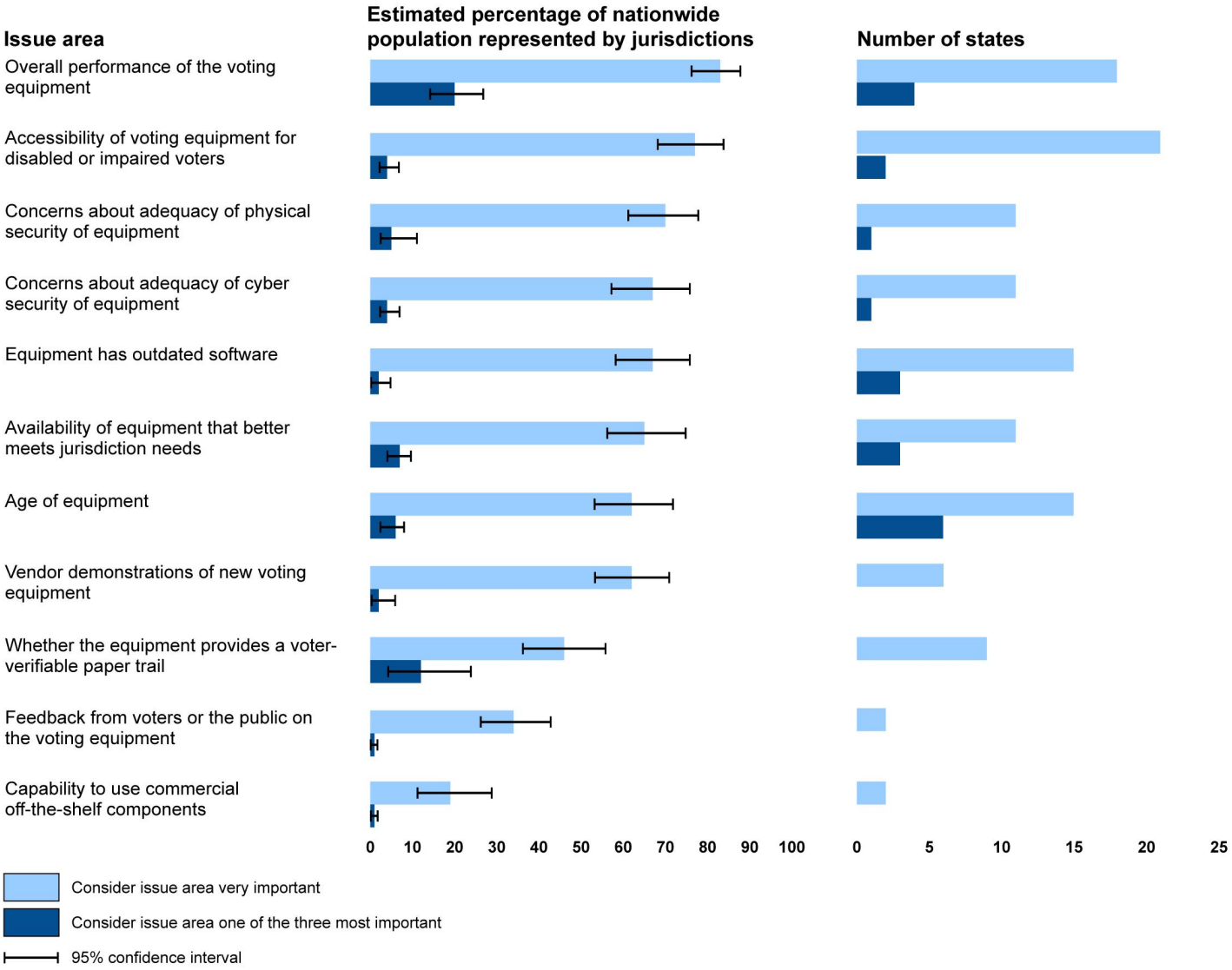
The overall performance and features, both of the existing voting equipment and of potential replacement equipment, is also a factor considered by local election jurisdictions and states when determining whether to replace voting equipment. For example, jurisdictions and states may consider the age of their current equipment and how well it is performing, as well as how its performance compares to that of new equipment available for acquisition. In addition, according to elections literature we reviewed and election subject matter experts we spoke with, jurisdictions and states may also take into account specific features new voting equipment can provide that might better meet their needs. The desired features may vary from jurisdiction to jurisdiction depending on specific needs and circumstances, but such features may include an enhanced ability to process a high volume of absentee ballots, capability to present ballots in multiple languages, or ease for poll workers to set up and for voters to use, for example.

We identified 11 issue areas related to this factor. Figure 9 shows the importance local jurisdictions and state election officials attributed to

these issue areas when determining whether to replace voting equipment. For example, the overall performance of the voting equipment was considered "very important" by jurisdictions with 83 percent of the population nationwide and as one of the three "most important" issue areas overall by jurisdictions with 20 percent of the population nationwide.[74] Among the states, this issue area was considered as "very important" by 18 out of the 25 states that indicated having a role in determining whether to replace voting equipment while 4 out of the 25 states considered it as one of the three "most important" issue areas overall.

[74]The 95 percent confidence intervals for these estimates are (76, 88) and (14, 27) respectively.

Figure 9: Importance of Issue Areas within the Factor "Overall Performance and Features of Voting Equipment," for Jurisdictions and States

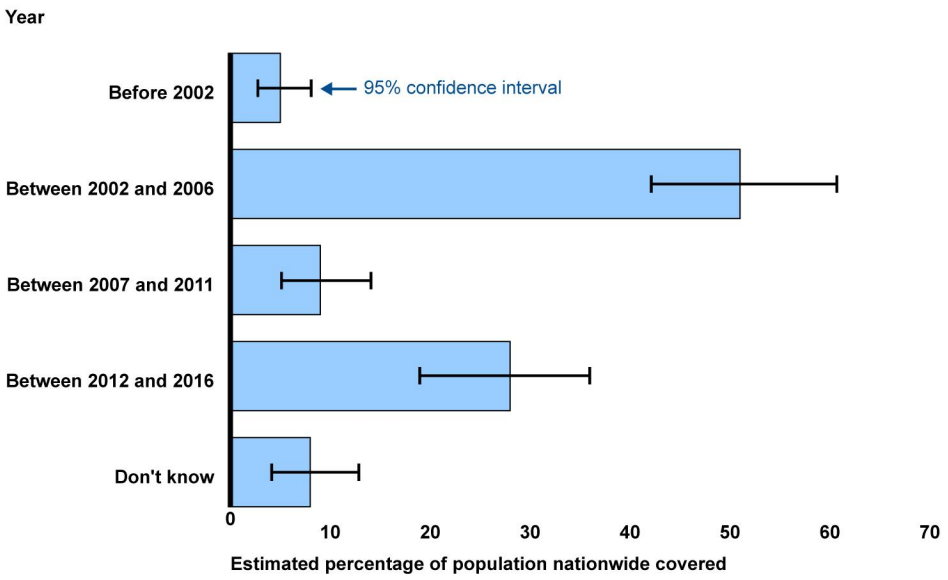


Source: GAO analysis of 2017 state and local election jurisdiction survey results. | GAO-18-294

Given the potential challenges local election officials have identified with using aging or outdated equipment, in our local election jurisdiction survey we asked jurisdictions when they first used their predominant voting equipment. Based on their responses, we estimate that jurisdictions with over half of the population nationwide used predominant

voting equipment in the 2016 general election that was first deployed between 2002 and 2006 (see fig. 10)[75] Jurisdictions with the next largest estimated share of the population (28 percent) used equipment that was first deployed between 2012 and 2016.[76]

Figure 10: Year of First Use of Predominant Voting Equipment Used in 2016 General Election



Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Approaches to Replacing Voting Equipment Varied across Selected Jurisdictions

The five local election jurisdictions we selected to include in our review either replaced their voting equipment between 2012 and 2016 or plan to replace their equipment in time for the 2020 general election.[77] We selected these jurisdictions to obtain variation in, to the extent possible,

[75]The 95 percent confidence interval for this estimate is (42, 61).

[76]The 95 percent confidence interval for this estimate is (19, 36).

[77]On the basis of our survey of local election jurisdictions, we estimate that jurisdictions with 28 percent (19, 36) of the population nationwide replaced their predominant equipment between 2012 and 2016, and jurisdictions with 30 percent (21, 39) of the population nationwide plan to acquire new voting equipment in time for use in the 2020 general election.

population of jurisdiction, type of voting equipment replaced and selected, and state involvement in selecting and funding voting equipment replacement, among other factors. Table 3 summarizes information related to voting equipment replacement across the five selected jurisdictions.

Table 3: Information Related to Voting Equipment Replacement across Five Selected Jurisdictions

Aspect	Los Angeles County, California	Travis County, Texas	Anne Arundel County, Maryland	Lafayette County, Florida	Beaver County, Utah
Number of registered voters on Election Day 2016	4,993,937	732,037	407,162	4,467	3,268
Number of voting locations on Election Day 2016	4,523	191	155	5	1 (conducted vote-by-mail elections)
Year new equipment first used or planned to be deployed in an election	Plans to fully deploy new equipment in 2020	Plans to fully deploy new equipment in 2020	First used new equipment in 2016	First used new equipment in 2016	First used new equipment in 2014
Type of voting equipment replaced or to be replaced	Central count optical scan with manually marked paper ballot	Direct recording electronic (DRE) equipment without a voter-verified paper audit trail (VVPAT)	DRE without a VVPAT	Precinct count optical scan with manually marked paper ballot	DRE with a VVPAT
Type of new voting equipment used or planned to be used	Central count digital scan with electronically marked paper ballot	DRE with a VVPAT or ballot marking device with precinct count digital scan	Precinct count digital scan with manually marked paper ballot	Precinct count digital scan with manually marked paper ballot	Central count digital scan with manually marked paper ballot
State involvement in selecting voting equipment for the November 2016 general election	State maintains a list of approved voting equipment from which local jurisdictions were required to select[a]	State maintains a list of approved voting equipment from which local jurisdictions were required to select[b]	State required the use of the same voting equipment type and model statewide	State maintains a list of approved voting equipment from which local jurisdictions were required to select[b]	State was not involved in the approval or selection of voting equipment
Sources of public funding to acquire voting equipment	Help America Vote Act (HAVA), state, and local funds	HAVA and local funds	State and local funds. State provides funding for 50% of acquisition costs	HAVA and local funds	HAVA and local funds
State requirements on the use of federal voting system guidelines to test or certify equipment	None, requires state certification to state standards[c]	Requires federal certification	Requires federal certification	None, requires state certification to state standards	Required federal certification until May 2017[d]

Source: GAO analysis of 2017 state and local election jurisdiction survey responses, interviews with election officials in selected local jurisdictions and their respective states, and state elections codes and other relevant documentation. | GAO-18-294

[a]Vendors can submit voting equipment for state approval to use in elections. Los Angeles County officials noted that approval for use of voting equipment can also be granted on a county-by-county basis.

[b]Vendors can submit voting equipment for state approval to use in elections.

[c]California's elections code requires the voting system standards adopted by the Secretary of State to meet or exceed federal voluntary voting system guidelines set forth by the Election Assistance Commission or its successor agency. See Cal. Elec. Code § 19101(a).

[d]Utah's elections code required voting equipment to be federally certified when Beaver County purchased their new equipment in 2014. As of May 2017, voting equipment is required to be certified by the Lieutenant Governor to meet certain standards outlined in code (e.g., accuracy and reliability), which can be met if the equipment has been certified by the Election Assistance Commission or a laboratory accredited by the commission to test voting equipment. See Utah Code Ann. § 20A-5-802.

These jurisdictions illustrate varying approaches that localities have used or are using to replace their voting equipment based on their specific needs, circumstances, and resources. For example,

- *Los Angeles County, California.* The county has a large and diverse electorate and is in the process of self-designing its own voting system, which is expected to consist of ballot marking devices that produce paper ballots to be tallied on central count digital scanners. County officials stated that the current design concept for the new equipment is intended to provide greater flexibility in administering elections, provide a more user-friendly and accessible voting experience, enhance accuracy and auditability, and could potentially lower costs for system upgrades if developed as planned. For example, according to officials, the ballot marking device is intended to provide the ease of use of a touch screen interface, which would incorporate features such as scrolling and tapping that are familiar to voters who use mobile devices, and will include a headset, tactile keypad, and other devices for voters with disabilities. It would also allow the county to have ballots with multiple formats and a large number of races.

  The county's process for developing and deploying its new voting equipment began in 2009 and has five phases—(1) public opinion and stakeholder baseline research, (2) establishment of voting system guiding principles, (3) system design and engineering, (4) manufacturing and certification, and (5) phased implementation. According to officials, the county has taken a user-centered approach to the design of the new voting equipment that prioritizes the specific needs and expectations of the voters. The county is currently in the manufacturing and certification phase and reported that about $19 million has been expended to develop the new voting equipment as of December 31, 2017. County officials told us they plan to retain ownership of the intellectual property rights of the new voting equipment so that the system remains publicly owned and not

proprietary like traditional vendor equipment. The county plans to pilot the new equipment in some early voting locations in 2019 and fully roll it out in 2020.

- *Travis County, Texas.* The county began its efforts to design its own voting equipment based in part on findings and recommendations from an election study group it convened in 2009. In 2012, it developed a concept for a DRE with a voter-verified paper audit trail that centered on system security, auditability, and the use of commercial off-the-shelf technology.[78] In September 2017, the county announced that it had decided to no longer pursue building the voting equipment because the proposals it received from vendors and other organizations for developing key components of the equipment were not sufficient to build a complete voting system, among other reasons. According to county officials, the county plans to acquire either DREs or ballot marking devices with precinct count digital scanners from a voting system vendor with the goal that whatever equipment it acquires incorporates some of the key features it had intended for its self-designed equipment. For example, officials stated that the new equipment must produce printed paper records that can be tallied and connected with electronic voting records through an automated process and allow for third party verification of results and better postelection audits. They noted that they are prepared to work with vendors to customize existing equipment to meet the county's requirements if needed. County officials estimate that the new equipment will cost about $16 million and stated that acquisition will be funded through local bonds. The county issued a request for proposals for the equipment in November 2017 and plans to have it in place for the 2020 election.
- *Anne Arundel County, Maryland.* In 2016, the county replaced its DREs with a system in which voters manually mark paper ballots and insert them into precinct count digital scanners which then count them. Maryland requires the use of uniform voting equipment in

[78]The EAC defines commercial off-the-shelf products as software, firmware, devices, or components that are used in the United States by many different people or organizations for many different applications other than certified voting systems and that are incorporated into the voting system with no manufacturer- or application-specific modification. For example, such products can include hardware that can be purchased commercially (e.g., tablet devices, scanners, printers, etc.) and integrated as part of voting equipment. On the basis of our survey of local election jurisdictions, we estimate that jurisdictions with about 6 percent (4, 10) of the population nationwide used commercial off-the-shelf components in their predominant voting equipment for the 2016 general election.

polling places statewide and the state and counties each pay 50 percent of the costs of acquiring equipment. In 2007, Maryland enacted a law that prohibited the use of a voting system unless the State Board of Elections (SBE) determined that the system provides a voter-verifiable paper record, thereby requiring the state's DREs to be replaced.[79] According to Maryland SBE officials, state law specifically required the purchase of precinct count scanners so the board did not consider other types of voting equipment.[80]

The SBE issued a request for proposals for the new voting equipment in July 2014 and four vendors responded.[81] The board formed an evaluation committee to analyze the technical and financial details of the proposals, and according to officials, the committee hosted a public demonstration to collect feedback on the equipment under consideration and worked with the University of Baltimore to perform usability and accessibility testing on the equipment. The SBE decided to lease rather than purchase the equipment for a number of reasons.[82] For example, officials said that leasing provided increased flexibility to update or replace equipment more frequently and had lower upfront costs. According to SBE officials, the current payment to the vendor for leasing the digital scan equipment statewide is approximately $1.1 million per quarter. SBE and Anne Arundel County officials stated that deployment of the new equipment in the 2016 general election went smoothly with no significant challenges. The state contracted with a third party vendor to conduct a postelection audit of the 2016 general election by using independent software to tally all digital ballot images.[83] The audit confirmed the accuracy of the

[79]See 2007 Md. Adv. Legis. Serv. 547, 548.

[80]The law defines a voter-verifiable paper record to include a paper ballot prepared by the voter for the purpose of being read by a precinct-based scanner, among other features.

[81]State funding for the new equipment was not available until 2014 due to budgetary constraints.

[82]On the basis of our local election jurisdiction survey, we estimate that jurisdictions with 5 percent (2, 9) of the population nationwide used voting equipment in the 2016 general election that was leased rather than purchased.

[83]After piloting three postelection audit methods in selected counties following the April 2016 primary election, the SBE determined that using independent software to tally all digital ballot images best met the state's needs. Under this audit, the results from the independent automated tabulation by the vendor are compared to the tabulation results from the voting equipment used in the election. Any variance above the established threshold of half a percent for any given contest would trigger an additional review, which could include a manual review of voted paper ballots.

election results.[84] According to SBE officials, the new equipment's ability to capture and store digital images of the ballots made this type of audit possible. Anne Arundel County officials stated that the ability to conduct such an audit is one of the main benefits of the new equipment.

- *Lafayette County, Florida.* Lafayette County has a small population and, in 2016, replaced its precinct count optical scan equipment with precinct count digital scan equipment. The county formed a consortium with 11 other counties in the state to help acquire its new equipment.[85] According to the county's Supervisor of Elections, having the consortium approach state officials as a group helped secure HAVA funds to help the counties purchase the voting equipment. In addition, he stated that being a part of the consortium helped the counties negotiate a lower price for their equipment than what they could have obtained individually because they pooled their purchases and acquired a higher volume of machines.[86] According to the Supervisor of Elections, the consortium decided to purchase precinct count digital scanners from the same vendor the counties had used before because county staff were familiar with the vendor and equipment, among other reasons. He stated that the total cost to purchase Lafayette County's new voting equipment was about $70,000.[87]

[84]As part of the state's replacement of its voting equipment, it also acquired central count scanners to tally absentee and provisional ballots. The audit identified some issues with these scanners in Anne Arundel and other counties. For example, residue and scratches on the scanner lens, as well as folds on the ballots, were counted by the scanner as write-ins in some cases and resulted in overvotes. These issues were corrected prior to certification of the election results by having the counties rescan the problem ballots. SBE officials stated that they are working with the equipment vendor to address these issues by adjusting the sensitivity of the central count scanners.

[85]According to the Supervisor of Elections, the 12-county consortium consisted of Bradford, Franklin, Gadsden, Gulf, Hamilton, Hendry, Highlands, Holmes, Jackson, Lafayette, Suwanee, and Union Counties.

[86]On the basis of our survey of local election jurisdictions, we estimate that jurisdictions with 15 percent (8, 26) of the population nationwide consolidated individual purchase contracts into a single higher volume contract to acquire new voting equipment.

[87]According to the Supervisor of Elections, the equipment was purchased through a loan and payments are to be made in installments over a 5-year period. Florida Division of Elections officials noted that the HAVA funds allocated to the counties in the consortium are subject to annual approval by the state legislature.

The Supervisor of Elections said that the digital scanners have features that were an improvement over the county's previous optical scan equipment. For example, he told us that the new scanners have more robust security features, such as locking panels, seals, and a requirement for a passcode to access the system.[88] He also noted that the scanners digitally capture and store ballot images. The Supervisor of Elections and the two poll workers we interviewed stated that deployment of the new voting equipment went smoothly and the county did not experience any challenges because the new and previous equipment are both precinct count scanning systems. According to the Supervisor of Elections, a postelection audit that was conducted, in which the county manually tallied ballots from a randomly selected race and precinct, found that the results were accurate.[89]

- *Beaver County, Utah*. Beaver County has a small population and previously used DREs with a voter-verified paper audit trail. In 2014, Beaver County began conducting vote-by-mail elections and replaced its DREs with central count digital scan equipment to support this change.[90] County officials said that, in 2014, they verbally requested proposals for the new equipment from their current vendor and an elections services company that the county had employed in 2012 to provide training, systems testing, and other support for elections. According to the Deputy Clerk, the county requested proposals from these two entities because county officials were familiar with them and were not aware of other vendors that might submit proposals. Officials stated that the county received a proposal from the elections services company, and selected the company because it was the only bid

[88]According to the Supervisor of Elections, Lafayette County's previous optical scanners required a key to turn on and operate the equipment, but were not set up to require a passcode to access the system.

[89]Florida state law requires counties to conduct a postelection audit by performing either (1) a manual audit of votes for one randomly selected race in at least 1 percent but no more than 2 percent of precincts containing that race or (2) an automated tally of the votes cast across every race that appears on the ballot in at least 20 percent of randomly chosen precincts. See Fla. Stat. Ann. § 101.591.

[90]Utah legislation enacted in 2012 allows local jurisdictions in the state to elect to administer vote-by-mail elections, in which all registered voters receive a ballot in the mail which they can mark and return by mail or, if available, at a polling location or Election Day vote center. See Utah Code Ann. § 20A-3-302. Utah state election officials reported that 21 of the state's 29 counties conducted vote-by-mail elections in the November 2016 general election.

received and the equipment the company sold met the county's needs and was federally certified.[91] The county reported that the cost to purchase the equipment was about $46,000. Officials said that they are very satisfied with the performance of the new voting equipment. They noted that conducting vote-by-mail elections and using central count scanners allow them to administer elections from one location on Election Day, which requires less time and resources than having to manage multiple polling places. Officials also stated that the new digital scanners are able to count a high volume of ballots in a short period of time. According to officials, the county conducted two postelection audits for the 2016 general election—one required by the state and another that the county initiated.[92] They reported that both audits validated the election results.

See appendix V for additional details about voting equipment replacement in our five selected jurisdictions, including the factors that influenced their decisions to replace voting equipment; selection, acquisition, and implementation of their equipment; and perspectives on the process.

Stakeholders Have Varying Views on How the Voting System Guidelines Affect Equipment Replacement and Development, and the EAC is Updating the Guidelines with Stakeholder Input

Stakeholders Provided Varying Perspectives on How the Current Voluntary Guidelines and Testing and Certification Processes Affect Replacing and Developing Voting Equipment

On the basis of our survey of state election officials and interviews with officials from selected voting system vendors and subject matter

[91]Utah state law required voting systems used in elections to be federally certified at the time Beaver County acquired its new equipment.

[92]For the state audit, the county hand counted 1 percent of total ballots from a randomized list. In addition, the county conducted its own audit by running all ballots on its other digital scanner to compare results. Officials stated that the county has two scanners so that one can be used as a back-up or for auditing if needed.

experts—representatives from nongovernmental research and other organizations involved in the field of election administration—we found that these stakeholders have varying perspectives on how the current Voluntary Voting System Guidelines (VVSG 1.0 and VVSG 1.1) and their associated testing and certification processes facilitated or posed challenges to the replacement and development of voting equipment.[93] The states we surveyed and the other selected stakeholders we interviewed primarily had experience with VVSG 1.0. As discussed earlier, the VVSG 1.1 were issued in March 2015, but due to the time it generally takes to implement updates to new guidelines, including developing testing programs, among other things, no systems had been certified under this version of the guidelines as of November 2017. One vendor's system underwent partial testing using VVSG 1.1 but the vendor withdrew the system before the testing was completed.

Perspectives on How the Voluntary Guidelines Facilitate Replacing and Developing Voting Equipment

States and selected vendors and subject matter experts provided varying perspectives on how aspects of the current voluntary voting system guidelines and their associated testing and certification processes facilitate the replacement and development of voting equipment. Generally, stakeholders indicated that the guidelines and processes provide assurance that new equipment meets certain requirements, provide guidance for equipment developers, provide a model for state standards, and provide cost savings for states that do not have to duplicate federal testing. For example, 15 of the 26 state survey respondents said the guidelines provide assurance that new voting equipment meets baseline requirements related to security, functionality, usability, accessibility, and privacy. One of these 15 state respondents noted that if the EAC certified voting equipment against the federal guidelines, he believes it meets the highest election standards and also meets requirements set by his state. Another of these 15 state respondents noted that voting equipment that has been tested using the

[93]Election officials from 26 states responded to our survey question on how the current federal voluntary voting system guidelines (VVSG 1.0 and 1.1) facilitate the replacement of voting equipment in their state and officials from 20 states did not respond to our question. Officials from 27 states responded to our question on how the current federal guidelines hinder the replacement of voting equipment and officials from 19 states did not respond to our question. In interviews, we asked seven selected voting system vendors and nine selected subject matter experts how the current guidelines facilitate or hinder the replacement and development of voting systems.

federal guidelines and certified by the EAC will have a higher level of reliability than equipment that has not met these guidelines or been certified by the EAC.

Subject matter experts from one nongovernmental organization noted that states that establish their own voting system standards often use the federal guidelines as a base to help develop their standards because the federal guidelines have comprehensive requirements and are well vetted. Experts from another nongovernmental organization said that the guidelines establish a standard for voting equipment features and performance, which may help small jurisdictions that want to acquire new voting equipment but may not have the expertise to independently evaluate the equipment. Further, officials from most of the vendors we interviewed agreed that the federal standards serve as effective baseline requirements. For example, officials from five of the seven vendors we interviewed said that when they are developing voting systems, the federal guidelines help them define the baseline standards that their systems should meet, and five of the nine subject matter experts said the federal guidelines provide baseline requirements.

Further, 4 of the 26 state survey respondents indicated that the current voluntary guidelines help reduce the costs and resources needed for states to test and approve new voting equipment. For example, one of the 4 state respondents reported that states do not have to rely on their own voting system testing laboratories for all aspects of the testing and certification of new voting equipment to meet state requirements because most of the testing and certification relevant to state requirements has already been done by EAC-accredited testing laboratories and the EAC. The official noted that this allows the states to do less testing, which could save them money.

Perspectives on How the Voluntary Guidelines Pose Challenges to Replacing and Developing Voting Equipment

The states we surveyed and selected vendors and subject matter experts we interviewed also reported that aspects of the current voluntary voting system guidelines and their associated testing and certification processes could pose challenges to the replacement and development of voting equipment in a number of ways. Specifically, some stakeholders indicated that aspects of the guidelines and processes could discourage innovation in equipment development, could limit the choices of voting equipment on the market because the testing and certification processes take too long, and could be costly for states and vendors. For example, officials

representing three of the seven vendors we interviewed said the current federal guidelines may discourage innovation for new voting equipment because they are too specific or overly prescriptive. Officials from one of these three vendors said the current guidelines require a specific oval size on the ballots, prescribing how tall and wide the oval should be.[94] Instead of such requirements, the officials said they would like the guidelines to be more performance-based and state, for example, that voters should be able to successfully mark a ballot a specified percentage of the time. Further, officials from another vendor said that the current guidelines are generally written for the purpose of testing and certifying end-to-end voting systems rather than system components such as ballot marking devices, which are generally developed by smaller vendors. As a result, according to this vendor, smaller vendors may face challenges getting new technology certified and into the market. EAC officials stated that they recognize that the current guidelines should be more flexible because specificity may limit innovation and they believe the updates to the VVSG 2.0 should help address this issue.

In addition, some stakeholders said they believed that the voluntary guidelines and associated testing and certification processes take too long, and thus limit the choices of voting equipment on the market and make it difficult to make improvements to existing equipment. For example, officials from 8 of the 27 state survey respondents and three subject matter experts said the guidelines and their respective processes limit the number of voting systems that are available for acquisition. Three of the 8 states and three subject matter experts said, in their view, the EAC testing and certification process takes too long. In addition, according to one subject matter expert, if a jurisdiction wants to make changes to its existing voting equipment, such as incorporating new software, it can be a difficult and lengthy process to certify the modified equipment, and in some cases the entire system must be recertified. Also, an official from one vendor said that the federal certification processes are complicated, onerous, and time-consuming and they discourage vendors from making modifications to their voting systems even though the modifications might improve the systems. EAC officials said they have heard from stakeholders that the certification process takes too long but stated that this perception was more accurate in the years immediately following the EAC's issuance of the VVSG 1.0 in 2005.

[94]The VVSG 1.1 require that a voting system ensures the ovals or boxes on the ballots where voters mark their selections be no less than 3 millimeters across in any direction.

They said that if voting equipment has been modified and is ready for testing and there are no significant problems encountered during the testing, certifying modifications should take a few weeks to a few months to complete and full system testing and certification of new systems should take about 6 to 9 months.

Further, officials from 4 of the 27 states that responded to our survey said the EAC testing and certification process can be costly. One state election official said that the cost of certification may discourage vendors from developing new systems and pursuing EAC certification for their systems, which could limit their ability to sell or supply their systems to state and local election jurisdictions. In addition, this state election official noted that costly federal certification of voting systems has limited the voting equipment choices for election officials. Further, officials from one vendor said that they submitted a new voting system for EAC testing and certification and spent over $12 million before they learned that there were significant issues with getting their system certified. According to EAC officials, this was an uncommon occurrence that resulted from the vendor submitting a system that needed additional work and was not ready for certification. The vendor decided to withdraw its system from the testing and certification process.

The EAC Is Updating the Voluntary Voting System Guidelines with Stakeholder Input and Plans to Issue the New Version in 2018

Shortly after the adoption of VVSG 1.1 in March 2015, the EAC, in conjunction with NIST and the TGDC, began work to develop the next iteration of the guidelines, VVSG 2.0, and anticipates issuing the new version in late summer 2018. The EAC, NIST, and the TGDC have taken actions to develop VVSG 2.0 that may address some of the issues with the earlier iterations of the guidelines that were raised by stakeholders. For example, they have

- established goals to guide the VVSG 2.0 development process,
- established working groups to inform the guidelines, and
- developed VVSG 2.0 high-level principles and guidelines.

Establishment of Voluntary Voting System Guidelines Development Goals and Working Groups

Voluntary Guidelines Development Goals

According to the EAC and NIST, in August 2014, the Future VVSG Working Group, which consisted of officials from state and local election offices, technical experts in such areas as security and disability, and voting system vendors, among others, began work which culminated in the creation of 12 goals to guide the development efforts for the voluntary guidelines. One goal, for example, states that the guidelines' requirements should be performance based and technology neutral. The goal statement further elaborates that the guidelines should be free from detailed descriptions of any technology, and that the guidelines should be functional in nature so that they can more easily be redefined as technology changes. Another development goal states that the voluntary guidelines and its testing and certification processes should not impose unanticipated cost burdens onto organizations. These goals are designed to address some of the issues with the current voluntary guidelines identified by the stakeholders we interviewed as posing challenges to the replacement and development of voting systems, such as discouraging innovation because they are too specific and discouraging vendors and other voting system developers from pursuing EAC certification for their systems because the process is potentially costly.

Working Groups

After the 12 goals for the voluntary guidelines were developed, the EAC and NIST established a new process for developing the next guidelines that is intended to allow for broader and more transparent stakeholder involvement than prior guidelines' development efforts. This new process brings stakeholders together through a working group structure to develop the guidelines. According to the EAC, the previous process did not fully allow for stakeholder input or effectively leverage stakeholder expertise in developing the guidelines because comments on the

guidelines were solicited from the Standards Board and external stakeholders after most of the work had been done.[95]

In 2015, the EAC and NIST established seven working groups to obtain feedback and input from stakeholders early in the voluntary guidelines development process. According to the EAC and NIST, the four constituency and three election cycle working groups were created as a public/private partnership to inform the development of the guidelines and are composed of state and local election officials, representatives from the federal and private sectors, members of standards bodies, EAC committee members, academic researchers, and other interested parties.[96]

The working groups are led by EAC and NIST staff, and have more than 600 participants across the seven groups.[97] EAC and NIST officials stated that they have informed election officials and other stakeholders about opportunities to participate on these working groups to share their ideas. The four constituency working groups represent areas related to human factors (accessibility and usability), cybersecurity, interoperability, and testing and are charged with developing guidance or other deliverables related to these four areas. For example, one objective for the human factors working group is to identify gaps or issues with current accessibility and usability requirements for voting. The election cycle working groups—focused on pre-election, election, and postelection activities—develop process models related to election activities. For example, an objective for the election working group is to identify the necessary functionality of election systems needed to administer early

[95]The EAC Standards Board, designated by HAVA to assist the EAC in carrying out its duties under the law, advises the EAC through review of the voluntary voting system guidelines, including updates to the guidelines, among other things. The board consists of 110 members—55 state election officials selected by their respective chief state election officials and 55 local election officials selected through a process supervised by their chief state election officials.

[96]Members of the federal sector include officials from agencies such as the Department of Homeland Security and U.S. Access Board—a federal agency that promotes equality for people with disabilities through leadership in accessible design and the development of accessibility guidelines and standards; members of the private sector include voting system vendors and advocates for cybersecurity; standards bodies include the EAC Standards Board and Board of Advisors; and EAC committee members include those serving on the TGDC, among others.

[97]According to EAC and NIST officials, the constituency working groups are led by NIST staff and the election cycle working groups are led by EAC staff.

voting and Election Day activities. The work by these seven working groups will help inform the development of the voluntary guidelines' requirements. Table 4 shows the seven working groups and their respective responsibilities.

Table 4: Voluntary Voting System Guidelines (VVSG) 2.0 Working Groups and Their Responsibilities

	Working Group	Responsibilities
Constituency working groups	Human Factors Working Group	Issues related to human factors, including access to and use of voting systems
	Cybersecurity Working Group	Issues related to voting system security, including various aspects of security controls and auditing capabilities
	Interoperability Working Group	Issues related to voting system interoperability, including producing common data format specifications for election equipment
	Testing Working Group	Issues related to voting system testing, including determining that specifications and requirements are clear, unambiguous, and testable, among other things
Election cycle working groups	Pre-election Working Group	Pre-election activities, including voting equipment initialization and election readiness, among others things
	Election Working Group	Election Day activities, including equipment operation in polling places and elsewhere, casting, counting, and tabulation, among other things
	Postelection Working Group	Postelection activities, including reporting, reconciliations, auditing, and certification, among other things

Source: Election Assistance Commission and National Institute of Standards and Technology documents on the VVSG 2.0 development process. | GAO-18-294

Some of the stakeholders we interviewed participate in these working groups. For example, officials from six of the seven voting system vendors we contacted said they have a representative on one or more of the constituency working groups. Generally, these six vendors said the working groups are a positive feature of the voluntary guidelines' development process. For example, officials from one vendor said they have been encouraged by the amount of collaboration on the working groups, and officials from another vendor said it is beneficial that vendors are part of the working groups because they bring experience and expertise with designing and developing various types of voting systems.

Development of the VVSG 2.0 High-Level Principles and Guidelines

In August 2017, the TGDC adopted high-level principles and supporting guidelines for the VVSG 2.0. These principles and guidelines are intended to provide system design goals and broad descriptions of the functions that make up a voting system, in contrast to the VVSG 1.1 which focused more on device- or system-specific requirements. The

VVSG 2.0 will be supplemented by requirements consisting of technical details voting system vendors can use to design devices that meet the new guidelines. The supplemental requirements will also detail test assertions for how the accredited test laboratories will validate that a system complies with the requirements.[98] One of the VVSG 2.0 principles, for example, is that ballots and vote selections should be presented in a clear, understandable way so that they can be marked, verified, and cast by all voters. The corresponding guidelines for this principle focus on ballots being perceivable, operable, and understandable. For example, the guideline for perceivable ballots notes that default voting system settings for displaying ballots should work for the widest range of voters and allow voters to adjust settings and preferences to meet their needs.

Another VVSG 2.0 principle is that the voting system should be designed to support interoperability, including having voting devices that can interface with each other. The corresponding guidelines for this principle include using standard data formats and commercial off-the-shelf devices if they meet applicable requirements. According to NIST officials, one goal of the interoperability working group is to develop guidance that will enable election equipment and interfacing software to interoperate more easily and "speak the same language." NIST officials stated that this goal is intended to allow vendors to build and certify system components instead of a full voting system. These principles are designed to help address some of the issues reported by stakeholders, such as the impact of prescriptive requirements for ballot designs on vendor innovation and the challenges encountered with component certification under the current voluntary guidelines.

Further, officials from the EAC told us that one key change with the VVSG 2.0 is that the EAC commissioners no longer have to approve changes to the supplemental requirements and test assertions, which will instead be vetted by the EAC's Board of Advisors and Standards Board. EAC officials noted that this allows for greater flexibility to make improvements to the requirements and testing process, including making changes in response to technological advancements. Additionally, depending on the situation, the new voluntary guidelines are intended to allow for more streamlined testing and certification processes. For example, EAC officials said that under the new guidelines, if there are modifications that

[98]The previous VVSG versions do not include principles and guidelines but do include requirements and test assertions.

have been made to a voting system that has already been certified, the changes can be tested without having the entire voting system go back through the testing and certification process.

Next Steps in Developing the VVSG 2.0

According to EAC officials, the next steps in the VVSG 2.0 development process are to share the high-level principles and guidelines with the EAC's Board of Advisors and Standards Board for further vetting, provide the public the opportunity to comment on them, and provide them to the EAC commissioners for approval. Specifically, before final adoption of the guidelines, both boards are to review and submit comments and recommendations regarding the guidelines to the commissioners.[99] EAC officials anticipate that the EAC boards will likely review and pass resolutions in support of the principles and guidelines in April 2018. Following the board reviews, there will be a 90-day period for public comment on the VVSG 2.0, as required by HAVA. The EAC hopes that the time it typically takes to respond to public comments will be shorter than for prior voluntary guidelines, due to the extensive feedback and comments received and considered by the working groups during the development phase. EAC officials anticipate that the EAC commissioners will vote on the VVSG 2.0 principles and guidelines in August or September 2018, and the VVSG 2.0 will be issued after they are approved. According to EAC and NIST officials, the working groups have begun developing the supplemental requirements for the new guidelines. They said that the requirements are expected to be drafted by the summer of 2018 and test assertions for most voting systems are expected to be developed by the summer of 2019.[100]

EAC officials noted that it will likely take 12 to 24 months after the EAC commissioners approve the new guidelines before they are ready for use. EAC officials plan to submit to the EAC commissioners a range of recommended dates to consider for implementation. They added that in developing these dates, including when vendors will be required to test new equipment against the updated guidelines, they must consider various factors such as the time voting equipment vendors will need to

[99]See 52 U.S.C. § 20962.

[100]According to NIST officials, test assertions depend on the technology used, and innovative solutions might require additional test assertions beyond those initially developed.

build their new equipment to VVSG 2.0, and reaccreditation of voting system test laboratories to ensure they can test to VVSG 2.0. Because of the lag between when the guidelines will be issued and when they will be used for testing and certification, EAC officials stated that it is unlikely that systems will be certified in time to be ready for use in the 2020 election. However, these officials noted that they are available to meet with vendors that would like to start developing equipment based on the new guidelines.

Agency and Third-Party Comments

We provided a draft of this report to the EAC, NIST, and election offices in the five local election jurisdictions that we selected and their respective states for review and comment. The EAC, two jurisdictions, and two states provided technical comments, which we incorporated in the report as appropriate. NIST, three jurisdictions, and three states indicated that they had no comments in e-mails received from March 1 through March 23, 2018.

We are sending copies of this report to the EAC, NIST, election offices in the five selected local jurisdictions and their respective states that participated in our research, appropriate congressional committees and members, and other interested parties. In addition, this report is available at no charge on GAO's website at http://www.gao.gov.

If you or your staff have any questions, please contact Rebecca Gambler at (202) 512-8777 or gamblerr@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made significant contributions to this report are listed in appendix VI.

Rebecca Gambler
Director, Homeland Security and Justice

List of Requesters

The Honorable Elijah E. Cummings
Ranking Member
Committee on Oversight and Government Reform
House of Representatives

The Honorable Tammy Duckworth
United States Senate

The Honorable Joaquin Castro
House of Representatives

The Honorable Danny K. Davis
House of Representatives

The Honorable Marcia L. Fudge
House of Representatives

The Honorable Eddie Bernice Johnson
House of Representatives

The Honorable Hank Johnson
House of Representatives

The Honorable Robin L. Kelly
House of Representatives

The Honorable John Lewis
House of Representatives

Appendix I: Objectives, Scope, and Methodology

This report addresses the following questions:

1. What types of voting equipment did local election jurisdictions use for the 2016 general election, and what are jurisdiction perspectives on equipment use and performance?
2. What factors are considered when deciding whether to replace voting equipment and what approaches have selected jurisdictions taken to replace their equipment?
3. What are selected stakeholders' perspectives on how federal voting system guidelines affect the replacement and development of voting equipment, and what actions has the Election Assistance Commission (EAC) taken to update the guidelines?

Objective 1

For our first objective, we conducted a web-based survey of officials from a stratified random sample of 800 local election jurisdictions nationwide to obtain information from the jurisdictions on the voting equipment used during the 2016 general election and perspectives on equipment use and performance.[1] In total, we received 564 completed questionnaires for a weighted response rate of 68 percent.[2] We surveyed the officials about the types of voting equipment they used, various characteristics of the equipment used, their perspectives on the benefits and challenges they experienced while using the equipment, and how satisfied they were with its performance during the election.

[1]As discussed below, we also conducted a survey of the state-level election offices in the 50 states and the District of Columbia. Although this survey was primarily used to obtain information for our second objective, we used some state survey results to provide additional context for information from local election jurisdictions presented in the first objective, where appropriate.

[2]To calculate our response rate, we used a standard definition, known as RR2, from the American Association for Public Opinion Research. See American Association for Public Opinion Research, *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*, 9th edition (2016).

Overall, there are 10,340 local election jurisdictions nationwide that are responsible for conducting elections. States can be divided into two groups according to how they delegate election responsibilities to the local election jurisdictions. One group is composed of 41 states that delegate election responsibilities primarily to counties. We also included the District of Columbia in this group of states. However, even within this group there are some exceptions to how election responsibilities are delegated. For example, there are no counties in Alaska, so the state groups all of its Boroughs and Census Areas into four election regions; and 6 states—Illinois, Maryland, Missouri, Nevada, New York, and Virginia—delegate responsibilities to some cities independently from counties.[3] The group of 41 states and the District of Columbia contains about one-fourth of the local election jurisdictions nationwide. The other group is composed of 9 states that delegate election responsibilities to subcounty governmental units, known by the U.S. Census Bureau as Minor Civil Divisions (MCD). This group of states contains about three-fourths of the local election jurisdictions nationwide. The categorization of the 50 states and the District of Columbia by how election responsibilities are organized is as follows (states in bold delegate election responsibilities to some cities independently from counties):

- County-level states: Alabama, Alaska (four election regions), Arizona, Arkansas, California, Colorado, Delaware, the District of Columbia, Florida, Georgia, Hawaii, Idaho, **Illinois**, Indiana, Iowa, Kansas, Kentucky, Louisiana, **Maryland**, Mississippi, **Missouri,** Montana, Nebraska, **Nevada**, New Jersey, New Mexico, **New York**, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, **Virginia**, Washington, West Virginia, and Wyoming
- MCD–level states: Connecticut, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, Rhode Island, Vermont, and Wisconsin[4]

While 27 percent of election jurisdictions nationwide are in states that delegate election responsibilities primarily to counties, according to the

[3]The four election regions in Alaska and the three county election jurisdictions in Delaware are managed by the state elections office in each state, respectively. Examples of cities that are separate election jurisdictions from the counties surrounding them include Baltimore in Maryland, and Kansas City and St. Louis in Missouri; 37 of the 133 jurisdictions in Virginia are cities. New York City is a single election jurisdiction that combines the five counties, or boroughs, that constitute the city.

[4]Election functions in Minnesota are split between county-level government and MCDs.

2010 Census, 89 percent of the U.S. population lived in these states. The U.S. population distribution between the two state groups is shown in table 5.

Table 5: Population in Each State Group

State group	Number of states	Number of jurisdictions	Population in 2010	Percentage of nationwide population
County-level states[a]	42	2,811	273,426,112	89
Minor civil division-level states	9	7,529	35,280,657	11
Total	**51**	**10,340**	**308,706,769**	**100**

Source: GAO analysis of U.S. Census data. | GAO-18-294

[a]This includes the District of Columbia.

The sampling unit for our survey was the geographically distinct local election jurisdiction at the county, city, or MCD level of local government (or, in Alaska, the election region). We constructed our nationwide sample frame of all local election jurisdictions using 2010 decennial Census data and information on local jurisdictions from state election office websites. Census population data were available for all counties, county equivalents, and MCDs.[5]

To obtain a representative sample that included a mix of both rural and non-rural jurisdictions, we used a two-level stratified sampling method in which the sample units, or jurisdictions, were broken out into rural and non-rural strata. To do this, we used the U.S. Department of Agriculture's Economic Research Service's Rural-Urban Continuum Code (RUCC) system which classifies counties into a nine-category continuum based on their characteristics and location relative to metropolitan areas.[6] The RUCC continuum coding scheme is shown in table 6.

[5]The county equivalents for Alaska were assigned to their respective election regions.

[6]The Rural-Urban Continuum Codes form a classification scheme that distinguishes metropolitan counties by the population size of their metro area, and nonmetropolitan counties by degree of urbanization and adjacency to a metro area.

Table 6: U.S. Department of Agriculture Economic Research Service Rural-Urban Continuum Codes, 2013

Code	Description
1	Counties in metro areas of more than 1 million population
2	Counties in metro areas of 250,000 to 1 million population
3	Counties in metro areas of fewer than 250,000 population
4	Urban population of 20,000 or more, adjacent to a metro area
5	Urban population of 20,000 or more, not adjacent to a metro area
6	Urban population of 2,500 to 19,999, adjacent to a metro area
7	Urban population of 2,500 to 19,999, not adjacent to a metro area
8	Completely rural or less than 2,500 urban population, adjacent to a metro area
9	Completely rural or less than 2,500 urban population, not adjacent to a metro area

Source: U.S. Department of Agriculture's Economic Research Service. | GAO-18-294

To assign a continuum code to each local election jurisdiction, we matched the RUCC county code to each county in the population frame. Cities that are independent local election jurisdictions and spread geographically across one or more counties received the lowest numbered code among the counties which contain them (i.e., most urban).[7] For independent cities that administer their own elections but are contained geographically within a single county, the city received the code assigned to the county. Where necessary, the parent state's 2010 decennial Census report was checked to make sure all counties that included part of the independent city were identified. MCDs in New England and the Midwest received the code of the parent county that contained them.[8] For our sampling purposes, the rural stratum was defined as all local election jurisdictions with an RUCC code of 7, 8, or 9. The non-rural stratum was defined as all local election jurisdictions with a code of 1, 2, 3, 4, 5, or 6. Of the 10,340 local election jurisdictions nationwide, 70 percent were classified as non-rural while 30 percent were classified as rural.

We selected a two-level stratified sample of 800 local election jurisdictions. Using the RUCC codes, we allocated 600 sampling units, or

[7]For example, New York City comprises New York, Kings, Queens, Richmond, and Bronx counties. All five counties have an urban-rural continuum code of 1, so New York City received this code in the population frame.

[8]Part of the process in building our sample frame was to identify MCDs that spread across two counties and assign them to the county with the larger share of population.

jurisdictions, to the non-rural stratum and 200 to the rural stratum. To obtain a sample that also reflected the population distribution across jurisdictions nationwide, we used the population of the local election jurisdiction as the measure of unit size and selected the sample units within each stratum with probability proportionate to population of the local election jurisdiction, without replacement. We used jurisdiction population size, rather than the number of eligible or registered voters, because these Census data were readily available for all counties and MCDs nationwide.[9] Because the sample was selected with probability proportionate to population size, any jurisdiction (county or MCD) with more than about 225,000 people was selected with certainty. Table 7 shows the breakout of jurisdictions by population size, the total population within each size grouping, and the number of jurisdictions sampled.

Table 7: Local Election Jurisdiction Survey Sample Allocation

Jurisdiction size (population)	Number of jurisdictions in population	2010 decennial Census population	Number of jurisdictions sampled	Number of jurisdictions in non-rural stratum	Number of jurisdictions in rural stratum
Greater than 1,000,000	**33**	**76,063,811**	**33**	**33**	**0**
County/City	33	76,063,811	33	33	0
MCD	0	0	0	0	0
500,001 to 1,000,000	**77**	**54,838,023**	**77**	**77**	**0**
County/City	74	52,911,819	74	74	0
MCD	3	1,926,204	3	3	0
100,001 to 500,000	**417**	**87,196,079**	**251**	**251**	**0**
County/City	395	83,836,753	243	243	0
MCD	22	3,359,326	8	8	0
50,001 to 100,000	**431**	**30,252,065**	**101**	**96**	**5**
County/City	346	24,394,838	84	79	5

[9]We did not use numbers of registered voters to define the strata because Census data on registered voters were not available at the county and MCD levels nationwide. We also did not use numbers of eligible voters 18 years and over to define the strata because Census data allowing us to exclude noncitizens and felons from the 18 years and over population were also not available at the county and MCD levels nationwide. Noncitizens are not eligible to vote, and voting eligibility for citizens convicted of a felony varies among states.

Jurisdiction size (population)	Number of jurisdictions in population	2010 decennial Census population	Number of jurisdictions sampled	Number of jurisdictions in non-rural stratum	Number of jurisdictions in rural stratum
MCD	85	5,857,227	17	17	0
25,001 to 50,000	**726**	**25,787,558**	**126**	**68**	**58**
County/City	550	19,796,522	105	47	58
MCD	176	5,991,036	21	21	0
10,001 to 25,000	**1,228**	**20,133,561**	**120**	**41**	**79**
County/City	772	12,948,330	101	25	76
MCD	456	7,185,231	19	16	3
0 to 10,000	**7,428**	**14,435,672**	**92**	**34**	**58**
County/City	641	3,474,039	36	0	36
MCD	6,787	10,961,633	56	34	22
Total	**10,340**	**308,706,769**	**800**	**600**	**200**

Source: GAO analysis of U.S. Census Bureau data and allocation of jurisdictions to sample. | GAO-18-294

After selecting the units to be included in our survey sample, we obtained contact information for the chief election official within the jurisdictions selected. To do this, we first collected contact information for local election jurisdictions from state election office websites and other publicly available sources. We then called the jurisdiction offices directly to confirm the accuracy of the information and the appropriate official and e-mail address to which the survey URL and the respondent's login information for the questionnaire should be sent. We launched our web-based local election jurisdiction survey on March 27, 2017, and made it available to respondents to complete online through July 14, 2017. Log in information to the survey was e-mailed to the chief election official of each sampled jurisdiction. Between April 4, 2017, and July 10, 2017, we conducted follow-up with nonrespondents by phone and e-mail. During this follow-up, we learned that some MCDs in Minnesota contract with their respective counties to carry out election administration responsibilities, including those concerning the use of voting equipment. In these cases, we reassigned and sent the questionnaire for the particular MCD to the appropriate county election official for completion.[10] Finally, we adjusted the sampling weights to compensate for nonresponse using weighting classes within each stratum that were based upon population size of the jurisdictions.

[10]There were 8 Minnesota MCDs for which we did this.

All sample surveys are subject to sampling error—that is, the extent to which the survey results differ from what would have been obtained if the whole population had been observed. Because we followed a probability procedure based on random selections, our sample is only one of a large number of samples that we might have drawn. As each sample could have provided different estimates, we express our confidence in the precision of our particular sample's results as a 95 percent confidence interval. This is the interval that would contain the actual population value for 95 percent of the samples we could have drawn. As a result, we are 95 percent confident that each of the confidence intervals based on our web-based survey includes the true values in the sample population.

In addition to the reported sampling errors, the practical difficulties of conducting any survey may introduce other types of errors, commonly referred to as nonsampling errors. For example, differences in how a particular question is interpreted, the sources of information available to respondents, or the types of people who do not respond can introduce unwanted variability into the survey results. We took numerous steps in questionnaire development, data collection, and the editing and analysis of the survey data to minimize nonsampling errors. For example, to inform the development of our questionnaire, we reviewed existing reports and studies about voting equipment and elections, such as those by various national public policy research organizations and professional associations of state and local officials involved in election administration, as well as previous GAO surveys and work related to this issue area.[11] In addition, we interviewed election subject matter experts and representatives from organizations in the field of election administration and voting equipment to obtain their views and perspectives on potential issues and subject areas to consider covering in our questionnaire. We also pretested the draft questionnaire by telephone with officials in 4 local election jurisdictions (3 counties and 1 MCD) of various sizes in 4 states and had the draft questionnaire reviewed by two election experts.[12] We used these pretests and reviews to further refine our questions, develop new questions, clarify any ambiguous portions of the questionnaire, and identify any potentially biased questions, and made revisions, as

[11]See, for example, GAO, *Elections: The Nation's Evolving Election System as Reflected in the November 2004 General Election*, GAO-06-450 (Washington, D.C.: June 6, 2006), and *Elections: Observations on Wait Times for Voters on Election Day 2012,* GAO-14-850 (Washington, D.C.: Sept. 30, 2014).

[12]One election expert has conducted extensive work in the area of elections and voting equipment while the other has managed voting equipment for a state.

necessary.[13] Further, during our analysis of the responses, we found that due to a higher level of nonresponse by very small jurisdictions of 2,500 persons or less, some national-level estimates that included responses from jurisdictions of all sizes had wider than desired confidence intervals. To improve the precision of these national-level estimates, we subsequently excluded the very small jurisdictions of 2,500 persons or less from our analysis. Computer analyses were conducted to identify any inconsistencies in response patterns or other indications of questionnaire response errors. All computer syntax was peer reviewed and verified by separate programmers to ensure that the syntax had been written and executed correctly.

Unless noted otherwise, the point estimates we report are national-level point estimates representing the experiences, views, and opinions of all local election jurisdictions nationwide with populations greater than 2,500. We also provide some point estimates for jurisdiction population subgroups, such as large jurisdictions (greater than 100,000 persons), medium jurisdictions (25,001 to 100,000 persons), and small jurisdictions (2,501 to 25,000 persons), and jurisdictions that used a particular type of voting equipment, in cases where statistically significant differences exist between the subgroups that may be of interest. The jurisdictions we surveyed were selected with probability proportionate to population size, so rather than expressing the point estimates in terms of the percentage of jurisdictions nationwide that had a specified characteristic, we express the point estimates for the survey responses in terms of the percentage of the population nationwide that resides within jurisdictions that had a specified characteristic. Similarly, in instances where we report point estimates for jurisdiction subgroups, we express the point estimate in terms of the percentage of the population that resides within jurisdictions of that respective subgroup that had a specified characteristic.

Objective 2

For our second objective, we used our local election jurisdiction survey as described above to obtain information from jurisdictions about the factors they consider when determining whether to replace their voting equipment. In addition to the local election jurisdiction survey, we also conducted a web-based survey of the state-level election offices in the 50

[13]The survey questionnaire and aggregated responses for each question are included in appendix III.

states and the District of Columbia about issues pertaining to the states' role in selecting and acquiring voting equipment, including the factors considered when determining whether to replace voting equipment.[14] In total, we obtained 46 responses (a 90 percent response rate). We took the same steps to develop the state questionnaire as we did in developing the local election jurisdiction questionnaire described above. We conducted pretests of our draft state questionnaire by telephone with election officials of 4 states with varying election system characteristics such as type of voting equipment used, population size, use of federal voting equipment certification processes, and age of equipment, among other characteristics. We also had the draft questionnaire reviewed by two election experts.[15] We used these pretests and reviews to help further refine our questions, develop new questions, clarify any ambiguous portions of the survey, and identify any potentially biased questions, and made revisions, as necessary.

Prior to fielding our state survey, we contacted the secretaries of state or other responsible state-level officials, as well as officials from the District of Columbia, to confirm the contact information for the director of elections or comparable official for their respective state. We launched our web-based state survey on April 6, 2017, and made it available to respondents to complete online through May 19, 2017. Log-in information to the survey was e-mailed to directors of elections or comparable officials. Between April 12, 2017, and May 16, 2017, we conducted follow-up with nonrespondents by phone and e-mail. The total number of responses to individual questions may be fewer than 46, depending upon how many respondents were eligible or chose to respond to a particular question. For example, survey respondents who indicated that their state did not have a role in determining whether to replace voting equipment were directed to skip all subsequent questions related to the factors considered when determining whether to replace equipment.[16]

[14]When reporting survey results, we use the term "states" in reference to the 50 states and the District of Columbia. For the purposes of this report, this survey of the 50 states and the District of Columbia will be referred to as the "state survey" or "survey of states."

[15]These two election experts also reviewed the draft questionnaire for our local election jurisdiction survey.

[16]The state survey questionnaire and aggregated responses for each question are included in appendix IV.

Because this survey was not a sample survey, there are no sampling errors. However, the practical difficulties of conducting any survey may introduce nonsampling errors. For example, differences in how a particular question is interpreted, the sources of information available to respondents, or the types of people who do not respond can introduce unwanted variability into the survey results. We included steps in both the data collection and data analysis stages for the purpose of minimizing such nonsampling errors. For example, we examined the survey results and performed computer analyses to identify inconsistencies and other indications of error. Where these occurred, survey respondents were contacted to provide clarification and the response was modified to reflect the revised information. A second, independent analyst checked the accuracy of all computer analyses. The scope of this work did not include verifying states' survey responses with local election officials.

For additional perspectives and context on the factors considered by jurisdictions and states when replacing voting equipment, we also used our reviews of existing reports and studies about voting equipment and elections and interviews with election subject matter experts, including representatives from nongovernmental research and other organizations involved in the field of election administration and voting equipment. For our review of existing reports and studies, we reviewed literature covering the period from 2005 through 2017 including general news, trade and industry articles, association and nonprofit publications, and government reports related to voting system technology, specifically on the replacement and development of voting systems and voting system standards or guidelines. For our interviews, we identified and selected nine subject matter experts based on our review of reports and studies on voting equipment, their expertise and work in this area, and recommendations from these and other researchers. These subject matter experts represented the following organizations: (1) Brennan Center for Justice, (2) National Conference of State Legislatures, (3) National Association of Secretaries of State, (4) National Association of Counties, (5) National Association of State Election Directors, (6) Verified Voting, (7) Kennesaw State University Center for Election Systems, (8) Center for Election Innovation and Research, and (9) Election Data Services, Inc. The information we obtained from these experts cannot be generalized; however, these experts provided additional perspectives and information on the factors considered by jurisdictions and states when replacing voting equipment.

In addition, we interviewed election officials from five local jurisdictions—Los Angeles County, California; Travis County, Texas; Anne Arundel

County, Maryland; Lafayette County, Florida; and Beaver County, Utah—that replaced their voting equipment between 2012 and 2016 or plan to replace their equipment in time for the 2020 general election to learn about the approaches and practices they used and obtain their perspectives on the replacement process. We selected these jurisdictions to reflect variation in, to the extent possible, population of jurisdiction, type of voting equipment replaced and selected, state involvement in selecting and funding voting equipment, and particular practices used to replace equipment (e.g., self-designing equipment, leasing equipment), among other factors. For each jurisdiction, we interviewed—on site or by phone—local election officials, state election officials in the jurisdiction's state, and individuals who have served as poll workers at the jurisdiction's polling locations if applicable. While these five jurisdictions are not representative of all local election jurisdictions nationwide that replaced or plan to replace their voting equipment, they provide examples of various approaches for replacing voting equipment and perspectives on key issues with replacing equipment. We corroborated various information we obtained through these interviews by reviewing relevant state statutes and documentation that these jurisdictions provided to us, such as postelection reports, voting system studies, expenditure summaries, and solicitations for vendor proposals to provide voting equipment and services.

Objective 3

To address objective 3, we used responses to our survey of state election officials and interviews with seven selected voting system vendors, the nine selected subject matter experts mentioned above, and officials from the EAC and National Institute of Standards and Technology (NIST) to obtain perspectives on how federal voting system guidelines and their associated testing and certification processes affect the replacement and development of voting equipment. We obtained perspectives on the most recent federal voluntary voting system guidelines (Voluntary Voting System Guidelines, versions 1.0 and 1.1) because they are currently being used to federally test and certify voting systems. We selected the seven voting system vendors based on the prevalence of jurisdictions' use of their equipment, and to obtain variation in the type of voting system manufactured, such as optical scanners and direct recording electronic voting equipment, and whether systems were federally certified, under

test to be certified, or not certified.[17] We also wanted to include a company that plans to enter the voting system market and potentially submit its product for federal certification. Based on these criteria, we selected the following voting equipment vendors—Dominion Voting Systems, DFM Associates, Election Systems and Software, Everyone Counts, Hart InterCivic, Open Source Election Technology Institute, and Unisyn Voting Solutions.

To determine the actions taken or planned by the EAC to update the federal voluntary voting system guidelines, we reviewed EAC and NIST documents and interviewed officials from the EAC and NIST about these actions. We also interviewed the seven selected voting system vendors about their involvement, if any, in updating the guidelines and their perspectives on these actions.

The perspectives of the seven voting system vendors and nine subject matter experts are not generalizable but provide examples of views on the federal guidelines and their associated testing and certification processes from a range of stakeholders.

We conducted this performance audit from June 2016 to April 2018 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

[17]We obtained information from our local election jurisdiction survey on who manufactured jurisdictions' predominant voting equipment and based our selections in part on prevalence of use. Vendors with uncertified systems include one that chose not to submit its system for EAC certification.

Appendix II: Categories of State Requirements for Federal Certification and Testing of Voting Systems

We reviewed state statutes and regulations as of December 2017 regarding the testing and certification of voting systems to describe the extent to which state laws and regulations reference federal voting system certification or testing standards and the extent to which states require the use of these standards. As shown in table 8 below, we grouped the state laws into three categories for the purposes of this report: (1) requires full federal certification; (2) requires testing by a federally accredited laboratory and/or testing to federal voting system standards; and (3) no federal requirements. Category 2 includes states that use some aspect of the federal testing and certification program but do not require full certification. A number of states in this category require both testing by a federally accredited laboratory and testing to federal standards, but we included in this category states that had either requirement in state law or regulation. Category 3 includes some states that utilize the federal certification or testing standards to some extent but that do not require certification or testing to meet federal standards by law or regulation.[1] We then sent our categorization to state officials in the 50 states and the District of Columbia and incorporated changes that we received from those officials.[2]

[1]For example, California's election code requires voting systems to be tested to state standards adopted by the Secretary of State, which are to meet or exceed federal voluntary voting system guidelines set forth by the Election Assistance Commission or its successor agency. See Cal. Elec. Code § 19101(a).

[2]This appendix generally includes only requirements in state statutes and regulations and does not include those in other state documents (such as policy documents or manuals) unless they were provided to us by state officials.

Table 8: Categories of State Requirements for Federal Certification and Testing of Voting Systems, as of December 2017

Requires federal certification[a]	Requires testing by a federally accredited laboratory and/or testing to federal voting system standards[b]	No federal requirements[c]
Delaware	Alabama	Alaska
Georgia	Arizona	Arkansas
Maryland	Colorado	California
Minnesota	Connecticut	Florida
North Carolina	District of Columbia	Maine
North Dakota	Kansas[e]	Mississippi
Ohio	Hawaii	Montana
South Carolina	Idaho	Nebraska
South Dakota	Illinois	New Hampshire
Tennessee	Indiana	New Jersey
Texas[d]	Iowa	Oklahoma
West Virginia	Kentucky	Oregon
Wyoming	Louisiana	Vermont
	Massachusetts	
	Michigan	
	Missouri	
	Nevada	
	New Mexico	
	New York	
	Pennsylvania	
	Rhode Island	
	Utah	
	Virginia[f]	
	Washington	
	Wisconsin	

Source: GAO. | GAO-18-294

[a]See Del. Code Ann. tit. 15, § 5001 (Delaware); Ga. Code Ann. § 21-2-324; Ga. Comp. R. & Regs. 590-8-1-.01 (Georgia); Md. Election Law Code Ann. § 9-102; Md. Code Regs. 33.09.01.03 (Maryland); Minn. Stat. §§ 206.57, 206.81; see also Minn. R. ch. 8220 (Minnesota); N.C. Gen. Stat. §§ 163A-1115 to 163A-1119; 08 N.C. Admin. Code 4.0302 (North Carolina); N.D. Cent. Code § 16.1-06-26; N.D. Admin. Code §§ 72-06-01-04, 72-06-01-02 (North Dakota); Ohio Rev. Code § 3506.05; see Ohio Admin. Code 111:3-3-01 (Ohio); S.C. Code Ann. § 7-13-1330 (South Carolina); S.D. Codified Laws § 12-17B-2; S.D. Admin R. 5:02:09:02 (South Dakota); Tenn. Code Ann. §§ 2-9-117, 2-20-104 (Tennessee); Tex. Election Code Ann. § 122.001; 1 Tex. Admin. Code §§ 81.60, 81.61 (Texas); W. Va. Code § 3-4A-8 (West Virginia); Wyo. Stat. Ann. § 22-11-103; 2-12 Wyo. Code R. § 4 (Wyoming).

[b]This category includes states that require testing of voting systems by a federally accredited laboratory and those that require testing to federal standards. Some states in this category require both, but we included in this category states that had either requirement in state law or regulation.

See Ala. Code §§ 17-7-23, 17-2-4, 17-7-21 (Alabama); Ariz. Rev. Stat. § 16-442 (Arizona); Colo. Rev. Stat. §§ 1-5-601.5, 1-5-608.5, 1-5-616, 1-5-617, 1-5-619, 1-5-704, 1-5-801, 1-5-802; Secretary of State Election Rules 11 and 21 (Colorado); Conn. Gen. Stat. §§ 9-241, 9-242; Conn. Agencies Regs. § 9-241-1 (Connecticut); D.C. Code § 1-1001.09; D.C. Mun. Regs. tit. 3, § 800 (District of Columbia); Haw. Rev. Stat. § 16-1; Haw. Code R. §§ 3-176-1, 3-176-2, 3-176-3 (Hawaii); Idaho Code § 34-2409 (Idaho); Ill. Comp. Stat. § 5/24C-16; Ill. Adm. Code, tit. 26, §§ 204.10-204.180 (Illinois); Ind. Code §§ 3-11-15-13.3, 3-11-15-20, 3-11-16-4 (Indiana); Iowa Code Ann. § 52.5; Iowa Admin. Code r. § 721-22.1 to 721-22.52 (Iowa); Kan. Stat. Ann. §§ 25-4404, 25-4405, 25-4406, 25-4603, 25-4613 (Kansas); Ky. Rev. Stat. § 117.379 (Kentucky); La. Rev. Stat. Ann. § 18:1361 (Louisiana); Mass. Gen. Laws ch. 54, § 32, 950 Mass. Regs. 50.03 (Massachusetts); Mich. Comp. Laws Ann. § 168.795a (Michigan); Mo. Rev. Stat. § 115.225, Mo. Code Regs. Ann. tit. 15, § 30-10.020 (Missouri); Nev. Rev. Stat. §§ 293.2696, 293.2699, 293B.032, 293B.033, 293B.050, 293B.063, 293B.104, 293B.105, 293B.110, 293B.120, 293B.122; Nev. Admin. Code §§ 293B.010, 293B.020, 293B.110 (Nevada); N.M. Stat. Ann. §§ 1-9-7.2, 1-9-7.4, 1-9-7.5, 1-9-7.7, 1-9-7.8, 1-9-7.9, 1-9-7.10, 1-9-14; see also N.M. Code R. §§ 1.10.20 to1.10.20.14 (New Mexico); N.Y. Election Law §§ 7-201, 7-208; N.Y. Comp. Codes R. & Regs. tit. 9, §§ 6209.1, 6209.2, 6209.5, 6209.6, 6209.7, 6210.5, 6210.12 (New York); 25 Pa. Cons. Stat. §§ 3002, 3006, 3007, 3031.1, 3031.5, 3031.6. 3031.7 (Pennsylvania); R.I. Gen. Laws § 17-19-3 (Rhode Island); Utah Code Ann. § 20A-5-802 (Utah); Va. Code Ann. §§ 24.2-629, 24.2-631 (Virginia); Wash. Rev. Code Ann. §§ 29A.12.020, 29A.12.030, 29A.12.040, 29A.12.080; Wash. Admin. Code § 434-335-010 (Washington); Wis. Stat. § 5.91; Wis. Adm. Code EL §§ 7.01, 7.02 (Wisconsin).

[c]See Alaska Stat. § 15.20.910 (Alaska); Ark. Code Ann. §§ 7-5-301, 7-5-503, 7-5-606 (Arkansas); Cal. Elec. Code §§ 19006, 19101, 19202, 19209, 19210, 19232, 19270 (California); Fla. Stat. §§ 101.015, 101.017, 101.5605 (Florida); Me. Stat. tit. 21-A, §§ 809, 812 (Maine); Miss. Code Ann. §§ 23-15-391, 23-15-531.1, 23-15-507 (Mississippi); Mont. Code Ann. §§ 13-17-101, 13-17-102, 13-17-103; Mont. Admin R. 44.3.1701 (Montana); Neb. Rev. Stat. § 32-1041 (Nebraska); N.H. Rev. Stat. §§ 656:41, 656:42 (New Hampshire); N.J. Rev. Stat. Ann. §§ 19:48-2, 19:53A-2 (New Jersey); Okla. Stat. Ann. tit. 26, §§ 9-100, 21-101 (Oklahoma); Or. Rev. Stat. §§ 246.550, 246.560 (Oregon); Vt. Stat. Ann. tit. 17, § 2493; 04-010 Vt. Code R. § 001 (Vermont). This category includes some states that utilize the federal certification or testing standards to some extent but that do not require certification or testing to meet federal standards by law or regulation.

[d]Texas officials reported that Texas requires both Election Assistance Commission federal certification and state certification for any voting system used in Texas. Further, officials stated that the Texas Secretary of State conducts examination and testing of voting equipment and the testing is similar to the federal requirements.

[e]Although Kansas state law does not require testing to federal requirements or by a federally accredited laboratory, Kansas officials told us that the Kansas Secretary of State, through the adoption of election standards, does require testing by an independent testing authority recognized by the National Institute of Standards and Technology.

[f]According to Virginia officials, state law requires the State Board of Elections to set voting system standards and the standards set by the Board require compliance with the Election Assistance Commission's voluntary voting system standards.

Appendix III: Results of GAO's Survey of Local Election Jurisdictions on Voting Equipment

To determine the types of voting equipment local election jurisdictions used for the 2016 general election, jurisdiction perspectives on equipment use and performance, and the factors jurisdictions consider when deciding whether to replace voting equipment, we conducted a web-based survey of officials from a stratified random sample of 800 local election jurisdictions nationwide. In total, we received 564 completed questionnaires for a weighted response rate of 68 percent.[1] The questions we asked in our survey are shown below. Our survey was composed of closed- and open-ended questions. In this appendix, we include all survey questions and results of responses to the closed-ended questions; we do not provide information on responses provided to open-ended questions.

The tables below represent the estimated percentages of the jurisdictions' responses to the closed-ended questions. The estimates we report are rounded to the nearest percentage point and are national-level point estimates representing the experiences, views, and opinions of all local election jurisdictions nationwide with populations greater than 2,500. Because our estimates are from a generalizable sample, we express our confidence in the precision of our particular estimates as 95 percent confidence intervals which are also provided in the tables. As the jurisdictions we surveyed were selected with probability proportionate to population size, rather than expressing the point estimates in terms of the percentage of jurisdictions nationwide that had a specified characteristic, we express the point estimates for the survey responses in terms of the

[1]We conducted our survey from March 27, 2017, through July 14, 2017. To calculate our response rate, we used a standard definition, known as RR2, from the American Association for Public Opinion Research. See American Association for Public Opinion Research, *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*, 9th edition (2016).

percentage of the population nationwide that resides within jurisdictions that had a specified characteristic. For a more detailed discussion of our survey methodology, see appendix I.

Survey Contact

Question 1 (open-ended question): What is the name, title, telephone number, and e-mail address of the primary person completing this questionnaire so that we may contact someone if we need to clarify any responses?

Jurisdiction Characteristics

Table 9: Responses to GAO 2017 Local Election Jurisdiction Survey Question 2

Approximately how many precincts, voting locations, and registered voters were there in your jurisdiction on the November 2016 General Election Day?

Aspect	Estimated mean	95 percent confidence interval—lower bound	95 percent confidence interval—upper bound
Precincts	33	26	40
Voting locations	20	16	25
Registered voters	44,823	29,233	60,412

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 10: Responses to GAO 2017 Local Election Jurisdiction Survey Question 3

For the November 2016 general election, how many ballots were cast through each of the following methods in your jurisdiction? (Note: Please use the numbers available as of the certification date of the election.)

Method	Mean number of ballots cast	95 percent confidence interval—lower bound	95 percent confidence interval—upper bound
a. In-person voting on Election Day (excluding absentee and provisional voting)	14,107	11,271	16,944
b. Provisional voting (all accepted and rejected provisional ballots)	n/r	n/r	n/r
c. In-person early voting (excluding any absentee and early provisional voting)	11,046	8,305	13,787
d. Voting using any type of absentee and mail-in ballots, including absentee and mail-in ballots that were submitted in-person (all accepted and rejected absentee or mail-in ballots)	7,379	5,312	9,445

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points.

Information about Your Current Voting Equipment

Table 11: Responses to GAO 2017 Local Election Jurisdiction Survey Question 4 part I

For the November 2016 general election, which types of voting equipment were used in your jurisdiction? For each type of equipment used, how many machines were used and how many ballots were processed by those machines? (Mark one box in each row either as "yes" if used, "no" if not used, or "don't know" if unknown. For "yes" responses, please enter the number of machines used in the third column and the number of ballots processed in the last column.)

Recording Type	Estimated percentage of population nationwide residing within jurisdictions that used equipment	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
a. Direct recording electronic (DRE) without a voter-verified paper audit trail (VVPAT)	19	13	25
b. Direct recording electronic (DRE) with a voter-verified paper audit trail (VVPAT)	25	15	36
c. Central count optical or digital scan	42	33	50
d. Precinct count optical or digital scan	61	53	70
e. Electronic ballot marking device	45	35	55
f. Paper (hand-counted) ballot	22	13	33
g. Other	4	2	7

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: Respondents who indicated that they used "Other" were asked to provide additional information in a free-form text box.

Table 12: Responses to GAO 2017 Local Election Jurisdiction Survey Question 4 part II

For which voting methods were <<type of voting equipment>> used for the November 2016 general election in your state?

Estimated percentage of population nationwide residing within jurisdictions using type of equipment for:

Recording Type	In-person voting on Election Day (excluding absentee and provisional voting)	Provisional voting	In-person early voting (excluding any absentee and early provisional voting)	Voting using any type of absentee and mail-in ballots that were submitted in-person on Election Day
a. Direct recording electronic (DRE) without a voter-verified paper audit trail (VVPAT)	94 (85, 98)	17 (9, 29)	n/r	21 (11, 34)
b. Direct recording electronic (DRE) with a voter-verified paper audit trail (VVPAT)	89 (76, 97)	7 (3, 15)	n/r	n/r

Recording Type	In-person voting on Election Day (excluding absentee and provisional voting)	Provisional voting	In-person early voting (excluding any absentee and early provisional voting)	Voting using any type of absentee and mail-in ballots that were submitted in-person on Election Day
c. Central count optical or digital scan	43	63	36	91
	(33, 52)	(54, 73)	(26, 45)	(83, 96)
d. Precinct count optical or digital scan	90	21	33	79
	(81, 96)	(13, 32)	(21, 46)	(70, 87)
e. Electronic ballot marking device	85	20	n/r	n/r
	(71, 94)	(11, 33)		
f. Paper (hand-counted) ballot	n/r	n/r	n/r	n/r
g. Other	n/r	n/r	n/r	n/r

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points. Respondents were asked this question only for the types of voting equipment that they indicated "yes" for in part I of question 4.

Table 13: Responses to GAO 2017 Local Election Jurisdiction Survey Question 5

For the November 2016 general election, what voting equipment did your jurisdiction predominantly use to process the largest number of in-person ballots? (If your jurisdiction conducts all vote-by-mail or mail-ballot elections, consider only the voting equipment used to process vote-by-mail ballots.) Note: If your jurisdiction used more than one type of equipment to process about an equal number of ballots, please select the equipment that is the older of the two types. (Check one.)

Recording Type	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Direct recording electronic (DRE) without a voter-verified paper audit trail (VVPAT)	15	11	21
Direct recording electronic (DRE) with a voter-verified paper audit trail (VVPAT)	17	9	28
Central count optical or digital scan with electronic ballot marking device	2	0	6
Central count optical or digital scan with manually marked ballot	15	10	20
Precinct count optical or digital scan with electronic ballot marking device	2	1	6
Precinct count optical or digital scan with manually marked ballot	44	35	53
Paper (hand-counted) ballot (skip to question 9)	0	0	1
Other	2	0	4
Don't know (skip to question 9)	3	1	7

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: Respondents who indicated that they used "Other" were asked to provide additional information in a free-form text box.

Table 14: Responses to GAO 2017 Local Election Jurisdiction Survey Question 6

What is the name of the manufacturer(s) of the predominant voting equipment identified in question 5? (Check all that apply.)

Manufacturer	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Avante International Technology, Inc.	0	0	1
Clear Ballot Group, Inc.	0	0	1
Dominion Voting Systems Corp.	12	6	21
Election Systems & Software, Inc. (ES&S)	47	38	56
Everyone Counts, Inc.	0	0	1
Hart InterCivic, Inc.	7	5	10
MicroVote General Corp.	1	0	2
Open Source Digital Voting Foundation	0	0	1
Precise Voting, LLC	0	0	1
Premier Election Solutions. Inc. (formerly Diebold Election Systems, Inc.)	9	5	14
Sequoia Voting Systems	12	5	25
Smartmatic USA Corporation	0	0	1
SOE Software	0	0	1
TruVote International	0	0	1
Unisyn Voting Solutions	4	2	7
Other	5	2	11
Don't know	1	0	4

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: Respondents who indicated that they used "Other" were asked to provide additional information in a free-form text box.

Table 15: Responses to GAO 2017 Local Election Jurisdiction Survey Question 7

Was your jurisdiction's predominant voting equipment identified in question 5 purchased or leased?

Note: For the purposes of this survey, the term "lease" refers to any contract granting use of equipment for a specified period in exchange for payment, but does not transfer or provide ownership of the equipment to the state or jurisdictions. (Check one.)

Ownership Type	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Purchased (skip to question 9)	93	88	96
Leased	5	2	9
Both purchased and leased	3	1	5

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 16: Responses to GAO 2017 Local Election Jurisdiction Survey Question 8

If your jurisdiction's predominant voting equipment was leased, how important, if at all, were each of the following reasons for doing so? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Reasoning	Very important	Somewhat important	Not very important	Not important at all	Don't know
a. Leasing was less expensive than buying for the time period considered	n/r	n/r	7 (2, 19)	2 (0, 11)	n/r
b. Leasing was the only way to obtain new equipment within budgetary constraints	n/r	n/r	5 (1, 15)	2 (0, 12)	n/r
c. Leasing allows for more frequent updates of equipment than buying	n/r	1 (0, 12)	1 (0, 12)	8 (2, 23)	n/r
d. Did not want to buy until newer equipment became available after the implementation of updated federal or state guidelines	n/r	n/r	8 (2, 20)	n/r	n/r
e. Leasing enabled jurisdiction to try new equipment first that it may decide to buy in the future	n/r	9 (2, 22)	3 (0, 16)	n/r	n/r
f. Other	n/r	0 (0, 13)	n/r	n/r	n/r

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points. Respondents who indicated "Other" were asked to provide additional information in a free-form text box.

Table 17: Responses to GAO 2017 Local Election Jurisdiction Survey Question 9

Which of the following statements best describes your state's involvement in the selection of the predominant voting equipment used in your jurisdiction for the November 2016 general election? (Check one.)

Reasoning	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
State required the use of the same voting equipment type and model statewide	17	12	23
State maintains a list of approved voting equipment from which local jurisdictions were required to select	54	44	63
State approved the use of voting equipment following selection by the local jurisdiction	8	4	15
State was not involved in the approval or selection of voting equipment	1	0	3

Reasoning	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
We voluntarily consulted with the state, but state had no requirements regarding the selection or approval of voting equipment	2	0	6
Other	0	0	2
Don't know	17	9	29

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: Respondents who indicated "Other" were asked to provide additional information in a free-form text box.

Table 18: Responses to GAO 2017 Local Election Jurisdiction Survey Question 10

In what year did your jurisdiction first use the current predominant voting equipment identified in question 5 in an election? (Check one.)

Year	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Before 2002	5	3	8
Between 2002 and 2006	51	42	61
Between 2007 and 2011	9	5	14
2012	3	1	8
2013	2	0	6
2014	2	1	5
2015	8	3	17
2016	12	7	18
Don't know	8	4	13

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 19: Responses to GAO 2017 Local Election Jurisdiction Survey Question 11

What type(s) of voting equipment did your jurisdiction's current predominant voting equipment (that you identified in question 5) replace? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Recording Type	Yes, was replaced	No, was not replaced	Don't know
Direct recording electronic (DRE) without a voter-verified paper audit trail (VVPAT)	20 (13, 30)	52 (40, 65)	28 (18, 39)
Direct recording electronic (DRE) with a voter-verified paper audit trail (VVPAT)	n/r	57 (42, 72)	24 (15, 36)
Central count optical or digital scan with an electronic ballot marking device	4 (2, 8)	62 (49, 75)	34 (22, 48)
Central count optical or digital scan with manually marked ballot	29 (20, 39)	41 (28, 54)	30 (20, 43)

Recording Type	Yes, was replaced	No, was not replaced	Don't know
Precinct count optical or digital scan with an electronic ballot marking device	10 (5, 18)	54 (40, 67)	37 (24, 51)
Precinct count optical or digital scan with manually marked ballot	38 (26, 50)	40 (27, 53)	22 (14, 33)
Paper (hand-counted) ballot	n/r	36 (25, 48)	25 (16, 37)
Lever machine	n/r	43 (29, 57)	21 (13, 32)
Punch card ballot	20 (13, 28)	54 (41, 67)	27 (17, 39)
Other equipment	5 (2, 11)	61 (50, 72)	34 (23, 45)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points. Respondents who selected "Other equipment" were asked to provide additional information in a free-form text box.

Table 20: Responses to GAO 2017 Local Election Jurisdiction Survey Question 12

Which, if any, of the following practices or approaches were used when acquiring your jurisdiction's voting equipment? Note: Commercial off-the-shelf (COTS) products are defined as software, firmware, devices, or components that are used in the United States by many different people or organizations for many different applications other than certified voting systems and are incorporated into the voting system with no manufacturer- or application-specific modification. (Source: Election Assistance Commission Voluntary Voting System Guidelines, version 1.1.) For the purpose of this question, the term "voting equipment" refers only to the equipment your jurisdiction uses to cast and count votes. (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Practices	Used	Not used	Don't know
a. Used state-wide or consolidated cross-jurisdictional contracts	49 (39, 59)	19 (13, 26)	32 (23, 42)
b. Formed a task force, committee, advisory/working group, or other group to help select new voting equipment	40 (30, 50)	23 (16, 30)	37 (27, 48)
c. Conducted pilot project(s) to help evaluate new voting equipment	22 (12, 35)	38 (29, 47)	41 (30, 51)
d. Used open-source software (i.e., source code can be freely viewed, used, modified, and shared by the public) in voting equipment	1 (0, 5)	60 (49, 71)	39 (28, 50)
e. Designed own voting equipment predominantly without COTS products	0 (0, 2)	68 (58, 79)	32 (21, 43)
f. Designed own voting equipment predominantly with COTS products	0 (0, 2)	68 (57, 79)	31 (21, 43)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate.

Performance Measurement of and Satisfaction with Voting Equipment

Table 21: Responses to GAO 2017 Local Election Jurisdiction Survey Question 13

Did your jurisdiction track, measure, and/or assess any of the following aspects of the November 2016 general election? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Aspect	Yes, tracked, measured, or assessed	No, did not track, measure, or assess	Not applicable	Don't know
a. Number of pieces of equipment that failed (e.g., equipment failed and had to be taken out of service for the remainder of the election)	41 (32, 50)	13 (8, 20)	40 (30, 49)	6 (2, 16)
b. Down time for equipment	29 (21, 38)	23 (17, 30)	41 (32, 51)	6 (2, 16)
c. Speed of counting votes	16 (11, 22)	55 (45, 64)	21 (14, 30)	9 (3, 18)
d. Accuracy of casting votes (e.g., equipment accurately records selections of voters)	78 (69, 85)	13 (8, 19)	8 (3, 16)	2 (1, 3)
e. Accuracy of counting votes (e.g., equipment accurately tabulates votes cast)	87 (81, 92)	8 (4, 12)	4 (2, 8)	2 (1, 3)
f. Time for election workers to set up equipment	32 (23, 41)	47 (38, 56)	16 (10, 23)	5 (1, 15)
g. Number of ballots ruined while being processed or tabulated by voting equipment	45 (35, 54)	22 (16, 29)	28 (20, 35)	6 (3, 12)
h. Misfeed rate (for optical or digital scan)	18 (12, 25)	51 (42, 61)	21 (15, 29)	10 (4, 19)
i. Overvotes	63 (53, 72)	17 (10, 25)	13 (7, 21)	8 (3, 17)
j. Undervotes	64 (54, 73)	20 (12, 29)	9 (5, 16)	7 (2, 17)
k. Cost to operate and maintain equipment (e.g., labor, postage, paper and printing supplies, electricity, parts, etc.)	51 (42, 61)	33 (24, 41)	5 (2, 9)	11 (5, 21)
l. Ease of casting votes for disabled or impaired individuals	50 (41, 60)	31 (23, 39)	11 (7, 17)	7 (2, 17)
m. Ease of providing multilingual ballot formats, as necessary	9 (5, 14)	30 (21, 38)	50 (40, 59)	12 (5, 24)
n. Number of malfunction instances or crashes	40 (31, 49)	21 (14, 28)	34 (25, 43)	5 (1, 15)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate.

Table 22: Responses to GAO 2017 Local Election Jurisdiction Survey Question 14

During the November 2016 general election, how common, if at all, were each of the following errors or malfunctions for the predominant voting equipment in your jurisdiction? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Error/Malfunction	Very common	Somewhat common	Not very common	Did not occur	Not applicable	Don't know
a. For precincts with different ballot layouts, equipment did not always display correct ballot	0 (0, 1)	0 (0, 1)	2 (1, 5)	60 (50, 70)	37 (27, 47)	1 (0, 2)
b. Equipment stopped operating during election	0 (0, 1)	2 (1, 5)	22 (16, 28)	69 (61, 77)	6 (1, 16)	1 (0, 2)
c. Equipment response was sluggish or slower than acceptable	0 (0, 1)	3 (1, 8)	12 (8, 17)	81 (74, 86)	3 (1, 8)	1 (0, 2)
d. Errors with equipment interactive functions to assist voters in casting votes (e.g., prompts, user help screen)	0 (0, 1)	0 (0, 1)	8 (5, 13)	82 (75, 87)	8 (5, 14)	1 (0, 2)
e. Equipment credited votes to incorrect candidate or ballot measure	0 (0, 1)	0 (0, 1)	2 (1, 5)	90 (84, 94)	5 (2, 9)	3 (1, 7)
f. Equipment failed to print an auditable ballot for votes cast	0 (0, 1)	0 (0, 1)	2 (1, 4)	74 (68, 81)	23 (17, 28)	1 (0, 2)
g. Equipment ruined ballots during processing or tabulation	0 (0, 1)	1 (0, 3)	6 (4, 10)	86 (81, 91)	6 (3, 10)	1 (0, 2)
h. Jams or misfeeds in device to scan paper-based ballots (optical or digital scan only)	1 (0, 4)	3 (2, 5)	48 (39, 57)	40 (31, 49)	5 (2, 10)	2 (1, 4)
i. Other	0 (0, 1)	0 (0, 2)	0 (0, 2)	39 (27, 51)	49 (36, 61)	12 (7, 19)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. Respondents who indicated "Other" were asked to provide additional information in a free-form text box.

Table 23: Responses to GAO 2017 Local Election Jurisdiction Survey Question 15

Which of the following methods, if any, has your jurisdiction used to obtain direct feedback from voters and the public on their perspectives on the use and performance of your jurisdiction's current voting equipment? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Method	Used	Not used	Don't know
a. Review comments from the public	50 (40, 59)	45 (36, 54)	5 (3, 9)
b. Offer the public an opportunity to participate in pretests of equipment before the election and provide comments	62 (53, 72)	35 (25, 44)	3 (1, 7)
c. Conduct listening sessions or group discussions with voters or the public	14 (9, 20)	78 (69, 85)	8 (3, 17)
d. Other	3 (1, 8)	76 (65, 86)	20 (11, 32)

Source: GAO analysis of local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. Respondents who indicated "Other" were asked to provide additional information in a free-form text box.

Table 24: Responses to GAO 2017 Local Election Jurisdiction Survey Question 16

How satisfied or dissatisfied were you with the overall performance of your jurisdiction's predominant voting equipment during the November 2016 general election? (Check one.)

Satisfaction	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Very satisfied	70	61	79
Generally satisfied	26	18	36
As satisfied as dissatisfied	2	1	4
Generally dissatisfied	1	0	3
Very dissatisfied	1	0	2
No opinion	0	0	1

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 25: Responses to GAO 2017 Local Election Jurisdiction Survey Question 17

How did your satisfaction with the overall performance of your equipment change between 2012 and 2016, if at all? (Check one.)

Satisfaction	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
More satisfied in 2016 than in 2012	16	10	22
Just as satisfied in 2016 as in 2012 (skip to question 19)	67	59	75
Less satisfied in 2016 than in 2012	4	3	7
No opinion (skip to question 19)	13	7	22

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 26: Responses to GAO 2017 Local Election Jurisdiction Survey Question 18

Which of the following factors affected the change in your satisfaction with the overall performance of your jurisdiction's predominant voting equipment? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Factor	Affected change in satisfaction	Did not affect change in satisfaction	Not applicable	Don't know
a. Number of pieces of equipment that failed (e.g., equipment failed and had to be taken out of service for the remainder of the election)	39 (26, 54)	21 (11, 34)	n/r	1 (0, 4)
b. Down time for equipment	25 (16, 37)	34 (21, 49)	n/r	1 (0, 5)
c. Speed of counting votes	47 (32, 62)	n/r	14 (6, 25)	1 (0, 4)
d. Accuracy of casting votes (e.g., equipment accurately records selections of voters)	n/r	46 (31, 60)	22 (12, 34)	2 (0, 5)
e. Accuracy of counting votes (e.g., equipment accurately tabulates votes cast)	n/r	n/r	19 (10, 30)	2 (0, 5)

Factor	Affected change in satisfaction	Did not affect change in satisfaction	Not applicable	Don't know
f. Time for election workers to set up equipment	n/r	34 (22, 48)	14 (6, 25)	1 (0, 3)
g. Number of ballots ruined while processed or tabulated by voting equipment	n/r	n/r	28 (17, 41)	1 (0, 4)
h. Misfeed rate (for optical or digital scan)	n/r	n/r	21 (12, 32)	2 (0, 9)
i. Overvotes	8 (4, 14)	n/r	n/r	1 (0, 4)
j. Undervotes	6 (2, 11)	n/r	n/r	1 (0, 5)
k. Cost to operate and maintain equipment (e.g., labor, postage, paper and printing supplies, electricity, parts, etc.)	n/r	n/r	16 (7, 29)	3 (1, 8)
l. Ease with which individuals with disabilities or impairments can cast votes	n/r	38 (25, 53)	20 (11, 32)	1 (0, 4)
m. Ease of providing multilingual ballot formats, as necessary	8 (2, 19)	25 (14, 38)	n/r	n/r
n. Number of malfunction instances or crashes	39 (26, 53)	29 (17, 44)	n/r	1 (0, 3)
o. Ability to audit the election results	n/r	38 (25, 52)	17 (8, 30)	2 (0, 6)
p. Other	n/r	n/r	n/r	n/r

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points. Respondents who indicated "Other" were asked to provide additional information in a free-form text box.

Table 27: Responses to GAO 2017 Local Election Jurisdiction Survey Question 19

Based on your experience with the predominant voting equipment your jurisdiction used during the November 2016 general election, how much of a benefit or challenge to your jurisdiction were each of the following as a result of using the equipment? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Experience	Major benefit	Minor benefit	Neither a benefit nor a challenge	Minor challenge	Major challenge	Don't know
a. Ease of setting up voting equipment by jurisdiction poll workers	40 (31, 49)	7 (4, 11)	41 (31, 51)	7 (4, 11)	2 (1, 4)	3 (1, 6)
b. Accessibility for individuals with disabilities or impairments	46 (37, 55)	16 (9, 25)	32 (23, 40)	4 (2, 8)	0 (0, 1)	2 (1, 3)
c. Efficiency of operation	72 (65, 79)	10 (6, 16)	13 (9, 19)	4 (1, 8)	0 (0, 1)	1 (0, 2)
d. Producing an accurate count of votes cast	81 (75, 87)	4 (1, 10)	12 (8, 17)	1 (0, 3)	0 (0, 1)	2 (0, 5)
e. Ease of conducting routine maintenance	52 (43, 61)	16 (9, 25)	23 (16, 32)	5 (3, 8)	1 (0, 2)	3 (2, 5)

Experience	Major benefit	Minor benefit	Neither a benefit nor a challenge	Minor challenge	Major challenge	Don't know
f. Cost to operate voting equipment (e.g., poll worker labor, postage, paper and printing supplies, electricity, etc.)	30 (21, 40)	9 (5, 15)	42 (33, 51)	7 (5, 10)	2 (1, 4)	9 (4, 18)
g. Cost to maintain voting equipment (e.g. costs for maintenance-related labor and parts)	29 (20, 37)	13 (6, 23)	34 (25, 42)	11 (8, 16)	3 (2, 5)	10 (5, 20)
h. Costs to store and transport voting equipment	21 (14, 29)	6 (3, 10)	49 (40, 58)	14 (10, 20)	4 (2, 6)	6 (2, 16)
i. Security of equipment against outside electronic hacking or intrusion	60 (51, 69)	5 (3, 8)	26 (19, 33)	2 (0, 4)	0 (0, 1)	8 (3, 17)
j. Protection and preservation of votes cast against potential non-cybersecurity related threats (e.g., adverse weather conditions, power failures, theft or tampering, etc.)	57 (48, 66)	8 (5, 12)	23 (16, 31)	2 (1, 4)	1 (0, 3)	10 (3, 21)
k. Ease of troubleshooting or resolving equipment malfunctions during Election Day	49 (40, 59)	18 (11, 26)	21 (15, 28)	6 (3, 9)	1 (0, 3)	6 (1, 16)
l. Customer support and problem resolution assistance from vendor	63 (54, 71)	10 (7, 15)	18 (13, 25)	2 (1, 3)	0 (0, 1)	7 (2, 17)
m. Availability of replacement parts	38 (29, 48)	13 (7, 23)	26 (19, 35)	7 (4, 11)	3 (2, 5)	12 (6, 22)
n. Ease of capturing digital image of voter-marked paper ballot (optical or digital scan equipment only)	34 (25, 43)	7 (4, 11)	29 (20, 37)	2 (1, 3)	1 (0, 2)	28 (19, 39)
o. Preventing or alerting voters of any overvotes or undervotes before ballot is cast	57 (47, 66)	10 (6, 15)	19 (13, 25)	6 (2, 15)	0 (0, 2)	8 (3, 17)
p. Ease of presenting lengthy ballots in a clear and understandable way	42 (33, 51)	16 (9, 25)	26 (19, 33)	4 (1, 8)	1 (0, 2)	12 (5, 24)
q. Ease of presenting or producing ballots in multiple languages as needed	11 (6, 16)	4 (2, 7)	41 (32, 50)	1 (0, 4)	2 (1, 5)	42 (32, 51)
r. Ease of connectivity with other election administration systems (e.g., voter registration, election night reporting)	25 (18, 34)	8 (5, 11)	40 (31, 49)	5 (1, 15)	1 (0, 3)	21 (12, 31)
s. Timely election night reporting	63 (54, 72)	11 (7, 16)	17 (10, 25)	3 (1, 5)	1 (0, 2)	6 (1, 16)
t. Ability to facilitate a postelection audit	50 (41, 60)	16 (11, 23)	22 (15, 30)	1 (0, 2)	0 (0, 1)	10 (4, 21)

Experience	Major benefit	Minor benefit	Neither a benefit nor a challenge	Minor challenge	Major challenge	Don't know
u. Proper storage of equipment when not in use	49 (39, 58)	11 (7, 16)	24 (18, 31)	8 (3, 17)	3 (1, 5)	6 (1, 16)
v. For direct recording electronic (DRE) equipment only: memory capacity or storage of electronically cast ballots	32 (22, 42)	5 (2, 9)	21 (14, 29)	1 (0, 2)	1 (0, 4)	41 (29, 52)
w. For direct recording electronic (DRE) equipment only: the provision of a voter-verified paper trail	23 (14, 35)	4 (1, 8)	23 (16, 32)	2 (0, 6)	2 (1, 5)	46 (35, 57)
x. Other benefit or challenge not listed above	3 (1, 9)	0 (0, 1)	36 (34, 50)	0 (0, 1)	1 (0, 2)	60 (48, 72)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. Respondents who indicated "Other" were asked to provide additional information in a free-form text box.

Testing Voting Equipment

Table 28: Responses to GAO 2017 Local Election Jurisdiction Survey Question 20

Acceptance testing of voting equipment is to verify that all new equipment or any equipment that has been outside election administrators' control (e.g., for repair) conforms to the purchase agreements and is identical to equipment that was tested and certified by state or federal testing organizations. Does your jurisdiction conduct acceptance testing to verify that any voting equipment delivered or repaired by the vendor or another outside party meets your contract requirements and/or any relevant state requirements? (Check one.)

Acceptance Testing	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Jurisdiction conducts or has another entity conduct acceptance testing on behalf of the jurisdiction	49	40	59
Jurisdiction does not conduct acceptance testing (skip to question 22)	4	2	7
Not applicable —jurisdiction did not have any voting equipment that requires acceptance testing (skip to question 22)	24	16	33
Don't know (skip to question 22)	23	13	36

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 29: Responses to GAO 2017 Local Election Jurisdiction Survey Question 21

If acceptance testing is performed, who performs the test(s)? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Tester	Performs acceptance testing	Does not perform acceptance testing	Don't know
a. Local jurisdiction personnel	88	12	0
	(80, 94)	(6, 20)	(0, 2)
b. State election personnel	24	62	14
	(16, 34)	(52, 72)	(8, 24)
c. Experts or consultants	13	73	14
	(7, 22)	(63, 82)	(7, 22)
d. Contractors	21	67	12
	(13, 33)	(56, 77)	(6, 20)
e. Voting equipment vendors	58	35	7
	(48, 68)	(25, 45)	(3, 14)
f. State auditor or equivalent	3	82	15
	(1, 7)	(73, 90)	(8, 24)
g. Other	6	63	31
	(1, 18)	(49, 77)	(19, 46)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. Respondents who indicated "Other" were asked to provide additional information in a free-form text box.

Table 30: Responses to GAO 2017 Local Election Jurisdiction Survey Question 22

Did your jurisdiction have documented policies or procedures in place for testing the security and functionality of voting equipment in preparation for the November 2016 general election? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Testing	Yes, had policies or procedures	No, did not have policies or procedures	Don't know
a. Security of voting equipment	84 (74, 92)	8 (3, 17)	7 (3, 17)
b. Functionality of voting equipment (e.g., logic and accuracy testing)	90 (81, 96)	3 (1, 7)	7 (2, 16)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate.

Table 31: Responses to GAO 2017 Local Election Jurisdiction Survey Question 23

Did your jurisdiction conduct any of the following types of testing on any voting equipment in preparation for or during the November 2016 general election? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Type of Testing	Yes, conducted	No, did not conduct	Not applicable	Don't know
a. Logic and accuracy (functional or readiness) testing to determine whether voting equipment was functioning properly (for instance, tallying and transmission)	99 (97, 99)	1 (0, 2)	0 (0, 1)	1 (0, 2)
b. Parallel testing on Election Day by running predefined votes cast with known results, then comparing the actual and expected results	37 (28, 45)	44 (34, 53)	14 (7, 22)	6 (3, 13)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate.

Table 32: Responses to GAO 2017 Local Election Jurisdiction Survey Question 24

Did your jurisdiction conduct a postelection audit or targeted recounts of any election results for the November 2016 general election? (Check one.)

Audit	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Yes	45	36	55
No (skip to question 26)	52	42	61
Don't know (skip to question 26)	3	2	5

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Question 25 (open-ended question): Please describe any significant issues or problems with your voting equipment that were identified through the postelection audit or targeted recounts and the steps you took to address them. If no issues or problems with the voting equipment were identified, please put "NA."

Security of Voting Equipment

Table 33: Responses to GAO 2017 Local Election Jurisdiction Survey Question 26

During the November 2016 general election, did your jurisdiction detect any attempted physical tampering with voting equipment or ballots and/or cyber security breach(es) or manipulation(s) of your voting equipment?

Note: For the purposes of this question, only consider attempted tampering, breaches, or manipulations of the voting equipment used to define and create ballots, cast and count votes, report election results, and maintain and produce audit trail information. (Check one.)

Tampering	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Yes, detected an attempted physical tampering of voting equipment or ballots	0	0	1
Yes, detected an attempted cyber security breach or manipulation of voting equipment	0	0	1
Yes, detected both attempted physical tampering of voting equipment or ballots and cyber security breaches or manipulation of voting equipment	0	0	1
No (skip to question 28)	99	96	100
Not applicable (skip to question 28)	1	0	4
Don't know (skip to question 28)	0	0	1

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Question 27 (open-ended question): Please briefly describe the attempted physical and/or cyber security breach(es) or manipulation(s) of your voting equipment, whether it was successful, and the impact it had, if any, on your jurisdiction's ability to conduct the election.

Table 34: Responses to GAO 2017 Local Election Jurisdiction Survey Question 28

Did your jurisdiction interact or consult with any of the following entities or individuals to assess the physical and/or cyber security of your current voting equipment in preparation for the November 2016 general election?

Note: For the purposes of this question, only consider those interactions or consultations specifically about the security of the voting equipment used to define and create ballots, cast and count votes, report election results, and maintain and produce audit trail information. (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Entities	Yes, interacted or consulted with	No, did not interact or consult with	Don't know
a. Department of Homeland Security (DHS)	4	93	4
	(2, 6)	(89, 95)	(2, 8)

Entities	Yes, interacted or consulted with	No, did not interact or consult with	Don't know
b. Federal Bureau of Investigation (FBI)	4	93	4
	(2, 6)	(89, 96)	(2, 8)
c. State or local law enforcement or homeland security agency	14	82	4
	(9, 20)	(76, 88)	(2, 8)
d. State or local chief information officer or chief information security officer	12	84	4
	(8, 16)	(79, 89)	(2, 8)
e. Secretary of State or State Elections Director's office	36	62	3
	(28, 44)	(54, 70)	(1 , 6)
f. Private security contractors	2	95	3
	(1, 5)	(91, 98)	(1, 6)
g. Other	6	86	8
	(2, 12)	(79, 92)	(4, 13)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. Respondents who indicated "Other" were asked to provide additional information in a free-form text box.

Table 35: Responses to GAO 2017 Local Election Jurisdiction Survey Question 29

Overall, compared to the November 2012 general election, did your jurisdiction implement more, about the same, or fewer security (physical and/or cyber security) precautions for your voting equipment during the November 2016 general election? (Check one.)

Implementation	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Jurisdiction took more precautions for the security of voting equipment in 2016 compared to 2012	20	14	27
Jurisdiction took about the same precautions for the security of voting equipment in 2016 compared to 2012	69	60	77
Jurisdiction took fewer precautions for the security of voting equipment in 2016 compared to 2012	0	0	2
Don't know	11	5	20

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Use of Commercial Off-the-Shelf (COTS) Components

The Election Assistance Commission's (EAC) Voluntary Voting System Guidelines, Version 1.1, defines commercial off-the-shelf (COTS)

products as software, firmware, devices, or components that are used in the United States by many different people or organizations for many different applications other than certified voting systems and are incorporated into the voting system with no manufacturer- or application-specific modification. Examples of COTS components include hardware that can be purchased commercially (e.g., tablet devices, scanners, printers, memory cards or chips, etc.) and integrated as part of voting equipment. The next series of questions asks about your jurisdiction's integration of COTS components into voting equipment that was acquired from a vendor or self-designed by your jurisdiction. For the purpose of questions 30-36 (the next 7 questions), the term "voting equipment" refers only to the equipment your jurisdiction used to cast and count votes.

Table 36: Responses to GAO 2017 Local Election Jurisdiction Survey Question 30

For the November 2016 general election, did your jurisdiction use commercial off-the-shelf (COTS) components in self-designed voting equipment or existing voting equipment? (Check one.)

COTS Component	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Yes, jurisdiction used COTS components in self-designed voting equipment	1	0	2
Yes, jurisdiction used COTS components in existing voting equipment	6	3	9
No, jurisdiction did not use COTS components in any voting equipment (skip to question 35)	71	60	80
Don't know (skip to question 35)	23	14	34

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 37: Responses to GAO 2017 Local Election Jurisdiction Survey Question 31

What components of your voting equipment were commercial off-the-shelf (COTS)? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Component	COTS	Not COTS	Don't know
a. Touchscreen or touchpad devices to allow voters to cast ballots	9 (3, 20)	90 (79, 96)	1 (0, 7)
b. Printers to print ballots or a voter-verified paper trail	n/r	n/r	2 (0, 9)
c. Memory cards or other removable memory devices (e.g., flash drives)	n/r	n/r	n/r

Component	COTS	Not COTS	Don't know
d. Software	14 (5, 28)	84 (70, 93)	2 (0, 8)
e. Network components (e.g., modems, Wi-Fi receivers)	n/r	n/r	4 (1, 11)
f. Ballot scanning hardware	n/r	n/r	1 (0, 7)
g. Monitors and other devices for judges to review ballots	22 (11, 37)	n/r	4 (1, 12)
h. Other	5 (1, 15)	n/r	n/r

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points. Respondents who indicated "Other" were asked to provide additional information in a free-form text box.

Table 38: Responses to GAO 2017 Local Election Jurisdiction Survey Question 32

How important were each of the following reasons for deciding to use commercial off-the-shelf (COTS) components in your voting equipment? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Reason	Very important	Somewhat important	Not very important	Not important at all	Don't know
a. Equipment manufacturer no longer made spare parts or components for existing equipment and jurisdiction wanted to extend the existing equipment's service life	n/r	8 (2, 20)	8 (2, 17)	n/r	n/r
b. COTS components were less expensive than the comparable parts made by equipment manufacturer	17 (8, 31)	n/r	11 (4, 24)	n/r	n/r
c. COTS components provided more functional options or features than equivalent parts made by equipment manufacturer	n/r	n/r	9 (3, 20)	n/r	n/r
d. Other	n/r	2 (0, 12)	n/r	n/r	n/r

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points. Respondents who indicated "Other" were asked to provide additional information in a free-form text box.

Table 39: Responses to GAO 2017 Local Election Jurisdiction Survey Question 33

How did your satisfaction with the performance of your voting equipment with and without commercial off-the-shelf (COTS) components compare to each other? (Check one.)

Satisfaction	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
More satisfied with the equipment with COTS components than previous equipment without COTS	13	5	26
Just as satisfied with the equipment with COTS components as previous equipment without COTS components	19	9	34
Less satisfied with the equipment with COTS components than previous equipment without COTS components	n/r	n/r	n/r
No opinion	n/r	n/r	n/r
Not applicable —jurisdiction's voting equipment has always included some COTS components	n/r	n/r	n/r
Don't know	0	0	3

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points.

Table 40: Responses to GAO 2017 Local Election Jurisdiction Survey Question 34

To use commercial off-the-shelf (COTS) components, to what extent did your jurisdiction have to retest and recertify your equipment to comply with your state's requirements? (Check one.)

Testing	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
All voting equipment used to cast and count ballots needed to be retested and recertified to state and/or federal standards (skip to question 37)	10	4	20
Only the voting equipment components with COTS parts needed to be retested and recertified (skip to question 37)	5	2	12
None, state requirements do not require retesting and recertifying equipment after incorporation of COTS components (skip to question 37)	n/r	n/r	n/r
Don't know (skip to question 37)	n/r	n/r	n/r

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points.

Table 41: Responses to GAO 2017 Local Election Jurisdiction Survey Question 35

Did your jurisdiction ever consider using commercial off-the-shelf components in your voting equipment? (Check one.)

Consideration	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Yes	2	1	3
No (skip to question 37)	76	66	85
Don't know (skip to question 37)	22	14	33

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 42: Responses to GAO 2017 Local Election Jurisdiction Survey Question 36

If your jurisdiction considered using commercial off-the-shelf (COTS) components in its voting equipment, but ultimately decided not to use COTS components, how important, if at all, were each of the following reasons for doing so? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Consideration	Very important	Somewhat important	Not very important	Not important at all	Don't know
a. No equivalent or compatible COTS parts or components were available for jurisdiction's equipment	n/r	n/r	n/r	n/r	n/r
b. COTS parts or components were too expensive to acquire	n/r	n/r	n/r	n/r	n/r
c. Using COTS parts or components would require retesting and recertification of entire voting equipment	n/r	n/r	n/r	n/r	n/r
d. Using COTS parts would void manufacturer warranty of original equipment	n/r	n/r	n/r	n/r	n/r
e. Other	n/r	n/r	n/r	n/r	n/r

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points. Respondents who indicated "Other" were asked to provide additional information in a free-form text box.

Replacement of Voting Equipment

Table 43: Responses to GAO 2017 Local Election Jurisdiction Survey Question 37

Does your jurisdiction plan to acquire new voting equipment in time to use in the November 2020 general election?

Note: For this question, voting equipment refers to equipment used to cast and count ballots. (Check one.)

Consideration	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Yes	30	21	39
No (skip to question 44)	43	33	52
Don't know (skip to question 44)	28	20	35

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 44: Responses to GAO 2017 Local Election Jurisdiction Survey Question 38

Is leasing an option for your jurisdiction as a means to acquire new voting equipment? (Check one.)

Consideration	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Yes	24	13	39
No (skip to question 40)	n/r	n/r	n/r
Don't know (skip to question 40)	8	4	16

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points.

Table 45: Responses to GAO 2017 Local Election Jurisdiction Survey Question 39

Will your jurisdiction's new voting equipment be leased or purchased? (Check one.)

Ownership Type	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Purchased	n/r	n/r	n/r
Leased	n/r	n/r	n/r
Both purchased and leased	2	0	8
Don't know	n/r	n/r	n/r

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points.

Table 46: Responses to GAO 2017 Local Election Jurisdiction Survey Question 40

In what year does your jurisdiction plan to first use new voting equipment in an election? (Check one.)

Year	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
2017	n/r	n/r	n/r
2018	n/r	n/r	n/r
2019	12	4	25
2020	6	2	17
Don't know	12	6	21

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points.

Table 47: Responses to GAO 2017 Local Election Jurisdiction Survey Question 41

What type of voting equipment does your jurisdiction plan to acquire? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Equipment Type	Plan to acquire	Do not plan to acquire	Don't know
a. Direct recording electronic (DRE) without voter-verified paper audit trail (VVPAT)	8 (3, 15)	n/r	n/r
b. Direct recording electronic (DRE) with voter-verified paper audit trail (VVPAT)	n/r	n/r	n/r
c. Central count optical or digital scan with electronic ballot marking device	12 (6, 20)	n/r	n/r
d. Central count optical or digital scan with manually marked ballot	n/r	n/r	n/r
e. Precinct count optical or digital scan with electronic ballot marking device	n/r	n/r	n/r
f. Precinct count optical or digital scan with manually marked ballot	n/r	16 (8, 27)	n/r
g. Other equipment	n/r	n/r	n/r

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points. Respondents who indicated "Other equipment" were asked to provide additional information in a free-form text box.

Table 48: Responses to GAO 2017 Local Election Jurisdiction Survey Question 42

If your jurisdiction has selected a voting equipment vendor(s) or manufacturer(s) from which to acquire new voting equipment, what vendor(s) or manufacturer(s) were selected? (Check all that apply.)

Vendor/Manufacturer	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Have not yet selected a voting equipment vendor or manufacturer	n/r	n/r	n/r
Avante International Technology, Inc.	0	0	2
Clear Ballot Group, Inc.	2	0	7
Dominion Voting Systems Corp.	n/r	n/r	n/r
Election Systems & Software, Inc. (ES&S)	16	8	29
Everyone Counts, Inc.	0	0	2
Hart InterCivic, Inc.	6	1	17
MicroVote General Corp.	0	0	2
Open Source Digital Voting Foundation	0	0	2
Precise Voting, LLC	0	0	2
Smartmatic USA Corporation	0	0	2
SOE Software	0	0	2
TruVote International	0	0	2
Unisyn Voting Solutions	1	0	4
Other	0	0	3
Don't know	7	1	21

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points. Respondents who indicated "Other" were asked to provide additional information in a free-form text box.

Table 49: Responses to GAO 2017 Local Election Jurisdiction Survey Question 43

Has your jurisdiction used or does it plan to use any of the following practices or actions when acquiring new voting equipment in time for the November 2020 general election? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Practices	Used or plans to use	Not used or does not plan to use	Don't know
a. Use state-wide or consolidated cross-jurisdictional contracts	n/r	14 (7, 25)	n/r
b. Form a task force, committee, advisory/working group, or other group to help select new voting equipment	n/r	n/r	10 (5, 17)

Practices	Used or plans to use	Not used or does not plan to use	Don't know
c. Conduct pilot project(s) to help evaluate new voting equipment	n/r	n/r	n/r
d. Use open-source software (source code can be freely viewed, used, modified, and shared by the public) in voting equipment	3 (0, 11)	n/r	n/r
e. Design own voting equipment predominantly without commercial off-the-shelf products	1 (0, 4)	n/r	n/r
f. Design own voting equipment predominantly with commercial off-the-shelf products	0 (0, 4)	n/r	n/r

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points.

Table 50: Responses to GAO 2017 Local Election Jurisdiction Survey Question 44

Does your jurisdiction have sufficient in-house technical expertise or access to outside expertise as it relates to the selection and acquisition of new voting equipment? (Check one.)

Consideration	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Yes	78	69	86
No	11	7	17
Don't know	11	5	20

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 51: Responses to GAO 2017 Local Election Jurisdiction Survey Question 45 part I

The following is a list of factors that may influence a jurisdiction's decision to replace voting equipment. How important, if at all, are or were each of these factors to your jurisdiction's decision-making process for determining whether to replace voting equipment? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Factors	Very important	Somewhat important	Not very important	Not important at all	Not applicable	Don't know
a. Help America Vote Act (HAVA) requirements for voting equipment (e.g., provide voters with ballot verification and correction capabilities)	77 (69, 83)	9 (5, 16)	2 (1, 4)	1 (0, 2)	5 (3, 8)	7 (4, 12)
b. Need for voting equipment to meet federal voting system guidelines	80 (72, 87)	4 (2, 9)	1 (0, 3)	0 (0, 1)	7 (3, 16)	7 (4, 11)
c. Need for voting equipment to meet any state and/or local requirements, standards, or certification for voting equipment	87 (81, 91)	4 (1, 9)	0 (0, 1)	0 (0, 1)	4 (2, 8)	5 (3, 9)

Factors	Very important	Somewhat important	Not very important	Not important at all	Not applicable	Don't know
d. Need for voting equipment to meet new state or local statutorily mandated changes or requirements for voting equipment	86 (80, 90)	3 (1, 9)	1 (0, 3)	0 (0, 1)	5 (3, 8)	6 (3, 9)
e. Availability of remaining HAVA funds	43 (34, 53)	20 (13, 28)	10 (4, 21)	4 (2, 8)	13 (9, 17)	10 (6, 16)
f. Availability of state and/or local funding	62 (53, 71)	21 (13, 32)	2 (1, 3)	2 (1, 5)	8 (5, 12)	5 (3, 9)
g. Costs to operate voting equipment (e.g., poll worker labor to set up equipment, postage for mailing absentee or vote-by-mail ballots, paper and printing supplies for paper ballots or voter-verified paper trails, and electricity to operate equipment)	50 (41, 60)	31 (22, 41)	5 (2, 9)	3 (0, 10)	6 (3, 9)	6 (3, 9)
h. Costs to maintain voting equipment (e.g., labor to conduct maintenance between elections of any equipment hardware and software as well as any required parts, etc.)	58 (49, 68)	28 (19, 39)	2 (1, 5)	1 (0, 2)	5 (3, 8)	6 (3, 9)
i. Cost to acquire or lease new voting equipment	61 (52, 70)	21 (13, 31)	4 (1, 11)	1 (0, 2)	8 (4, 13)	6 (3, 10)
j. Vendor demonstrations of new voting equipment	62 (53, 71)	17 (10, 27)	10 (6, 15)	1 (0, 2)	6 (3, 10)	5 (3, 9)
k. Availability of replacement parts or components for voting equipment	70 (61, 78)	16 (9, 26)	2 (0, 4)	1 (0, 2)	5 (2, 8)	8 (4, 13)
l. Capability to use commercial off-the-shelf components with voting equipment	19 (11, 29)	19 (13, 27)	23 (15, 33)	8 (5, 13)	14 (8, 22)	17 (11, 24)
m. Concerns about the adequacy of the physical security of voting equipment	70 (61, 78)	17 (9, 27)	3 (1, 6)	1 (0, 2)	5 (3, 9)	5 (3, 9)
n. Concerns about the adequacy of the cyber security of voting equipment	67 (57, 76)	14 (7, 24)	2 (1, 5)	1 (0, 3)	10 (5, 18)	6 (3, 10)
o. Whether the voting equipment provides a voter-verifiable paper trail (direct recording electronic only)	46 (36, 56)	9 (5, 16)	7 (4, 12)	3 (2, 6)	19 (14, 25)	16 (8, 25)
p. Feedback from voters or the public on voting equipment	34 (26, 43)	34 (24, 44)	11 (5, 18)	2 (1, 5)	10 (6, 15)	9 (4, 17)
q. Overall performance of voting equipment	83 (76, 88)	7 (4, 13)	0 (0, 1)	0 (0, 1)	5 (2, 8)	5 (3, 9)
r. Voting equipment has outdated software	67 (58, 76)	13 (6, 23)	2 (1, 5)	0 (0, 1)	8 (5, 12)	9 (5, 15)
s. Age of voting equipment	62 (52, 71)	22 (13, 33)	3 (1, 8)	1 (0, 3)	6 (3, 9)	7 (4, 12)

Factors	Very important	Somewhat important	Not very important	Not important at all	Not applicable	Don't know
t. Availability of voting equipment that better meets states' or jurisdictions' needs (e.g., more voter friendly features)	65 (56, 75)	20 (12, 30)	2 (0, 4)	2 (0, 5)	6 (3, 9)	6 (3, 10)
u. Accessibility of voting equipment for disabled or impaired voters	77 (68, 84)	12 (6, 21)	1 (0, 2)	0 (0, 1)	6 (3, 9)	5 (3, 9)
v. Level of in-house technical expertise about voting equipment	44 (35, 54)	30 (21, 39)	10 (4, 19)	2 (0, 4)	8 (3, 16)	7 (4, 12)
w. Sufficiency of vendor support and problem resolution	81 (74, 87)	8 (4, 13)	1 (0, 4)	0 (0, 1)	4 (2, 8)	5 (3, 9)
x. Extent and expense of training required for poll workers and voters on the use of voting equipment	57 (47, 66)	25 (17, 35)	7 (3, 15)	1 (0, 2)	5 (3, 9)	6 (3, 9)
y. Other	5 (2, 11)	5 (1, 16)	n/r	1 (0, 3)	36 (25, 47)	40 (28, 52)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points. Respondents who indicated they considered an "Other" factor were asked to provide additional information in a free-form text box.

Table 52: Responses to GAO 2017 Local Election Jurisdiction Survey Question 45 part II

Of the factors that you rated as "very important" (or "somewhat important" if you did not rate any factors as "very important"), which one would you say was the most important, second most important, and third most important? Please enter the letter preceding the factor into the text box below. For example, if you want to rank "factor x" as most important you would enter the letter x in the text box for "most important factor." If you only rated two factors as "very important" (or "somewhat important" if you did not rate any factors as "very important") you only need to rank those two factors.

Estimated percentage of population nationwide residing within jurisdictions

Factors	Most important factor	Second most important factor	Third most important factor
Help America Vote Act (HAVA) requirements for voting equipment (e.g., provide voters with ballot verification and correction capabilities)	12 (5, 22)	4 (2, 8)	3 (1, 8)
Need for voting equipment to meet federal voting system guidelines	16 (9, 26)	11 (5, 22)	3 (1, 8)
Need for voting equipment to meet any state and/or local requirements, standards, or certification for voting equipment	11 (6, 18)	14 (7, 24)	11 (5, 21)
Need for voting equipment to meet new state or local statutorily mandated changes or requirements for voting equipment	4 (1, 8)	4 (2, 8)	5 (2, 11)
Availability of remaining HAVA funds	4 (1, 14)	3 (1, 8)	2 (0, 6)

Factors	Most important factor	Second most important factor	Third most important factor
Availability of state and/or local funding	6 (3, 10)	7 (2, 16)	5 (2, 11)
Costs to operate voting equipment (e.g., poll worker labor to set up equipment, postage for mailing absentee or vote-by-mail ballots, paper and printing supplies for paper ballots or voter-verified paper trails, and electricity to operate equipment)	2 (1, 4)	3 (1, 6)	2 (1, 5)
Costs to maintain voting equipment (e.g., labor to conduct maintenance between elections of any equipment hardware and software as well as any required parts, etc.)	1 (0, 6)	3 (1, 6)	1 (1, 3)
Cost to acquire or lease new voting equipment	5 (3, 10)	6 (3, 10)	4 (2, 8)
Vendor demonstrations of new voting equipment	0 (0, 1)	1 (0, 4)	1 (0, 5)
Availability of replacement parts or components for voting equipment	0 (0, 1)	1 (0, 3)	3 (1, 7)
Capability to use commercial off-the-shelf components with voting equipment	0 (0, 1)	0 (0, 2)	0 (0, 1)
Concerns about the adequacy of the physical security of voting equipment	2 (1, 4)	1 (0, 2)	3 (0, 10)
Concerns about the adequacy of the cyber security of voting equipment	2 (1, 5)	1 (0, 2)	1 (1, 3)
Whether the voting equipment provides a voter-verifiable paper trail (direct recording electronic only)	1 (0, 3)	4 (1, 10)	8 (2, 21)
Feedback from voters or the public on voting equipment	0 (0, 2)	0 (0, 1)	1 (0, 2)
Overall performance of voting equipment	7 (4, 12)	6 (3, 12)	7 (4, 11)
Voting equipment has outdated software	0 (0, 1)	1 (0, 2)	1 (0, 5)
Age of voting equipment	2 (1, 3)	2 (1, 6)	2 (1, 3)
Availability of voting equipment that better meets jurisdictions' needs (e.g., more voter friendly features)	2 (1, 4)	1 (1, 3)	4 (2, 7)
Accessibility of voting equipment for disabled or impaired voters	0 (0, 1)	2 (1, 3)	2 (1, 4)
Level of in-house technical expertise about voting equipment	0 (0, 1)	0 (0, 1)	0 (0, 1)
Sufficiency of vendor support and problem resolution	0 (0, 1)	2 (1, 4)	5 (2, 8)

Factors	Most important factor	Second most important factor	Third most important factor
Extent and expense of training required for poll workers and voters on the use of voting equipment	2 (1, 5)	0 (0, 1)	1 (0, 3)
Other	0 (0, 1)	0 (0, 1)	0 (0, 1)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate.

Funding

Table 53: Responses to GAO 2017 Local Election Jurisdiction Survey Question 46

How does your jurisdiction obtain funds to acquire new voting equipment? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Funds	Uses to obtain funds	Does not use to obtain funds	Don't know
a. Direct appropriation from local general funds or budget	79 (71, 85)	9 (5, 16)	12 (7, 18)
b. Local sale of bonds	2 (1, 4)	71 (62, 80)	27 (19, 37)
c. Local tax or fee revenue dedicated to fund election operations	5 (2, 9)	73 (63, 81)	23 (15, 32)
d. Private sector financing or loan	1 (0, 3)	77 (68, 85)	21 (14, 31)
e. Financial assistance from or cost sharing with your state	43 (33, 54)	35 (25, 44)	22 (15, 30)
f. Help America Vote Act (HAVA) funds	49 (39, 59)	28 (20, 39)	23 (15, 31)
g. Other	9 (3, 19)	41 (28, 54)	51 (38, 64)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. Respondents who indicated they used "Other" were asked to provide additional information in a free-form text box.

Table 54: Responses to GAO 2017 Local Election Jurisdiction Survey Question 47

What is the maximum portion of the cost of acquiring voting equipment for your jurisdiction that can be currently covered by financial assistance from or cost sharing with your state? (Check one.)

Cost	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Up to 25%	1	0	2
26-49%	1	0	2
50%	4	0	14
More than 50%, but less than 100%	5	2	10

Cost	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
All acquisition costs are covered by the state	9	5	15
Not applicable, does not obtain financial assistance from or share costs with your state (skip to question 50)	28	20	35
Don't know	53	44	62

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 55: Responses to GAO 2017 Local Election Jurisdiction Survey Question 48

What form(s) of financial assistance or cost sharing mechanisms does your state currently use to provide funds towards the acquisition of voting equipment? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Financial Assistance	Uses to obtain funds	Does not use to obtain funds	Don't know
a. Direct appropriation	26 (16, 38)	7 (4, 11)	68 (56, 78)
b. Grant program	18 (12, 26)	9 (5, 14)	73 (64, 82)
c. Loan	2 (0, 7)	25 (15, 37)	74 (62, 84)
d. Other	5 (1, 13)	13 (8, 21)	82 (72, 89)

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. Respondents who indicated they used "Other" were asked to provide additional information in a free-form text box.

Table 56: Responses to GAO 2017 Local Election Jurisdiction Survey Question 49

What conditions, if any, does your state require if it provides your jurisdiction financial assistance or shares the costs to acquire voting equipment? (Check one.)

Condition	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
State determines the type(s) and/or model(s) of new voting equipment to be acquired	11	7	18
State determines the timing of when new voting equipment is to be acquired	7	1	21
State determines the type(s) and/or model(s) and timing of when voting equipment is to be acquired	17	10	26
State does not impose any conditions; local jurisdiction may determine what type(s) and/or model(s) of equipment and when to acquire equipment	10	5	17

Condition	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Don't know	55	44	66

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 57: Responses to GAO 2017 Local Election Jurisdiction Survey Question 50

From your perspective, are the funding sources you have available from state and local sources generally sufficient to enable your jurisdiction to replace its voting equipment as needed? (Check one.)

Consideration	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Yes	37	27	47
No	31	23	39
Don't know	32	23	41

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 58: Responses to GAO 2017 Local Election Jurisdiction Survey Question 51

Does your jurisdiction have any Help America Vote Act (HAVA) funds remaining to apply towards the acquisition of new voting equipment if needed? (Check one.)

Funds	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Yes, jurisdiction has HAVA funds remaining to acquire all voting equipment needed (skip to question 54)	3	1	6
Yes, jurisdiction has HAVA funds remaining to acquire a portion of the voting equipment needed	6	2	16
Yes, jurisdiction has HAVA funds remaining to acquire voting equipment, but no new voting equipment is currently needed (skip to question 54)	1	0	3
No	42	33	50
Not applicable—all acquisition costs are covered by state (skip to question 54)	2	1	6
Don't know (skip to question 54)	46	36	56

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 59: Responses to GAO 2017 Local Election Jurisdiction Survey Question 52

Has the current availability or lack of Help America Vote Act (HAVA) funds affected your jurisdiction's decisions regarding replacing voting equipment? (Check one.)

Decision	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Yes	36	27	45
No (skip to question 54)	57	47	67
Don't know (skip to question 54)	7	3	15

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 60: Responses to GAO 2017 Local Election Jurisdiction Survey Question 53

How has the current availability or lack of Help America Vote Act (HAVA) funds affected your jurisdiction's decisions regarding replacing voting equipment? (Check all that apply.)

Outcome	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Delayed replacing voting equipment that is needed	57	45	70
Prevented jurisdiction from acquiring the type of voting equipment that best meets the jurisdiction's needs	25	15	37
Was a factor in decision to lease equipment	2	1	6
Other	11	4	22

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: Respondents who indicated "Other" were asked to provide additional information in a free-form text box.

Table 61: Responses to GAO 2017 Local Election Jurisdiction Survey Question 54

Does your state have a statewide acquisition contract from which your jurisdiction must purchase or has the option of purchasing voting equipment? (Note: For the purposes of this survey, the term "acquisition" pertains only to the actual procurement of equipment. It does not include costs related to the implementation of new equipment such as installation or training for poll workers, for example.) (Check one.)

Acquisition Contract	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Yes, state has a statewide contract from which jurisdictions must purchase	10	6	15
Yes, state has a statewide contract from which jurisdictions have the option of purchasing	8	4	13
No	36	26	46

Acquisition Contract	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Don't know	46	37	56

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 62: Responses to GAO 2017 Local Election Jurisdiction Survey Question 55

We understand that some jurisdictions and the states in which they are located have consolidated individual purchase contracts into a single higher volume contract to acquire new voting equipment. Has your jurisdiction done this? (Check one.)

Consideration	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Yes (skip to question 57)	15	8	26
No	30	22	38
Don't know (skip to question 57)	55	45	64

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Table 63: Responses to GAO 2017 Local Election Jurisdiction Survey Question 56

Which of the following were reasons why your jurisdiction has not pursued a consolidated contract with other jurisdictions or the state? (Select one answer per row.)

Estimated percentage of population nationwide residing within jurisdictions

Reason	Percentage	Not a reason	Don't know
a. Jurisdiction could negotiate better pricing or terms on its own	9 (4, 17)	45 (32, 59)	46 (33, 60)
b. Jurisdiction wanted to acquire voting equipment with different features than other consolidated contract participants wanted	7 (3, 15)	46 (33, 60)	47 (34, 61)
c. Jurisdiction had a different acquisition schedule than the other consolidated contract participants	11 (5, 19)	43 (30, 57)	46 (33, 60)
d. Consolidation of individual purchase contracts has not been attempted within the state	33 (20, 47)	24 (14, 36)	44 (31, 57)
e. Jurisdictions can use a statewide contract to purchase voting equipment	14 (5, 28)	42 (29, 55)	45 (31, 58)
f. Other	6 (2, 15)	n/r	n/r

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Note: The numbers in parentheses are the values for the 95 percent confidence interval for the estimate. n/r indicates that we are not reporting the estimate because the maximum half-width of the confidence interval is greater than 15 percentage points. Respondents who indicated "Other" were asked to provide additional information in a free-form text box.

Update of the Federal Voluntary Voting System Guidelines

Table 64: Responses to GAO 2017 Local Election Jurisdiction Survey Question 57

The federal Election Assistance Commission (EAC) is in the process of updating the voluntary voting system guidelines. How, if at all, does the updating of the guidelines affect the timing of any plans your jurisdiction may have to replace your current voting equipment? (Check one.)

Impact	Estimated percentage of population nationwide residing within jurisdictions	95 percent confidence interval—lower bound (percent)	95 percent confidence interval—upper bound (percent)
Jurisdiction will hold off on replacing current voting equipment	10	6	15
No impact on the timing of the replacement of current voting equipment	44	35	53
Don't know	46	37	56

Source: GAO analysis of 2017 local election jurisdiction survey results. | GAO-18-294

Additional Comments

Question 58 (open-ended question): If you have any additional comments concerning any of the topics covered in this questionnaire, please use the space below.

Appendix IV: Results of GAO's Survey of States on Voting Equipment

To obtain information on the types of voting equipment used in the 2016 general election and the factors states consider when deciding whether to replace voting equipment, we conducted a web-based survey of state-level election offices in the 50 states and the District of Columbia.[1] The questions we asked in our survey of state election offices are shown below. Our survey was composed of closed- and open-ended questions. In this appendix, we include all survey questions and results of responses to the closed-ended questions; we do not provide information on responses provided to open-ended questions that required manually entered text responses. The tables below represent the frequencies of state responses to the questions. We received surveys from 46 states (a 90 percent response rate), while 5 states did not respond. However, the total number of responses to individual questions may be fewer than 46, depending upon how many states were eligible or chose to respond to a particular question. For a more detailed discussion of our survey methodology, see appendix I.

Survey Contact

Question 1 (open-ended question): What is the name, title, telephone number, and e-mail address of the primary person completing this questionnaire so that we may contact someone if we need to clarify any responses?

[1]For the purpose of this appendix, we refer to the 50 states and the District of Columbia collectively as "states."

Information on State Election Characteristics and Practices

Table 65: Responses to GAO 2017 State Survey Question 2

Approximately how many precincts, voting locations, and registered voters were there in your state on the November 2016 General Election Day?

Count	Mean number
Precincts	3,001
Voting locations	2,462
Registered voters	5,330,815

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 66: Responses to GAO 2017 State Survey Question 3

Did your state or any local jurisdiction in your state use any of the following practices for the November 2016 general election? (Note: For the purposes of this question, if any local jurisdiction in your state uses these practices, please mark as "used" below.) (Select one answer per row.)

Method	Used	Didn't use	Don't know
a. Vote by mail (i.e., all-mail or mail-ballot elections), not including absentee	17	29	0
b. In-person voting prior to Election Day (e.g., early or in-person absentee voting)	44	2	0
c. Vote centers on Election Day (voting locations where any voter in a jurisdiction can vote regardless of precinct)	16	29	0
d. Same-day voter registration for early or Election Day voting	20	26	0
e. Electronic poll books at voting locations on Election Day or during early voting	31	15	0
f. Paper poll books at voting locations on Election Day or during early voting	41	5	0
g. Ballots in different languages	25	21	0
h. No-excuse absentee voting by mail	29	17	0
i. Other	4	12	10

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who indicated that they used "Other" were asked to provide additional information in a free-form text box.

Table 67: Responses to GAO 2017 State Survey Question 4

For the November 2016 general election, approximately how many ballots in your state were cast through each of the following methods? (Note: Please use the numbers available as of the certification date of the election.)

Method	Mean number of ballots cast
a. In-person voting on Election Day (excluding absentee and provisional voting)	1,648,190
b. Provisional voting (all accepted and rejected provisional ballots)	61,566

Method	Mean number of ballots cast
c. In-person early voting (excluding any absentee and early provisional voting)	400,254
d. Voting using any type of absentee and mail-in ballots, including absentee and mail-in ballots that were submitted in-person (all accepted and rejected absentee or mail-in ballots)	760,943
e. Total ballots cast	2,350,821

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: The sum of the mean number of ballots cast for the voting methods listed above does not equal the mean number of total ballots cast due to incomplete data provided by some states.

Table 68: Responses to GAO 2017 State Survey Question 5

The management of elections is complex and can involve many types of expertise. For the November 2016 general election, who performed each of the following elections activities in your state? (Select all that apply.)

Management	Local election officials (counties, cities, townships, etc.)	State officials	Other (independent consultants, vendors, etc.)
a. Voting equipment setup	44	4	12
b. Voting equipment acceptance testing	36	16	9
c. Voting equipment logic and accuracy testing	40	12	14
d. Voting equipment security	42	12	7
e. Ballot programming or creation	31	12	28
f. Vote tallying, tabulation, or recount	43	14	7
g. Voting equipment troubleshooting	41	17	30
h. Voting equipment performance monitoring or reporting	40	15	17
i. Voting equipment maintenance	32	6	34
j. Voting equipment repair or replacement	32	6	33

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Information on the Voting Equipment Used in Your State

Table 69: Responses to GAO 2017 State Survey Question 6 part I

For the November 2016 general election, which types of voting equipment were used in your state? For each type of equipment used, approximately how many machines were used? (Mark one box in each row either as "yes" if used, "no" if not used, or "don't know" if unknown. For "yes" response, please enter the approximate number of machines used in the last column.)

Equipment	Yes	No	Don't know
a. Direct recording electronic (DRE) without a voter-verified paper audit trail (VVPAT)	12	31	0
b. Direct recording electronic (DRE) with a voter-verified paper audit trail (VVPAT)	18	23	0

Equipment	Yes	No	Don't know
c. Central count optical or digital scan	36	7	0
d. Precinct count optical or digital scan	32	10	0
e. Electronic ballot marking device	29	12	3
f. Paper (hand-counted) ballot	20	22	1
g. Other	1	18	1

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who indicated that they used "Other" were asked to provide additional information in a free-form text box.

Table 70: Responses to GAO 2017 State Survey Question 6 part II

For which voting methods were <<type of voting equipment>> used for the November 2016 general election in your state?

Number of states using type of equipment for:

Method	In-person voting on Election Day (excluding absentee and provisional voting)	Provisional voting	In-person early voting (excluding any absentee and early provisional voting)	Voting using any type of absentee and mail-in ballots that were submitted in person on Election Day
a. Direct recording electronic (DRE) without a voter-verified paper audit trail (VVPAT)	12	3	5	2
b. Direct recording electronic (DRE) with a voter-verified paper audit trail (VVPAT)	16	5	13	3
c. Central count optical or digital scan	18	23	13	28
d. Precinct count optical or digital scan	30	10	13	19
e. Electronic ballot marking device	28	16	17	5
f. Paper (hand-counted) ballot	13	12	9	12
g. Other	0	0	0	0

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents were only asked this question for the types of voting equipment that they indicated "yes" for part I of question 6.

State Involvement in the Selection and Funding of Voting Equipment

Table 71: Responses to GAO 2017 State Survey Question 7

Which of the following statements best describes your state's current level of involvement in the selection of the voting equipment used in your state? (Check one.)

Level of Involvement	Number of states
State requires the use of the same voting equipment type and/or model statewide	15
State maintains a list of approved voting equipment from which local jurisdictions were required to select	26
State approves the use of voting equipment following selection by the local jurisdiction	3
State is not involved in the approval or selection of voting equipment used in the state	1
Other (please specify below)	1
Don't know	0

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who selected "Other" were asked to provide additional information in a free-form text box.

Table 72: Responses to GAO 2017 State Survey Question 8

Which of the following statements best describes your state's current level of involvement in the acquisition of voting equipment used in your state? (Note: For the purposes of this survey, the term "acquisition" pertains only to the actual procurement of equipment. It does not include other costs that may be related to the implementation of new equipment, such as installation or training for poll workers, for example.) (Check one.)

Level of Involvement	Number of states
State covers all acquisition costs for the voting equipment (skip to question 11)	11
State provides financial assistance or cost sharing to local jurisdictions for equipment acquisition	8
State does not provide any financial assistance or cost sharing to local jurisdictions for equipment acquisition (skip to question 13)	24
Other (please specify below)	2
Don't know (skip to question 13)	1

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who selected "Other" were asked to provide additional information in a free-form text box and then skip to question 13.

Table 73: Responses to GAO 2017 State Survey Question 9

What form(s) of financial assistance or cost sharing does your state currently provide local jurisdictions for the acquisition of voting equipment? (Select one answer per row.)

Financial Assistance	State provides	State does not provide	Don't know
a. Direct appropriation	5	3	1
b. Grant program	2	5	1
c. Loan	1	6	0
d. Other	0	6	1

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who indicated that state provides "Other" were asked to provide additional information in a free-form text box.

Table 74: Responses to GAO 2017 State Survey Question 10

What is the maximum portion of the cost of acquiring voting equipment by local jurisdictions that your state can cover in the form of financial assistance or cost sharing? (Check one.)

Percentage	Number of states
Up to 25%	1
26-49%	0
50%	4
More than 50%, but less than 100%	1
Don't know	3

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 75: Responses to GAO 2017 State Survey Question 11

What conditions, if any, does your state require of local jurisdictions when it provides them financial assistance or shares the costs to acquire voting equipment? (Check one.)

Conditions	Number of states
State determines the type(s) and/or model(s) of new voting equipment to be acquired	10
State determines the timing of when new voting equipment is to be acquired	1
State determines the type(s) and/or model(s) and timing of when new voting equipment is to be acquired	7
State does not impose any conditions; local jurisdictions may determine what type(s) and/or model(s) of equipment and when to acquire equipment	1
Don't know	0
Other	1

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who selected "Other" were asked to provide additional information in a free-form text box.

Table 76: Responses to GAO 2017 State Survey Question 12

How does your state currently obtain funds to acquire new voting equipment or provide financial assistance or cost sharing to jurisdictions to acquire new voting equipment? (Select one answer per row.)

Financial Assistance	Uses to obtain funds	Does not use to obtain funds	Don't know
a. From general fund or budget	16	3	0
b. Sale of bonds	3	11	2
c. Tax or fee revenue dedicated to fund election operations	0	15	1
d. Private sector financing or loan	0	15	1
e. Obtain a loan from a state agency or other governmental organization	0	15	1
f. Help America Vote Act (HAVA) funds	11	6	0
g. Other	0	6	3

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who indicated they use "Other" to obtain funds were asked to provide additional information in a free-form text box.

Table 77: Responses to GAO 2017 State Survey Question 13

Does your state have a statewide acquisition contract from which jurisdictions must purchase or have the option of purchasing voting equipment? (Note: For the purposes of this survey, the term "acquisition" pertains only to the actual procurement of equipment. It does not include other costs that may be related to the implementation of new equipment such as installation or training for poll workers, for example.) (Check one.)

Acquisition Contract	Number of states
Yes, state has a statewide contract from which jurisdictions must purchase (skip to question 15)	8
Yes, state has a statewide contract from which jurisdictions have the option of purchasing	5
No	30
Don't know	2

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 78: Responses to GAO 2017 State Survey Question 14

We understand that some local election jurisdictions and their states have consolidated individual purchase contracts into a single higher volume contract to acquire new voting equipment. Does your state have such a contract in place?

(Check one.)

Consideration	Number of states
Yes	5
No	29
Don't know	4

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 79: Responses to GAO 2017 State Survey Question 15

Does your state generally pay all, some, or none of the operation or maintenance costs of the voting equipment used in your state? (Note: For the purpose of this question, operation costs include things such as poll worker labor to set up equipment, postage for mailing absentee or vote-by-mail ballots, paper and printing supplies for paper ballots or voter-verified paper trails, and electricity to operate equipment during elections, for example. Maintenance costs include things such as labor to conduct maintenance between elections of any equipment hardware and software as well as any required parts, for example.) (Select one answer per row.)

Costs	State generally pays all costs	State generally pays some costs	State does not pay any costs	Don't know
Operation costs	8	11	26	0
Maintenance costs	12	8	25	0

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 80: Responses to GAO 2017 State Survey Question 16

Does your state or any local jurisdictions in your state lease voting equipment? (Note: For the purposes of this survey, the term "lease" refers to any contract granting use of equipment for a specified period in exchange for payment, but does not transfer or provide ownership of the equipment to the state or jurisdictions.) (Check one.)

Lease	Number of states
Yes, state leases	5
Yes, all or some jurisdictions lease	14
No (skip to question 18)	23
Don't know (skip to question 18)	4

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 81: Responses to GAO 2017 State Survey Question 17

How important, if at all, are each of the following reasons for deciding to lease voting equipment? (Select one answer per row.)

Reason	Very important	Somewhat important	Not very important	Not important at all	Don't know
a. Less expensive than buying for the time period considered	6	5	0	0	7
b. Leasing is the only way to obtain new equipment within budgetary constraints	7	1	0	2	8
c. Leasing allows for more frequent updates of equipment than buying	4	4	2	0	8
d. Do not want to buy until newer equipment becomes available after the implementation of updated federal or state guidelines	3	4	4	0	7
e. Leasing enables state and/or jurisdiction to try new equipment first that it may decide to buy in the future	1	4	3	2	8
f. Other	4	0	0	0	6

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who provided a response for "Other" were asked to provide additional information in a free-form text box.

Table 82: Responses to GAO 2017 State Survey Question 18

Since 2012, has your state elections office had any Help America Vote Act (HAVA) funds available to spend or budget towards voting equipment or other voting related activities? (Check one.)

Funds	Number of states
Yes	33
No (skip to question 21)	11
Don't know (skip to question 21)	2

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 83: Responses to GAO 2017 State Survey Question 19

How have Help America Vote Act (HAVA) funds been applied by your state elections office since 2012, if at all, to each of the following activities? (Select one answer per row.)

Application	Funds expended	Funds budgeted but not yet expended	Funds neither budgeted nor expended	Don't know
a. Approval of voting equipment (including federal or state testing and certification)	7	1	21	3
b. Purchase or lease of voting equipment	16	2	12	2
c. Testing of voting equipment for election use (e.g., acceptance testing and parallel testing)	9	0	21	2
d. Monitoring voting equipment for errors or malfunctions during the election cycle	8	0	22	2
e. Collecting data on voting equipment errors or malfunctions	5	0	24	2
f. Resolving voting equipment errors or malfunctions that occurred during elections	8	0	21	3
g. Conducting postelection audits	4	0	26	2
h. Other activities related to voting equipment and/or testing to standards	7	0	19	6

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 84: Responses to GAO 2017 State Survey Question 20

Does your state have any Help America Vote Act (HAVA) funds remaining to apply towards the acquisition of any new voting equipment if needed? (Check one.)

HAVA Funds	Number of states
Yes, state has HAVA funds remaining to acquire all voting equipment needed (skip to question 23)	1
Yes, state has HAVA funds remaining to acquire a portion of the voting equipment needed	7
Yes, state has HAVA funds remaining to acquire voting equipment, but no new voting equipment is currently needed (skip to question 23)	5
No	16
Not applicable—state is not involved in the allocation or distribution of HAVA funds for the purpose of acquiring voting equipment (skip to question 23)	3
Don't know (skip to question 23)	1

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 85: Responses to GAO 2017 State Survey Question 21

Has the current availability or lack of Help America Vote Act (HAVA) funds affected your state's decisions regarding replacing voting equipment in your state? (Check one.)

Affect	Number of states
Yes	20
No (skip to question 23)	6
Not applicable—state is not involved in decision to replace voting equipment (skip to question 23)	8
Don't know (skip to question 23)	0

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 86: Responses to GAO 2017 State Survey Question 22

How has the current availability or lack of Help America Vote Act (HAVA) funds affected your state's decisions regarding replacing voting equipment in your state? (Check all that apply.)

Affect	Number of states
Delayed replacing equipment	14
Prevented state from acquiring the type of voting equipment that best meets the state's needs	3
Was a factor in state's decision to lease equipment	1
Other	6

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who selected "Other" were asked to provide additional information in a free-form text box.

Testing and Performance of Voting Equipment

Table 87: Responses to GAO 2017 State Survey Question 23

Did your state require any of the following types of testing on any voting equipment used in the state in preparation for or during the November 2016 general election? (Select one answer per row.)

Testing	Yes, required	No, did not require	Not applicable	Don't know
a. Acceptance testing to verify that all new equipment or any equipment that has been outside election administrators' control (e.g., for repair) conformed to the purchase agreements and is identical to equipment that was tested and certified by state or federal testing organizations	24	11	9	1
b. Logic and accuracy (functional or readiness) testing to determine whether voting equipment was functioning properly (for instance, correct ballot installation, tallying, and transmission)	45	1	0	0
c. Parallel testing on Election Day by running predefined votes cast with known results, then comparing the actual and expected results	9	29	5	2

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 88: Responses to GAO 2017 State Survey Question 23.a

If acceptance testing is required, who is responsible for performing the testing? (Check one box per row.) (This question was asked only of respondents who indicated acceptance testing is required in question 23 above.)

Responsibility	Responsible for performing acceptance testing	Not responsible for performing acceptance testing	Don't know
Local jurisdiction personnel	20	4	0
State election personnel	9	14	0
Experts or consultants	3	17	3
Contractors	5	16	2
Voting equipment vendors	7	15	1
State auditor or equivalent	0	20	2
Other	1	12	1

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who selected "Other" were asked to provide additional information in a free-form text box.

Table 89: Responses to GAO 2017 State Survey Question 24

Did your state or any local jurisdiction in your state conduct any postelection audits or targeted recounts of any election results for the November 2016 general election? (Check one.)

Postelection Audits	Number of states
Yes	35
No (skip to question 26)	11
Don't know (skip to question 26)	0

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Question 25 (open-ended question): Please describe any significant issues or problems with the voting equipment that were identified through the postelection audit or targeted recounts and the steps taken to address them. If no issues or problems with the voting equipment were identified, please put "NA."

Table 90: Responses to GAO 2017 State Survey Question 26

Which of the following methods, if any, has your state generally used to obtain direct feedback from voters and the public on their perspectives on the use and performance of voting equipment in your state? (Select one answer per row.)

Method	Used	Not used	Don't know
a. Review comments from the public	34	9	2

Method	Used	Not used	Don't know
b. Offer the public an opportunity to participate in pretests of equipment before the election and provide comments	30	13	2
c. Conduct listening sessions or group discussions with voters or the public	13	29	3
d. Other	5	15	6

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who indicated they used "Other" were asked to provide additional information in a free-form text box.

Table 91: Responses to GAO 2017 State Survey Question 27

Did your state require local jurisdictions to report voting equipment errors or malfunctions to state officials during the November 2016 general election? (Check one.)

Report Errors	Number of states
Yes, required	27
No, did not require	16
Don't know	0

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 92: Responses to GAO 2017 State Survey Question 28

For the November 2016 general election, did your state obtain information about errors or malfunctions in local jurisdictions' voting equipment in any of the following ways? (Select one answer per row.)

Information	Yes	No	Not applicable	Don't know
a. Onsite monitoring by state officials of local jurisdictions	13	26	4	0
b. Local jurisdictions reported problems to state	35	5	2	1
c. Voters reported problems to state	32	10	1	0
d. Vendors reported problems to state	21	17	4	1
e. State obtained information on errors or malfunctions in the types and models of equipment used in the state from information shared by other states using similar equipment, from the Election Assistance Commission (EAC), or from other federal entities	0	37	5	1
f. Help America Vote Act (HAVA) administrative complaint procedures	8	30	2	4
g. Other	3	14	4	5

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who indicated they used "Other" were asked to provide additional information in a free-form text box.

Table 93: Responses to GAO 2017 State Survey Question 29

Did your state or any local jurisdiction in your state experience any significant errors or malfunctions with its voting equipment during the November 2016 general election? (Check one.)

Errors	Number of states
Yes	6
No (skip to question 31)	39
Don't know (skip to question 31)	0

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 94: Responses to GAO 2017 State Survey Question 30

Has your state taken or does your state plan to take any of the following actions specifically in response to voting equipment errors or malfunctions that occurred during the November 2016 general election? (Select one answer per row.)

Action	Yes	No	Not applicable	Don't know
a. Implement new policies or procedures	3	2	0	0
b. Add voter-verified paper trail capability to voting equipment	0	3	1	1
c. Make an alternate voting method available for future elections	2	3	0	0
d. Report problem to Election Assistance Commission (EAC)	0	3	0	2
e. Report problem to local jurisdictions within the state	5	0	0	0
f. Report problem to other states	1	3	0	1
g. Report problem to vendor	5	0	0	0
h. Revoke or require re-approval of voting equipment	0	5	0	0
i. Fine vendor	0	5	0	0
j. Other	2	3	1	0

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who indicated they used "Other" were asked to provide additional information in a free-form text box.

Table 95: Responses to GAO 2017 State Survey Question 31

For the November 2016 general election, did any of the following have remote access to the voting equipment (e.g., equipment used to cast or count votes) of local jurisdictions in your state (for example, utilizing internet access for the purposes of dial-in trouble-shooting or ballot downloads)? (Select one answer per row.)

Remote Access	Yes, had remote access	No, did not have remote access	Don't know
a. Voting equipment vendors	0	42	1

Remote Access	Yes, had remote access	No, did not have remote access	Don't know
b. State election officials	0	43	0
c. Local election officials	0	43	1
d. Third party (other than vendors) voting equipment support	0	43	1

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Security of Voting Equipment

Table 96: Responses to GAO 2017 State Survey Question 32

Did your state interact or consult with any of the following entities or individuals to assess the physical and/or cyber security of the voting equipment in your state in preparation for the November 2016 general election? (Note: For the purposes of this question, only consider those interactions or consultations specifically about the security of the voting equipment used to define and create ballots, cast and count votes, report election results, and maintain and produce audit trail information.) (Select one answer per row.)

Agency	Yes, interacted or consulted with	No, did not interact or consult with	Don't know
a. Department of Homeland Security (DHS)	29	16	1
b. Federal Bureau of Investigation (FBI)	24	18	3
c. State or local law enforcement or homeland security agency	24	17	5
d. State or local chief information officer or chief information security officer	34	10	2
e. Private security contractors	13	28	4
f. Other	6	13	4

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who indicated they used "Other" were asked to provide additional information in a free-form text box.

Table 97: Responses to GAO 2017 State Survey Question 33

During the November 2016 general election, did your state or any local jurisdiction in your state detect any attempted physical tampering with voting equipment or ballots and/or cyber security breach(es) or manipulation(s) of the voting equipment used in your state? (Note: For the purposes of this question, when considering attempted tampering, breaches, or manipulations of voting equipment, only consider the voting equipment used to define and create ballots, cast and count votes, report election results, and maintain and produce audit trail information.) (Check one.)

Tampering	Number of states
Yes, detected an attempted physical tampering of voting equipment or ballots	0
Yes, detected an attempted cyber security breach or manipulation of voting equipment	0
Yes, detected both attempted physical tampering of voting equipment or ballots and cyber security breaches or manipulation of voting equipment	0
No (skip to question 35)	46

Tampering	Number of states
Not applicable (skip to question 35)	0
Don't know (skip to question 35)	0

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Question 34 (open-ended question): Please briefly describe the attempted physical tampering and/or cyber security breach(es) or manipulation(s) of the voting equipment or ballots, whether it was successful, and the impact, if any, on the ability to conduct the election.

Replacement of Current Voting Equipment

Table 98: Responses to GAO 2017 State Survey Question 35

What is your state's role in determining whether voting equipment in your state needs to be replaced? (Check one.)

Role	Number of states
Only the state determines whether to replace voting equipment	12
State and local jurisdictions jointly determine whether to replace voting equipment	13
State does not have a role—only local jurisdictions determine whether to replace voting equipment (skip to question 37)	21
Don't know (skip to question 37)	0

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 99: Responses to GAO 2017 State Survey Question 36 part I

The following is a list of factors that may influence the decision to replace voting equipment. How important, if at all, are or were each of these factors to your state's process for determining whether to replace voting equipment used within your state? (Select one answer per row.)

Factor	Very important	Somewhat important	Not very important	Not important at all	Not applicable	Don't know
Help America Vote Act (HAVA) requirements for voting equipment (e.g., provide voters with ballot verification and correction capabilities)	17	3	1	0	4	0
Need for voting equipment to meet federal voting system guidelines	17	2	1	0	5	0

Factor	Very important	Somewhat important	Not very important	Not important at all	Not applicable	Don't know
Need for voting equipment to meet any state and/or local requirements, standards, or certification for voting equipment	18	2	0	0	5	0
Need for voting equipment to meet new state or local statutorily mandated changes or requirements for voting equipment	11	2	2	0	10	0
Availability of remaining HAVA funds	5	6	4	1	9	0
Availability of state and/or local funding	20	2	0	0	2	0
Costs to operate voting equipment (e.g., poll worker labor to set up equipment, postage for mailing absentee or vote-by-mail ballots, paper and printing supplies for paper ballots or voter-verified paper trails, and electricity to operate equipment)	9	10	3	1	2	0
Costs to maintain voting equipment (e.g., labor to conduct maintenance between elections of any equipment hardware and software as well as any required parts, etc.)	13	10	1	0	1	0
Cost to acquire or lease new voting equipment	19	5	0	0	1	0
Vendor demonstrations of new voting equipment	6	12	6	0	1	0
Availability of replacement parts or components for voting equipment	13	9	2	0	1	0
Capability to use commercial off-the-shelf components with voting equipment	2	12	5	4	1	1
Concerns about the adequacy of the physical security of voting equipment	11	6	5	1	2	0
Concerns about the adequacy of the cyber security of voting equipment	11	8	0	1	5	0
Whether the voting equipment provides a voter-verifiable paper trail (direct recording electronic only)	9	3	0	2	11	0

Factor	Very important	Somewhat important	Not very important	Not important at all	Not applicable	Don't know
Feedback from voters or the public on voting equipment	5	16	1	0	3	0
Voting equipment has outdated software	15	8	0	0	2	0
Age of voting equipment	15	8	0	0	1	0
Availability of voting equipment that better meets state's or jurisdictions' needs (e.g., more voter friendly features)	11	11	1	0	2	0
Accessibility of voting equipment for disabled or impaired voters	21	2	0	0	2	0
Level of in-house technical expertise about voting equipment	8	9	1	2	5	0
Sufficiency of vendor support and problem resolution	15	5	1	2	2	0
Extent and expense of training required for poll workers and voters on the use of voting equipment	6	14	1	1	2	0
Overall performance of voting equipment	18	3	1	0	2	0
Other	1	0	1	0	7	3

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who indicated they used "Other" were asked to provide additional information in a free-form text box.

Table 100: Responses to GAO 2017 State Survey Question 36 part II

Of the factors that you rated as "very important" (or "somewhat important" if you did not rate any factors as "very important"), which one would you say was the most important, second most important, and third most important? Please enter the letter preceding the factor into the text box below. For example, if you want to rank "factor x" as most important you would enter the letter x in the text box for "most important factor." If you only rated two factors as "very important" (or "somewhat important" if you did not rate any factors as "very important") you only need to rank those two factors.

Factor	Most important factor	Second most important factor	Third most important factor
Help America Vote Act (HAVA) requirements for voting equipment (e.g., provide voters with ballot verification and correction capabilities)	3	2	2
Need for voting equipment to meet federal voting system guidelines	3	5	0
Need for voting equipment to meet any state and/or local requirements, standards, or certification for voting equipment	2	3	2
Need for voting equipment to meet new state or local statutorily mandated changes or requirements for voting equipment	0	0	1
Availability of remaining HAVA funds	0	0	0
Availability of state and/or local funding	1	7	1

Factor	Most important factor	Second most important factor	Third most important factor
Costs to operate voting equipment (e.g., poll worker labor to set up equipment, postage for mailing absentee or vote-by-mail ballots, paper and printing supplies for paper ballots or voter- verified paper trails, and electricity to operate equipment)	0	0	1
Costs to maintain voting equipment (e.g., labor to conduct maintenance between elections of any equipment hardware and software as well as any required parts, etc.)	0	0	1
Cost to acquire or lease new voting equipment	3	0	3
Vendor demonstrations of new voting equipment	0	0	0
Availability of replacement parts or components for voting equipment	0	1	2
Capability to use commercial off-the-shelf components with voting equipment	0	0	0
Concerns about the adequacy of the physical security of voting equipment	1	0	0
Concerns about the adequacy of the cyber security of voting equipment	0	1	0
Whether the voting equipment provides a voter-verifiable paper trail (direct recording electronic only)	0	0	0
Feedback from voters or the public on voting equipment	0	0	0
Voting equipment has outdated software	1	0	2
Age of voting equipment	6	0	0
Availability of voting equipment that better meets state's or jurisdictions' needs (e.g., more voter friendly features)	0	1	2
Accessibility of voting equipment for disabled or impaired voters	0	1	1
Level of in-house technical expertise about voting equipment	0	0	0
Sufficiency of vendor support and problem resolution	0	0	0
Factor	Most important factor	Second most important factor	Third most important factor
Extent and expense of training required for poll workers and voters on the use of voting equipment	0	0	0
Overall performance of voting equipment	1	0	3
Other	0	0	0

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 101: Responses to GAO 2017 State Survey Question 36 part III

When considering the performance of the current voting equipment as a factor in your state's decision as to whether to replace the equipment, which of the following performance measures, if any, does your state analyze? (Select one answer per row.)

Factor	Performance measure analyzed	Performance measure not analyzed	Not applicable	Don't know
a. Number of malfunction instances or crashes	15	4	2	0
b. Speed of counting votes	9	8	3	0

Factor	Performance measure analyzed	Performance measure not analyzed	Not applicable	Don't know
c. Accuracy of casting votes (e.g., equipment accurately records selections of voters)	19	0	2	0
d. Accuracy of counting votes (e.g., equipment accurately tabulates votes cast)	19	0	2	0
e. Time for election workers to set up equipment	8	11	2	0
f. Overvotes	9	6	6	0
g. Undervotes	10	6	5	0
h. Cost to operate and maintain equipment (e.g., labor, postage, paper and printing supplies, electricity, parts, etc.)	11	6	4	0
i. Misfeed rate of optical or digital scan	10	9	2	0
j. Number of pieces of equipment that failed (e.g., equipment failed and had to be taken out of service for the remainder of the election)	16	3	2	0
k. Ease of casting votes for disabled or impaired individuals	14	4	2	1
l. Ease of providing multilingual ballot formats, as necessary	4	8	8	1
m. Number of ballots ruined while processed or tabulated by voting equipment	6	10	5	0
n. Downtime for equipment	12	7	2	0
o. Other	1	3	4	3

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: This question was asked only of respondents who indicated in question 36 part l that overall performance of voting equipment was a factor in the determining whether to replace equipment. Respondents who indicated they used "Other" were asked to provide additional information in a free-form text box.

Federal Voting System Guidelines/Standards, Testing, and Certification

Table 102: Responses to GAO 2017 State Survey Question 37

Does your state require voting equipment to meet any federal voting system guidelines/standards? (Check one.)

Standards	Number of states
Yes	35
No (skip to question 40)	9
Don't know (skip to question 41)	1

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who selected "Yes" were asked to provide the legal citation or requirement of their state in a free-form text box.

Table 103: Responses to GAO 2017 State Survey Question 38

Which federal voluntary voting system guidelines/standards were used in your state to approve the voting equipment that was used during the November 2016 general election? (Check all that apply.)

Standards	Number of states
Election Assistance Commission (EAC) Voluntary Voting System Guidelines (VVSG) version 1.0 (December 2005)	22
EAC Voluntary Voting System Guidelines (VVSG) version 1.1 (March 2015)	10
Federal Election Commission 2002 Voting System Standards	25
Other federal standards or guidelines	2

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who selected "Other" were asked to provide additional information in a free-form text box.

Table 104: Responses to GAO 2017 State Survey Question 39

Does your state require voting equipment to be federally certified? (Check one.)

Certified	Number of states
Yes	19
No (skip to question 41)	15
Don't know (skip to question 41)	1

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who selected "Yes" were asked to provide the relevant legal citation or requirement in a free-form text box.

Question 40 (open-ended question): If your state does not require voting equipment to meet any federal voluntary voting system standards or guidelines, why does it not?

Question 41 (open-ended question): Please describe how, if at all, the current federal voluntary voting system guidelines (VVSG versions 1.0 and 1.1) facilitate the replacement of voting equipment in your state and provide examples (e.g., cost, reliability, security, flexibility, timeliness of process, availability of voting equipment/new technology, etc.) if possible.

Question 42 (open-ended question): Please describe how, if at all, the current federal voluntary voting system guidelines (VVSG versions 1.0 and 1.1) hinder the replacement of voting equipment in your state and provide examples (e.g., cost, reliability, security, flexibility, timeliness of process, availability of voting equipment/new technology, etc.) if possible.

Table 105: Responses to GAO 2017 State Survey Question 43

The Help America Vote Act (HAVA) required that the Election Assistance Commission (EAC), National Institute of Standards and Technology (NIST), and Technical Guidelines Development Committee (TGDC) work together to develop voluntary voting system guidelines (VVSG) that specify functional and testing-related requirements for voting devices. The EAC, NIST, and TGDC are currently updating the federal voluntary voting system guidelines, which will be referred to as VVSG v. 2.0. Is your state aware or not aware of these organizations' actions to update the guidelines? (Check one.)

Awareness	Number of states
Yes, the state is aware	41
No, the state is not aware (skip to question 46)	3

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Table 106: Responses to GAO 2017 State Survey Question 44

Has the Election Assistance Commission, National Institute of Standards and Technology, and Technical Guidelines Development Committee given your state the opportunity to provide input/feedback into the development of the voluntary voting system guidelines, version 2.0? (Check one.)

Feedback Opportunity	Number of states
Yes	31
No	4
Don't know	7

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Note: Respondents who selected "Yes" were asked to provide additional information in a free-form text box.

Table 107: Responses to GAO 2017 State Survey Question 45

The Election Assistance Commission anticipates issuing version 2.0 of the voluntary voting system guidelines (VVSG) in 2018. How, if at all, does the work on the VVSG being still underway affect your state's decision making process regarding whether to replace voting equipment? (Check one.)

Affect	Number of states
State will hold off on determining whether to replace current voting equipment	3
No effect, state considers existing federal guidelines (e.g., VVSG version 1.0 or 1.1, the Federal Election Commission 2002 Voting System Standards, or other federal voting system guidelines)	12
No effect, state does not consider federal guidelines	2
No effect, current voting equipment in state will not be replaced until after 2018	8
No effect, state does not have a role in the decision-making process regarding whether to replace voting equipment	15
Other	0
Don't know—effect not yet clear or determined	2

Source: GAO analysis of 2017 state survey results. | GAO-18-294

Additional Comments

Question 46 (open-ended question): If you have any additional comments concerning any of the topics covered in this questionnaire, please use the space below.

Appendix V: Approaches to Voting Equipment Replacement in Selected Local Election Jurisdictions

The five local election jurisdictions we selected to include in our review—Los Angeles County, California; Travis County, Texas; Anne Arundel County, Maryland; Lafayette County, Florida; and Beaver County, Utah—used varying approaches in replacing their voting equipment. Election officials in these jurisdictions and in their respective state election offices provided a range of perspectives on their experiences and the replacement process.

Los Angeles County, California

Los Angeles County is the most populous local election jurisdiction in the nation. It currently uses hand-marked paper ballots that are tallied using central count optical scan equipment, which has been in place since 2003. Prior to 2003 and dating back to 1968, these same ballots were used for its punch card voting system. The county is in the process of self-designing its own voting system, which is expected to consist of electronic ballot marking devices (BMDs) that produce paper ballots to be tallied on central count digital scanners, and plans to fully implement it in 2020.

Key Factors That Influenced the County's Decision to Replace Its Voting Equipment

According to county officials, the overall performance and features of the county's voting equipment and the need for the equipment to meet potential state and local requirements were among the key factors that influenced the county's decision to begin the process of replacing its optical scan system. County election officials stated that while the county's current voting equipment is reliable, accurate, and familiar to voters, the design and the age of the equipment do not offer the technical

and functional flexibility necessary to continue to accommodate potential state regulatory changes and the growing and increasingly diverse county electorate. For example, officials stated that the current equipment may not be able to effectively accommodate state mandates that may require changes to ballot formats or length. Specifically, officials said that state legislation enacted in 2015 requires many cities within Los Angeles County to consolidate their elections with the county's by 2022, and as a result, the number of races and measures on the ballot may exceed the 12-page capacity that the current equipment can accommodate.[1] They also noted that the technical limitations of the equipment present challenges to providing voters with greater voting options, such as early voting or the use of vote centers on Election Day, and features that enhance accessibility and ease of use.

Planned New Voting Equipment and In-Person Voting Process

The county has developed a design concept and specifications for its new voting equipment and is in the process of soliciting and selecting vendors to manufacture it. It has acquired several functional prototypes of the current design for the new equipment and has outlined the planned in-person voting process using this equipment, as shown in figure 11. According to county officials, the equipment specifications and in-person voting process have not been finalized and continue to be refined.

[1]The California Voter Participation Rights Act generally prohibits any city or other political subdivision conducting an election other than on a statewide election date if holding an election on a nonconcurrent date has previously resulted in a significant decrease in voter turnout. 2015 Cal. Adv. Legis. Serv. 235.

Figure 11: Los Angeles County's Planned Design Concept for Its New Voting Equipment and In-Person Voting Process, as of January 2018

1. Voters would check in using electronic poll books. The poll books would be attached to printers, which would print out blank paper ballots with each voter's Quick Response (QR) code.[a]

2. Voters would take their ballots to a ballot marking device (BMD) and insert them into the device. The QR code on the ballots would activate the appropriate ballot style for their precinct (e.g., races, ballot measures) on the BMD.

3. Voters would enter their selections using a touch screen device and could review a summary of their choices when they are finished.

4. After voters have approved their selections, the BMD would print out a paper copy of their ballot for voters to verify. After reviewing, voters would tap a button on the touch screen to cast their ballot, and the ballot would be pulled back into the BMD and collected in an attached box.

5. The ballots would be transported to one or more locations with central count scanners for tallying.

Source: Los Angeles County Registrar-Recorder/County Clerk and GAO analysis of information from the county's Voting Systems Assessment Project and demonstration of equipment by Los Angeles County election officials. | GAO-18-294

[a]A poll book is a list of eligible voters assigned to a local election jurisdiction and is commonly organized alphabetically or by the address of the voters. Jurisdictions use either paper or electronic poll books—most often laptops or tablets—to check in voters. A QR code is similar to a barcode but can carry more information and be read both vertically and horizontally.

County officials stated that the current design concept for the new equipment is intended to provide greater flexibility in administering elections, provide a more user-friendly and accessible voting experience, enhance accuracy and auditability, and could potentially lower costs for system upgrades if developed as planned:

- *Greater flexibility for administering elections.* According to county election officials, the new equipment is designed to provide more flexibility for administering elections and to respond to changing legislative provisions on conducting elections. For example, the California Voter's Choice Act, which was enacted in September 2016, generally authorizes Los Angeles County to conduct vote center

elections beginning in 2020 if certain conditions are met.[2] Officials stated that the proposed new equipment is expected to facilitate the use of vote centers because it would have the capability to electronically retrieve a voter's ballot regardless of the precinct in which the voter is registered. They also noted that the BMD would allow the county to have ballots with multiple formats and a large number of races.

- *A more user-friendly and accessible voting experience.* County election officials stated that the BMD is intended to provide the ease of use of a touch screen interface, which would incorporate features such as scrolling and tapping that are familiar to voters who use mobile devices. The BMD would also allow voters to select from English or the 11 other languages the county plans to support and is designed to include accessibility devices, such as a headset and tactile keypad for voters with vision impairments and other disabilities.[3] Voters would be able to make their selections and cast their paper ballot without having to handle the ballot. Officials stated that these features are expected to allow voters with special needs to use the same equipment as all other voters and cast their votes independently and privately.[4] The county's proposed design also includes an interactive sample ballot which voters can access from their computers or mobile devices to pre-mark their vote selections, convert to a Quick Response (QR) code, and then scan into the voting equipment to populate their ballots. Officials stated that this feature

[2]See 2016 Cal. Adv. Legis. Serv. 832. Conditions include meeting absentee ballot drop-off locations and vote center requirements. In addition, this provision expires no later than 4 years after conducting the first vote center election, after which Los Angeles County may begin conducting all mail-ballot elections. To conduct all mail-ballot elections, jurisdictions are required to have a specified number of vote centers, based on the number of registered voters, on Election Day and for 10 days prior to Election Day, among other conditions. Los Angeles County officials said that they collaborated with the authors of the California Voter's Choice Act and the California Secretary of State to draft certain provisions of the act to help provide the county with the regulatory framework needed to implement its new voting equipment.

[3]The BMD also has legs with clearance for wheelchair accessibility, includes a connector for a sip and puff device—a straw-like accessory that allows a voter to make selections by either blowing or sucking into the device—and has an extra headset for use by a person assisting the voter.

[4]Voters with disabilities currently can mark their ballots in a designated audio ballot booth or request assistance from poll workers. The booth includes an audio headset and a keypad for voters to use to make their selections, which are then printed out on a paper ballot.

may help reduce lines by decreasing the time it takes for voters to mark their ballots once they reach the BMD.[5]

- *Enhance accuracy and auditability.* The new voting equipment is designed to record vote selections on paper in human readable text. County officials stated that this is expected to more clearly capture voter intent than manually marked ballots, reduce the time and resources needed by county staff to interpret voters' intent, and increase the accuracy of election results and public trust in the voting process. Officials stated that the new equipment is also expected to improve the county's auditing capabilities. For example, the digital scanner is designed to allow the county to efficiently audit the results of individual races and measures, including conducting risk-limiting audits in which a specified number of ballots cast for a particular race are reviewed to confirm the election result for that race.[6] According to officials, the county's current equipment tallies ballots by precinct and does not keep an electronic record of the specific votes cast on individual ballots. As such, it provides the capability of auditing the results by precinct but not individual races at the ballot level.[7]
- *Easier and less costly upgrades.* According to county officials, the design of the voting equipment is intended to be modular so that key components can be replaced individually. Officials stated that this is intended to allow the county to more easily update equipment and incorporate technological advances because it will be able to swap out components if more affordable, better technology becomes available on the market. Officials said that the cost of replacing

[5]Officials noted that there would be mechanisms in place to help ensure the security of this feature. For example, the QR codes on the mobile device ballots are designed to be unreadable if manipulated, and voters would have the opportunity to review their selections on the BMD, as well as their paper ballot, before it is cast.

[6]Risk-limiting audits confirm the election result for a particular race by auditing a statistically determined number of ballots. For example, if a race is close, more ballots would need to be audited to have statistical confidence that the outcome is correct. Officials stated that the new equipment is designed to apply a unique identification number to the paper ballot as it enters the scanner. The digital image of the ballot and electronic cast vote record will also have that identification number, which would make it possible to trace the vote record back to the paper ballot. They noted that this is essential for conducting risk-limiting audits because such audits require reviewing a statistically significant sample of individual ballots to verify that the vote counting system determined the correct outcome for a contest.

[7]The county currently audits the results by precinct, which entails reviewing all the ballots cast in a specified percentage of randomly selected precincts and confirming the vote tabulations for those precincts.

equipment parts is expected to be lower than with traditional voting systems.

Process for Developing the New Voting Equipment

Los Angeles County's Voting Systems Assessment Project (VSAP) was established by the Registrar-Recorder/County Clerk in 2009 to help guide the development and acquisition of the county's new voting equipment. According to county election officials, the VSAP has taken a user-centered approach to the design of the new voting equipment that prioritizes the specific needs and expectations of the voters and incorporates the requirements of county election administrators.[8] Officials also stated that they sought to have a transparent design process that included voter input and participation to help promote public confidence in the new voting equipment. The project has five phases—(1) public opinion and stakeholder baseline research, (2) establishment of voting system guiding principles, (3) system design and engineering, (4) manufacturing and certification, and (5) phased implementation. The county is currently in the manufacturing and certification phase. Officials reported that about $19 million has been expended to develop the new voting equipment as of December 31, 2017. Officials also stated that after the new system is certified, an additional $49 million in state funds from the Voting Modernization Bond Act of 2002 will be available to the county.[9] Table 108 describes the VSAP phases, their associated expenditures and funding sources, and examples of key actions taken or planned in each phase.

[8]In September 2017, the county changed the project's name to Voting Solutions for All People. For the purposes of this report, we refer to the VSAP by its original name of Voting Systems Assessment Project.

[9]California's Voting Modernization Bond Act of 2002 allocated $200 million to local election jurisdictions in the state to upgrade voting systems. Counties are required to match $1 for every $3 of funds provided. According to county officials, these funds cannot be used until the system is certified by the state.

Table 108: Voting Systems Assessment Project (VSAP) Phases and Examples of Key Actions Taken or Planned

Phase	Expenditures and funding sources[a]	Examples of key actions taken or planned[b]
(1) Public opinion and stakeholder baseline research (September 2009 to July 2010)	$150,000 Funding: Grant from the James Irvine Foundation[c]	• The county partnered with the Voting Technology Project to gather information on the current and future needs of voters and other key stakeholders, such as county election officials, city clerks, and poll workers, through surveys and focus groups.[d] Focus groups included voters with disabilities, Latino and Asian voters, and 18- to 25-year-old voters. • In July 2010, the county issued a report with findings from the research, such as voters' preference for ballot marking devices and a paper record of their ballot to provide assurance that the voting equipment is accurate and secure.
(2) Establishment of voting system guiding principles (January to December 2011)	N/A	• The VSAP Advisory Committee, which includes election officials, academic researchers, and individuals representing various constituency groups, was formed to help provide input and guidance during the process of developing, acquiring, and implementing the new voting equipment and to help ensure transparency. • The VSAP Advisory Committee and county election officials adopted 14 principles to guide the design and implementation of the new voting system. The principles include the need for transparency; scalability (e.g., capacity to accommodate large and complex ballots styles and growing language needs); flexibility (e.g., the ability to adapt to different election types, such as vote center elections, and potential changes to state regulatory requirements); and ease of use for all voters, in particular, those with disabilities or limited English proficiency. • The county evaluated voting equipment available on the market and determined that none of the main types of equipment satisfactorily met the diverse needs of Los Angeles County voters and fully satisfied the 14 principles. As a result, the county decided to self-design its own system.
(3) System design and engineering (January 2012 to July 2016)	$16.6 million Funding: Help America Vote Act (HAVA) funds, county funds, and grants from the Election Assistance Commission and Los Angeles County Productivity Investment Fund[e]	• The VSAP Technical Advisory Committee, composed of voting technology experts, computer scientists, and practitioners from a variety of industries, was established to provide the project with the necessary technical expertise in voting technology, security, and accessibility during voting system design. • In January 2012, the VSAP partnered with the Information Technology and Innovation Foundation's Accessible Voting Technology Initiative and other organizations to conduct an Open Design Search, which engaged experts, designers, and the general public to help design the new system.[f] The VSAP invited the public to submit new approaches and concepts for the voting system and conducted brainstorming workshops on specific elements of the voting system (e.g., ballot marking, vote tallying) with stakeholder groups. • In 2013, the county engaged a design and innovation firm to analyze the information gathered to date and develop voting equipment designs. Throughout the design process, the firm and the VSAP team conducted focus groups and user testing sessions and incorporated the input collected into each prototype design iteration. The firm developed designs and engineering specifications for a ballot marking device, tally system, and other features of the new system, and in June 2016, produced five prototypes of the ballot marking device.

Phase	Expenditures and funding sources[a]	Examples of key actions taken or planned[b]
(4) Manufacturing and certification (current phase) (August 2016 to June 2020)	$2.25 million as of December 31, 2017 Funding: County funds, Voting Modernization Bond Act funds, and other sources[g]	• In October 2016, the county engaged a technology research and advisory firm to assess the voting equipment market and the county's operational readiness to administer a new voting system and help formulate a sourcing strategy for manufacturing the various components of the new equipment, among other tasks. • In April 2017, the county released a Request for Information to solicit input from vendors about their interest in potentially partnering with the county to provide services and/or manufacture any component of the new voting equipment. According to officials, the county received about 15 responses, which helped inform the development of its Request for Proposal (RFP). • In September 2017, the county released the first phase of its RFP to prequalify vendors interested in providing VSAP implementation and support services. It released the second phase of the RFP in January 2018, which provides prequalified vendors with the county's requirements and specifications for the new equipment and requests proposals for the equipment's development, manufacturing, implementation and support services. Proposals are due in March 2018 and the county anticipates selecting a contractor in late April 2018. • According to officials, the county plans to submit its new equipment for state approval to use under a pilot program in 2018. California state law allows for the experimental use of a voting system under such a program without full state certification if the Secretary of State approves the proposed program and the voting system complies with certain requirements.[h] • Officials stated that the county plans to submit the new system for full state certification in 2019. Once certified, the equipment will be mass produced for training, outreach, and elections.[i]
(5) Phased implementation (June 2018 to 2020)		• According to the RFP, the county envisions implementing the new equipment in multiple phases in a manner that can best balance the implementation risks with the risks in continuing to conduct elections with the current, aging voting equipment. • The county plans to pilot the ballot marking devices in some early voting locations in 2019 and fully roll out the equipment in 2020.

Source: GAO analysis of VSAP documents and interviews with Los Angeles County election officials. | GAO-18-294

[a]According to county officials, county permanent staff salaries were not included in the VSAP expenditures they provided because the positions are not project dependent.

[b]The VSAP also includes the development and implementation of a new absentee ballot and tally system. The information in this table focuses on the equipment for in-person voting at polling places.

[c]The James Irvine Foundation provides grants to organizations across California to achieve its mission of expanding opportunity for the people of the state.

[d]The Voting Technology Project is a collaboration of the California Institute of Technology and the Massachusetts Institute of Technology and studies all aspects of the elections process, including voting technologies and election administration.

[e]The Los Angeles County Productivity Investment Fund provides grants and loans to the county's departments to develop creative strategies for the enhancement of service delivery, improve the effectiveness and efficiency of operations, and generate cost savings and revenue generation opportunities.

[f]The Information Technology and Innovation Foundation's Accessible Voting Technology Initiative is a project funded by the Election Assistance Commission to make voting processes and technology more accessible.

[g]According to county officials, Los Angeles County has been allocated $49 million in state funds from the Voting Modernization Bond Act of 2002, which can be used after its voting system has been

certified by the state. County officials said that they plan to use these funds to develop and manufacture the new equipment. The state legislature is considering a bill in the 2017–2018 session that could make $450 million in bond money available to counties to upgrade elections technology. If the bill is enacted, a bond measure will go before voters to approve or disapprove in the June 2018 statewide primary election.

[h]Counties must submit a plan for the proposed pilot program to the Secretary of State for approval no later than 9 months before the election in which the program is to be conducted. Votes that are cast on the voting equipment during the pilot program are required to be subject to risk-limiting audits and, after completion of the program, counties are required to notify the Secretary of State of any defect, fault, or failure in the hardware, software, or firmware of the voting equipment.

[i]In 2013, California amended its law governing the certification of voting systems to require state certification of voting systems based on state-established voting system standards. See Cal. Elec. Code § 19101. According to state election officials, California previously required federal certification of voting systems used in the state. State and Los Angeles County election officials noted that they worked closely to enact the legislation, which they said was intended to provide greater flexibility and facilitate Los Angeles' and other counties' efforts to replace their voting equipment.

County officials told us they plan to retain ownership of the intellectual property rights of the new voting equipment so that the system remains publicly owned and not proprietary like traditional vendor equipment. The county also plans to use an open source technology framework wherein the source code for the system software is available for review and use by other election jurisdictions and entities by license.[10] According to county election officials, this will allow other jurisdictions to, for example, have similar systems manufactured for their use. Officials stated that having the county own the system design on behalf of the public and using an open source software model are expected to provide greater flexibility for any jurisdictions using the software to cost-effectively make modifications to the equipment and adapt it to their varying needs and requirements. For example, jurisdictions would no longer be limited to relying on a single manufacturer if they would like to make an enhancement to the equipment or replace parts.

Officials noted that there is currently no licensing model or institutional framework in use for a publicly owned elections system. However, they stated that open source technology solutions in other industries have been successfully implemented and administered, and the county's new system software could potentially be licensed and administered in a similar manner. In addition, county officials stated that they have outlined

[10]According to Los Angeles County's Request for Information that was released to vendors to solicit input on the VSAP, the California Elections Code allows the use of software with disclosed source codes in the development of voting systems in the state. The Request for Information states that open source software falls under this designation, which is understood to refer to source code made available for review and/or testing upon request by an authorized entity/individual, but does not permit the source code to be used operationally by other entities unless additionally and explicitly licensed by the owner of the intellectual property rights of the code.

a clear business plan in the Request for Proposal (RFP) and during various information sessions with vendors which officials believe will help incentivize them to participate in building the system without potentially owning the equipment or its intellectual property rights. Specifically, officials noted that vendors would primarily receive revenue from the services they would provide, such as building the equipment and software platform and providing ongoing maintenance and support, rather than from selling the equipment itself.

County officials stated that implementing the new voting equipment and moving to vote center elections in 2020 are changes to administering elections for the county that will require a substantial educational and informational effort. Officials noted that they have involved numerous stakeholders throughout the VSAP process to help effectively prepare for these changes and plan to allocate resources to educate voters and train poll workers. Some of these efforts are already underway. For example, the county has posted information and videos on the planned new voting equipment and process on the VSAP website and has been using the BMD prototype for public demonstrations and internal training on the new voting process.

Travis County, Texas

Travis County currently uses direct recording electronic (DRE) equipment without a voter-verified paper audit trail (VVPAT), which has been in place since 2001. The county also has conducted vote center elections since 2011. Starting in 2009, the county took steps to design and build its own equipment, including developing a concept for a DRE with a VVPAT that centered on system security and auditability. In September 2017, the county decided to no longer pursue building the voting equipment and plans to purchase equipment from a vendor. The county plans to have the new equipment in place for the 2020 election.

Key Factors That Influenced the County's Decision to Replace Its Voting Equipment

According to county officials, the overall performance and features of the county's voting equipment was the primary reason for deciding to begin the process of replacing its DREs. In 2009, the Travis County Clerk convened an Election Study Group to assess the county's current equipment and make recommendations for future equipment. This group

was composed of 45 members representing election officials and workers, advocacy organizations, voters with disabilities, computer security experts, academics, and other segments of the community. According to the report that the group issued, most members expressed confidence in the way Travis County conducted elections and in the accuracy of its current equipment. However, they also expressed concerns over the equipment's age and the lack of a paper trail, which they said decreased voter trust in the system and increased the risk of election equipment tampering. The group noted that the Travis County Clerk's Office's use of safeguards and security and testing procedures beyond those required by law helped minimize the risk of tampering. The report recommended that the county move toward using equipment that offers an electronic count and paper record as soon as an alternative that met the county's requirements became available.

Selection and Acquisition of New Voting Equipment

Development of Self-Designed Voting Equipment

The Election Study Group outlined 19 key requirements that Travis County's new equipment should meet. The requirements included, for example, producing a paper voting record that can be verified by the voter and be used to independently, transparently, and efficiently reconcile an electronic tally in an audit or recount; allowing voters with special needs to vote using the same equipment as other voters; enabling early voting and the use of vote centers; and having reasonable purchase, operational, and system upgrade costs. The group found that no equipment on the market in 2009 met the needs of the county and, as a result, the county began exploring options to design its own equipment. Officials stated that this effort was also intended to provide an alternative to the current vendor model that could reduce maintenance costs and annual licensing fees that are incurred with proprietary systems.

In 2012, the county Clerk convened a group of election administrators, usability experts, and academic experts in computer science and statistics, and through a series of discussion sessions, developed the concept for the county's new system, which they named STAR (Secure, Transparent, Auditable, and Reliable) Vote. STAR-Vote was designed to be centered around a DRE that produces verifiable and auditable paper records. At the polling place, voters would make their selections on a DRE device with a commercial off-the-shelf (COTS) tablet, which would also be equipped with an auditory interface for visually impaired voters

and other features to assist individuals with special needs.[11] The voters' selections would be encrypted and stored on the internally networked DRE devices, and voters would also receive a printed paper record with their choices. After reviewing the paper record and confirming their selections, voters would feed the paper record into a ballot box scanner to cast their vote.[12] Once the polls closed, the devices storing the votes would be transported to receiving stations, where voting data are transmitted for electronic tabulation. The paper records would be available for audit or recount purposes.

In addition, county officials stated that the equipment's proposed encryption technology was designed to potentially allow for the following features without revealing any individual's vote:

- Voters would receive a receipt that was attached to their paper records at the polling place and could go online after Election Day and use a code on the receipt to verify that their ballots had been cast and counted.
- Third parties, such as the League of Women Voters or political parties, could access encrypted voting data to verify that the results the county had reported matched vote totals they had independently derived from the data.
- The county could conduct risk-limiting audits to verify the consistency between the electronic and printed vote records and test the accuracy

[11]The EAC defines COTS as software, firmware, devices, or components that are used in the United States by many different people or organizations for many different applications other than certified voting systems and that are incorporated into the voting system with no manufacturer- or application-specific modification. For example, COTS components can include hardware that can be purchased commercially (e.g., tablet devices, scanners, printers, etc.) and integrated as part of voting equipment. On the basis of our survey of local election jurisdictions, we estimate that jurisdictions with about 6 percent (4, 10) of the population nationwide used COTS components in their predominant voting equipment for the 2016 general election. The numbers in parentheses are the values for the 95 percent confidence interval for the estimate.

[12]The ballot box was to have a scanner that would read a barcode identifier on the paper voting record and communicate with a central computer at the polling place to indicate that a voter's electronic selections on the DRE had been cast. The scanner would not read, count, or store the voter's selections.

of the reported election outcomes.[13] Audits could be conducted on individual ballots or races if needed.

In June 2015, the county issued a Request for Information for STAR-Vote to solicit input on the design, development, implementation, and maintenance of the equipment. Based on information gathered from the request, it issued an RFP in October 2016 to solicit proposals from voting system vendors and others for the development and implementation of key components of the equipment for in-person voting. The county also issued a Statement of Intent for the equipment to inform interested parties of the county's planned approach for the long-term management and support of STAR-Vote. According to these documents, the county planned to own the intellectual property rights for the equipment and provide open source software for its system to the elections community under a licensing agreement, which would allow other jurisdictions to use similar equipment. The Statement of Intent described the formation of a nonprofit organization to manage and support STAR-Vote and sought $25 million in funding from interested parties to complete the development of the open source software components, support the organization's operating budget for the first 5 years, and provide a cash reserve.[14] The county planned to use these funding commitments and local budget appropriations to develop, build, and deploy the equipment.[15]

In September 2017, the county announced that it had decided to no longer pursue developing and building STAR-Vote. The county stated that

[13]According to county election documents, conducting risk-limiting audits would entail randomly selecting ballot numbers and comparing the electronic voting records to the corresponding paper voting records. The audit team would use a statistical calculation to determine the number of paper voting records that must be inspected to demonstrate within a specified margin of error that electronic tabulation correctly reported the winners in a race.

[14]According to the Statement of Intent, once the nonprofit organization had been established and structured, other entities—such as counties or states that wanted to use the equipment or software to run their elections—could become "public user members" of the nonprofit through the payment of one-time and annual membership fees. The cash reserve was intended to assure counties of the organization's continued existence during long adoption times and a long product life-cycle.

[15]The county reported that it expended over $330,000 in time and other resources from 2012 through September 2017 to examine voting equipment and design specifications for STAR-Vote. County officials estimated that the upfront costs to develop and build STAR-Vote would be about $10 to $12 million, and budgeted $4 million to help launch the development of STAR-Vote and produce an operational voting system that would be ready for federal certification.

it received 12 proposals in response to the RFP but they were not sufficient to build a complete voting system. According to county officials, none of the proposals included the election management system for the equipment that would handle ballot definition and the tallying of results, among other related tasks. In addition, officials stated that they received limited responses to their solicitation for financial commitments in the Statement of Intent and thus lacked the necessary funding to develop and build the equipment. Officials noted that the open source software platform they had envisioned was seen by voting equipment vendors as a low-revenue business model in the current elections marketplace. They added that potential participants in a STAR-Vote entity may not have had a clear concept of how its business model might work, which they said was perhaps due to the county's more limited focus on this aspect when they were initially designing the system. Given these obstacles and the age of the county's current equipment, the county decided that it needed to move toward acquiring more immediately deliverable voting equipment through a voting system vendor.

Selection and Acquisition of New Voting Equipment from a Vendor

The county has incorporated some of the features of STAR-Vote into its requirements for new voting equipment. According to county officials, the county plans to acquire either DREs or ballot marking devices with precinct count digital scanners because, in their view, they are accurate (e.g., prevent voter errors, such as overvotes or stray marks on the ballot, and minimize questions about voter intent), allow individuals with disabilities to vote on the same equipment as other voters, support vote center elections, and offer fast reporting of election results. The county also plans to require that its next voting equipment have the following features:

- *A voter-verified, paper list of choices for recount purposes.* County officials stated that the equipment must produce printed paper records that can be tallied and connected with electronic voting records through an automated process. This electronic connectivity would allow paper-ballot recounts to be conducted on individual races.
- *Security features that include support for third party verification of results and better postelection audits.* According to county officials, the equipment they acquire must allow for third parties to independently verify reported election results and must support risk-limiting audits.

Officials stated that they believe there is or will be equipment on the market in the near future that could support these features. They noted that they are also prepared to work with vendors to customize existing equipment to meet the county's requirements if needed, acknowledging that such additions may increase expenses or require additional time to recertify parts of the voting system. County officials estimate that the new equipment will cost about $16 million and stated that acquisition will be funded through local bonds.[16]

County officials said they would like to have the new equipment in place for the 2020 election, which would require them to start deploying it no later than May 2019. The county issued an RFP for the system in November 2017, and officials stated that they plan to assemble a group of stakeholders similar to those who participated in the 2009 Election Study Group, as well as the individuals who designed STAR-Vote, to help evaluate the proposals received. Officials noted that their current equipment is functioning and robust, but that the new equipment must be deployed before the current equipment begins to degrade. In addition, they stated that the May 2019 implementation date is the latest possible date in order to allow sufficient time to educate voters and train county staff and election judges on the new equipment before using it in the 2020 election.

Anne Arundel County, Maryland

Anne Arundel County had used DREs without a VVPAT since 2004 and replaced its equipment in 2016 with a system in which voters manually mark paper ballots and insert them into precinct count digital scanners which then count them. Maryland requires the use of uniform voting equipment in polling places statewide and the state and counties each pay 50 percent of the costs of acquiring equipment. In our state survey, Maryland officials reported that the state determines when voting equipment is to be acquired and selects the type and model of voting equipment that local jurisdictions use.

[16]County officials stated that they can use local bond funds to acquire new voting equipment from a vendor but not to develop or build new equipment. Both state and county election officials reported that the state does not provide funding for voting equipment.

Key Factors That Influenced Maryland's Decision to Replace Its Voting Equipment

According to the Maryland State Board of Elections (SBE) and Anne Arundel County Board of Elections officials, the need for voting equipment to meet state requirements, the overall performance and features of the equipment, and the ability to maintain the equipment were among the key factors that influenced the state's decision to replace its equipment. Specifically, in 2007, Maryland enacted a law that prohibited the use of a voting system unless the SBE determined that the system provides a voter-verifiable paper record, thereby requiring the state's DREs to be replaced.[17] SBE officials said that the passage of the new law was driven primarily by a push from voting advocates to move to new equipment that used paper ballots and provided a verifiable paper trail. Although the law was enacted in 2007, state funding for the new equipment was not available until 2014 due to budgetary constraints.

While the change in state law was the main reason for replacing its voting equipment, both SBE and Anne Arundel County officials noted that the state's previous DRE equipment was nearing the end of its life cycle and various problems had begun to occur more frequently. For example, SBE officials said that nonresponsive touch screens and battery unit failures became more common with the equipment used in the state. In addition, Anne Arundel County officials stated that while their equipment generally performed satisfactorily, some of the touch screens had begun to degrade and develop calibration issues, which resulted in the appearance of incorrectly recording voters' selections. In addition, county officials said that the equipment could no longer support certain software or security updates, and replacement parts were challenging to acquire.

Selection and Acquisition of New Voting Equipment

According to SBE officials, state law specifically required the purchase of precinct count scanners so the board did not consider other types of voting equipment.[18] The SBE issued an RFP in July 2014 and four voting system vendors submitted proposals. The SBE formed an evaluation

[17]See 2007 Md. Adv. Legis. Serv. 547, 548.

[18]The law defines a voter-verifiable paper record to include a paper ballot prepared by the voter for the purpose of being read by a precinct-based scanner, among other features.

committee to analyze the technical and financial details of the proposals. According to SBE officials, the committee's members included a state official with expertise on voting systems, a county election director, a county technical specialist, and election experts and researchers, among others. Anne Arundel County election officials stated that the SBE also established various subcommittees to solicit input from county officials as the state made its selection. They said that relevant local elections staff members were involved in the selection process and that in their view, the process had worked well.

According to SBE officials, in addition to assessing the vendors' proposals, the evaluation committee worked with the University of Baltimore to perform usability and accessibility testing on the equipment under consideration. The committee also hosted a public demonstration to collect feedback on such areas as ease of use and confidence that votes were accurately cast. Officials stated that after conducting its assessment of the equipment, the committee presented its findings to the SBE, and in October 2014, the board selected the voting equipment to be acquired based on the committee's recommendation.

Maryland requires equipment to be certified by the EAC and the SBE before use in the state. The selected equipment had been certified by the EAC in July 2014 and was certified by the SBE in December 2014. As part of the certification process, the SBE tested the equipment to ensure that it met requirements in the Maryland elections code, including simulating primary and general elections using ballots typically used by jurisdictions in the state, and reviewed the findings from the public demonstration and usability testing performed during the selection process.

The SBE decided to lease rather than purchase the equipment for a number of reasons.[19] Specifically, SBE officials said that leasing provided increased flexibility to update or replace equipment more frequently and had lower upfront costs. In addition, the state did not want to buy new equipment until the implementation of updated federal guidelines. Under the current contract to lease the digital scan equipment, payments are made to the vendor on a quarterly basis. According to SBE officials, the

[19]On the basis of our local election jurisdiction survey, we estimate that jurisdictions with 5 percent (2, 9) of the population nationwide leased rather than purchased the predominant voting equipment used in the 2016 general election.

current payment to the vendor for leasing the digital scan equipment statewide is approximately $1.1 million per quarter.

SBE officials said that the process to acquire new equipment is inherently challenging, but in their view, the process generally went well. Knowing what type of equipment the state needed to acquire simplified the process and reduced the number of proposals that officials needed to review. Nevertheless, they noted that the process took more of their time and resources than they had anticipated, which presented challenges because the state was holding elections during the same time period it was selecting and acquiring the equipment. However, the SBE met its goal of implementing the new equipment by 2016.

Deployment of New Voting Equipment

SBE and Anne Arundel County officials stated that deployment of the new equipment in the 2016 general election went smoothly with no significant challenges. The officials said they took a number of steps to help ensure a successful rollout. For example, SBE officials said that they established a strong project management team and hired contractors to assist with tracking progress toward key deadlines; drafting policies, procedures, and training manuals; and testing equipment and sending it to the counties. Anne Arundel County officials said that they hired about 40 temporary staff to assist with deploying the new equipment and other tasks during the general election. In addition, they stated that the county conducted extensive election judge training and held mock elections using the new equipment. The officials noted that with the new paper-based system, the county needed to recruit and train more election judges compared to past elections to hand out ballots, show voters how to operate the equipment, and handle provisional voting. The two election judges we interviewed stated that the training they received was very comprehensive and effectively prepared them for Election Day.

Both SBE and Anne Arundel County officials stated that additional voter education efforts would have been beneficial. According to SBE officials, the SBE had developed plans for a statewide multimedia effort to educate voters on the new equipment but did not receive funding to implement it. A scaled down effort was carried out instead, which included demonstrating voting equipment at meetings and fairs around the state, producing local media news stories, and posting a video on the SBE's website on how to use the new equipment. SBE and Anne Arundel County officials stated that the more limited voter education efforts might

have contributed to longer lines on Election Day in some polling places because many voters were unfamiliar with the equipment and some had questions or needed assistance with using it. However, these officials noted that voter wait times were not a widespread or significant issue during the general election. The two election judges we interviewed stated that some voters needed help inserting their ballots into the scanner, but observed that voters generally appeared to find the new equipment easy to use. They also noted that some voters commented that paper ballots provided them with reassurance with regards to the security of their vote.

SBE and Anne Arundel County officials said that the equipment itself performed satisfactorily in the 2016 general election with only minor problems. For example, state officials said that the scanners jammed occasionally, but this was easily resolved by elections personnel. In addition, most polling locations in the state were allocated only one scanner, so some jurisdictions with two-page ballots, such as Anne Arundel County, experienced lines because of the length of time it took for voters to scan their ballots. Anne Arundel County officials plan to analyze voter registration data to help determine the number of scanners needed at each polling place and share the information with the SBE to help inform allocations for future elections. More generally, SBE officials noted that the new system has less equipment to manage—about 2,600 digital scan units compared to the approximately 18,000 DRE units used statewide in prior elections—so there is less pre-election testing and postelection maintenance that has to be done, saving time and labor for the state and counties.

The state contracted with a third party vendor to conduct a postelection audit of the 2016 general election by using independent software to tally all digital ballot images.[20] The audit confirmed the accuracy of the election

[20]After piloting three postelection audit methods in selected counties following the April 2016 primary election, the SBE determined that using independent software to tally all digital ballot images best met the state's needs. Under this audit, the results from the independent automated tabulation by the vendor are compared to the tabulation results from the voting equipment used in the election. Any variance above the established threshold of half a percent for any given contest would trigger an additional review, which could include a manual review of voted paper ballots.

results.[21] According to SBE officials, the new equipment's ability to capture and store digital images of the ballots made this type of audit possible. Anne Arundel County officials stated that the ability to conduct such an audit is one of the main benefits of the new equipment.

Lafayette County, Florida

Lafayette County has a small population and, in 2016, replaced its precinct count optical scan equipment with precinct count digital scan equipment. The county formed a consortium with other counties in the state to help acquire its new equipment.

Key Factors That Influenced the County's Decision to Replace Its Voting Equipment

According to the county's Supervisor of Elections, the cost to acquire new equipment and availability of funding and the need to meet state requirements were among the key factors that influenced the county's decision to replace its voting equipment. He stated that Lafayette County's optical scanners were approximately 15 years old but were generally in good condition and performed satisfactorily in prior elections. County officials had planned to replace the county's aging voting equipment by 2018 or 2020, but decided to replace it in 2016 because of the opportunity to join a consortium of counties that formed to acquire new equipment, which the Supervisor stated helped secure funding for and lower the costs of purchasing the equipment.

In addition, the Supervisor of Elections said that, to comply with state law, the county needed to acquire a paper ballot system with a BMD to replace the DRE it had used for voters with disabilities. Specifically, as of July 2008, Florida law required all voting in the state to be done using mark-sense paper ballots, which are generally counted using optical or

[21]As part of the state's replacement of its voting equipment, it also acquired central count scanners to tally absentee and provisional ballots. The audit identified some issues with these scanners in Anne Arundel and other counties. For example, residue and scratches on the scanner lens, as well as folds on the ballots, were counted by the scanner as write-ins in some cases and resulted in overvotes. These issues were corrected prior to certification of the election results by having the counties rescan the problem ballots. SBE officials stated that they are working with the equipment vendor to address these issues by adjusting the sensitivity of the central count scanners.

digital scanners, except for voting by individuals with disabilities.[22] Current state law requires jurisdictions to use these paper ballots for accessible voting by 2020. As such, according to the Supervisor of Elections, part of the impetus for acquiring new voting equipment was to replace the county's DRE to meet the 2020 deadline in the law.

Selection and Acquisition of New Voting Equipment

The Supervisor of Elections stated that Lafayette County is a small county and does not have much purchasing power. He said that Lafayette County and other small counties in the state formed a consortium to lobby the state for assistance and to leverage their collective purchasing power.[23] The 12-county consortium was established in a 2015 meeting that was attended by county election officials, the Florida Deputy Secretary of State, and the vendor that supplied the counties' previous voting system.[24] According to the Lafayette County Supervisor of Elections, the consortium decided to purchase precinct count digital scanners from the same vendor the counties had used before because county staff were familiar with the vendor and equipment, and the cost for the equipment was lower than similar equipment from another vendor that some counties in the consortium had considered. In addition, the Supervisor of Elections stated that the digital scanners have features that were an improvement over the county's previous optical scan equipment. For example, he stated that the new scanners have more robust security features, such as locking panels, seals, and a requirement for a passcode to access the system.[25] He also noted that the scanners have touch screens that flip up and are back-lit, which are easier for voters and poll

[22]See Fla. Stat. Ann. § 101.56075. According to the National Institute of Standards and Technology, mark-sense ballots contain predefined voting targets, typically in an oval or broken arrow format, intended for a voter's mark. To process mark-sense ballots, the voting equipment uses image processing techniques to detect votes. Florida's requirement for jurisdictions to use mark-sense ballots was effective as of July 1, 2008, but this deadline did not apply to equipment for voters with disabilities.

[23]On the basis of our survey of local election jurisdictions, we estimate that jurisdictions with 15 percent (8, 26) of the population nationwide consolidated individual purchase contracts into a single higher volume contract to acquire new voting equipment.

[24]According to the Supervisor of Elections, the 12-county consortium consisted of Bradford, Franklin, Gadsden, Gulf, Hamilton, Hendry, Highlands, Holmes, Jackson, Lafayette, Suwanee, and Union Counties.

[25]According to the Supervisor of Elections, Lafayette County's previous optical scanners required a key to turn on and operate the equipment but were not set up to require a passcode to access the system.

workers to read and more clearly identify overvotes. Further, he stated the scanners digitally capture and store ballot images. The two Lafayette County poll workers we interviewed confirmed that the new equipment more clearly identified overvotes for them and for voters than did the previous equipment.

According to the county's Supervisor of Elections, having the consortium approach state officials as a group helped secure HAVA funds to help the counties purchase the voting equipment. In addition, he stated that being a part of the consortium helped the counties negotiate a lower price for their equipment than what they could have obtained individually because they pooled their purchases and acquired a higher volume of machines. While the consortium negotiated as a unit, each county has an individual contract with the vendor. The Supervisor of Elections stated that the total cost to purchase Lafayette County's new voting equipment—which included seven digital scanners, seven BMDs for voters with disabilities, and various system components—was about $70,000.[26] The equipment was acquired primarily with HAVA funds, although he noted that the county allocated about $12,000 in local funds to purchase three additional BMDs. A memorandum of agreement for funding and purchasing the equipment was signed by Lafayette County and the state in November 2015 and, according to the Supervisor of Elections, the equipment was acquired in late 2015 and first used in the March 2016 primary election.

Deployment of New Voting Equipment

The Supervisor of Elections and the two poll workers we interviewed stated that deployment of the new voting equipment went smoothly and the county did not experience any challenges because the new and previous equipment are both precinct count scanning systems. The Supervisor noted that the voting process remained the same for the voter, so extensive voter education efforts were not needed. He stated that Lafayette County did not experience any equipment malfunctions during the November 2016 general election, and a postelection audit that was

[26]According to the Supervisor of Elections, the equipment was purchased through a loan and payments are to be made in installments over a 5-year period. Florida Division of Elections officials noted that the HAVA funds allocated to the counties in the consortium are subject to annual approval by the state legislature.

conducted, in which the county manually tallied ballots from a randomly selected race and precinct, found that the results were accurate.[27]

Beaver County, Utah

Beaver County has a small population and previously used DREs with a VVPAT. In 2014, Beaver County began conducting vote-by-mail elections and replaced its DREs with central count digital scan equipment to support this change.[28]

Key Factors That Influenced the County's Decision to Replace Its Voting Equipment

According to Beaver County officials, the overall performance and features of the equipment and the ability to maintain the equipment were among the key factors in their decision to replace the county's equipment. Officials stated that the county had been using DREs since 2005 and that by 2013, they had come to the conclusion that the equipment was not very efficient or user-friendly for administering elections. For example, the Deputy Clerk stated that it was time consuming to both set up the equipment and tally the votes, which required collecting and uploading the memory component from each of the DREs. She also noted that the operating software for the equipment's election management system had become out-of-date and did not have a user-friendly interface. According to the Deputy Clerk, this made it difficult for staff to navigate without detailed training, which was time consuming and costly. In addition, county election officials said that they were unsure about future maintenance and system upgrade costs and decided it would be more cost-effective to spend funds on purchasing new voting equipment rather than on upgrades to equipment with which they were not very satisfied.

[27]Florida state law requires counties to conduct a postelection audit by performing either (1) a manual audit of votes for one randomly selected race in at least 1 percent but no more than 2 percent of precincts containing that race or (2) an automated tally of the votes cast across every race that appears on the ballot in at least 20 percent of randomly chosen precincts. See Fla. Stat. Ann. § 101.591.

[28]Utah legislation enacted in 2012 allows local jurisdictions in the state to elect to administer vote-by-mail elections, in which all registered voters receive a ballot in the mail which they can mark and return by mail or, if available, at a polling location or Election Day vote center. See Utah Code Ann. § 20A-3-302. Utah state election officials stated that 21 of the state's 29 counties conducted vote-by-mail elections in the November 2016 general election.

In 2013, the county decided to begin conducting vote-by-mail elections the following year and to acquire new equipment to support this change. According to county officials, this decision was due to the performance of their DREs and a desire to reduce costs and increase the efficiency of administering elections, among other reasons. Officials said that because the county was moving to vote-by-mail elections and DREs would no longer be needed for each precinct, the county would instead acquire central count scanners designed to count the mail-in ballots it would receive at the county elections office.

Selection and Acquisition of New Voting Equipment

According to Beaver County officials, the main individuals involved in the process to select and acquire the county's new voting system included the current Beaver County Clerk, Deputy Clerk, a county information technology official, and the previous county clerk, among others. When the county started the process in 2013, the state had not initiated any efforts to help local jurisdictions acquire new equipment.[29] As such, both Utah and Beaver County election officials said that the state was aware of the county's decision to replace its equipment but was not involved in the selection and acquisition process.

County officials stated that they wanted to acquire central count scanners to support conducting vote-by-mail elections and a BMD for in-person voting at the elections office for individuals with disabilities. Officials said that, in 2014, they verbally requested proposals from their current vendor and an elections services company that the county had employed in 2012 to provide training, systems testing, and other support for elections. According to the Deputy Clerk, the county requested proposals from these two entities because county officials were familiar with them and were not aware of other vendors that might submit proposals. Officials said that the county received a proposal from the elections services

[29]After Beaver County acquired its new equipment, the state of Utah began efforts to help local jurisdictions replace their voting equipment. For example, the Utah Lieutenant Governor's office formed a Voting Equipment Selection Committee, which first convened in May 2016, to help select and contract for state-wide voting equipment that jurisdictions may choose to use. According to state election officials, the state issued an RFP in May 2017 and signed a contract with its selected vendor in November 2017. State election officials said that local jurisdictions will determine when to replace their equipment and will not be required to purchase the equipment that the state selects. They anticipate that funds for replacing voting equipment will primarily come from counties, with possible supplementation from state-appropriated funds.

company, and selected the company because it was the only bid received and the equipment the company sold met the county's needs and was federally certified.[30] They stated that one of the challenges they experienced as a small county looking to purchase equipment was that vendors were not actively marketing to them. In addition, the Deputy Clerk noted that she had limited elections and information technology experience when the county started the selection process. However, she said that the election services company was familiar with Utah's elections code and federal voting system requirements, helped negotiate with the vendor to acquire the new equipment, and educated county staff on the equipment.

Beaver County reported that the cost to purchase the equipment—two central count digital scanners, a BMD, and associated system components—was about $46,000. Local funds were used to purchase the scanners and HAVA funds were used to purchase the BMD. According to Beaver County officials, county commissioners approved the procurement of the equipment in spring 2014 and it was first used in the June 2014 primary elections.

Deployment of New Voting Equipment

Beaver County officials stated that they deployed the new equipment in 2014 because it was more manageable to conduct such a transition during a non-presidential election year. They noted that they needed to educate the public about both voting by mail and the new voting equipment. Officials stated that the county used local newspaper ads, social media posts, and direct mailings to provide information on these changes. Officials also posted information on the county's website and allowed people to observe logic and accuracy testing of the equipment. They noted that educating the public on the new voting method and equipment in smaller elections during 2014 and 2015 helped voters become more comfortable with what to expect for the presidential election in 2016.

County officials said that they are very satisfied with the performance of the new voting equipment. They noted that conducting vote-by-mail elections and using central count scanners allow them to administer

[30]Utah state law required voting systems used in elections to be federally certified at the time Beaver County acquired its new equipment.

elections from one location on Election Day, which requires less time and resources than having to manage multiple polling places. Officials also stated that the new digital scanners are able to count a high volume of ballots in a short period of time. They said that, for the November 2016 general election, the vote tallying was completed within an hour of the polls closing, which allowed the county to report results quickly. However, one challenge they experienced was that the new equipment's data format for election night reporting of results to the state was not compatible with the state's reporting system. To address this issue, county officials reformatted the data to produce a report that could be uploaded into the state's system, but cautioned that this may not be feasible for larger jurisdictions.

According to officials, the county conducted two postelection audits for the 2016 general election—one required by the state and another that the county initiated. For the state audit, the county hand counted 1 percent of total ballots from a randomized list.[31] In addition, the county conducted its own audit by running all ballots on its other digital scanner to compare results.[32] According to officials, both audits validated the election results.

[31]The state requires counties that conduct vote-by-mail elections to hand count the lesser of 1 percent of total ballots or 1,000 ballots from a randomized list.

[32]Officials stated that the county has two scanners so that one can be used as a back-up or for auditing if needed.

Appendix VI: GAO Contact and Acknowledgments

GAO Contact

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Appendix VII: Accessible Data

Data Tables

Data Table for Figure 1: Type of Voting Equipment Predominantly Used by Jurisdictions to Process the Most Ballots during the 2016 General Election

95% Confidence interval

Method	Estimated percentage of population nationwide covered	Lower Bound	Upper Bound
Optical/digital Scana	63	54	72
Direct Recording Electronic (DRE)b	32	23	41
Other (nonspecified)	2	0	4
Paper (hand-counted) ballot	0.3	0	1

Data Table for Figure 2: Predominant Voting Equipment Used in the 2016 General Election, by Equipment Type and Model

95% Confidence interval

Method	All jurisdictions	Lower Bound	Upper Bound	Small jurisdictions	Lower Bound	Upper Bound	Medium jurisdictions	Lower Bound	Upper Bound 95% CI	Large jurisdictions	Lower Bound	Upper Bound
Precinct Count	46	37	56	48	34	61	44	35	53	43	36	49
Central Count	16	12	22	15	9	23	20	13	28	18	14	23
Without a VVPAT	15	11	21	12	6	20	21	14	29	25	19	30
With a VVPAT	17	9	28	20	8	37	10	6	17	10	7	15
Paper Ballot	0.3	0	1	0.4	0	5	0	0	2	0.3	0	2

Data Table for Figure 3: Types of Voting Equipment Used by Local Election Jurisdictions during the 2016 General Election

95% Confidence interval

Method	Estimated percentage of population nationwide covered	Lower Bound	Upper Bound
One type of equipment	59	50	68
Optical/digital Scan Only[a]	49	39	58
Direct Recording Electronic (DRE) only[b]	9	4	18
Paper (hand-counted) ballots only	1	0	5
Two types of equipment	30	23	38
DRE and Optical/digital Scan	19	14	25
Optical/digital Scan and Paper (hand-counted) ballots	7	4	13
DRE and Paper (hand-counted) ballots	4	1	9
More than two types of equipment[c]	6	1	17

Data Table for Figure 4: Satisfaction with Performance of Predominant Voting Equipment Used in 2016 General Election

95% Confidence interval

Satisfaction	All Jurisdictions	Lower Bound	Upper Bound	Direct Recording Electronic Users	Lower Bound	Upper Bound	Optical/digital scan users	Lower Bound	Upper Bound
Very Satisfied	70	61	79	75	53	90	69	57	79
Generally satisfied	26	18	36	23	9	45	27	17	38
As satisfied as dissatisfied	2	1	4	1	0	4	2	1	5
Generally dissatisfied	1	0	3	0	0	3	1	0	4
Very dissatisfied	1	0	2	0	0	2	1	0	3
No opinion	0	0	1	0	0	3	0	0	1

Data Table for Figure 5: Satisfaction with Performance of Predominant Voting Equipment Used in 2016 General Election Relative to Predominant Voting Equipment Used in 2012 General Election

95% Confidence interval

Satisfaction	All Jurisdicitions	Lower Bound	Upper Bound	Direct Recording Electronic Users	Lower Bound	Upper Bound	Optical/ digital scan users	Lower Bound	Upper Bound
More satisfied in 2016 than in 2012	16	10	22	4	1	11	20	13	29
Just as satisfied in 2016 as in 2012	67	59	75	71	49	87	69	60	78
Less satisfied in 2016 than in 2012	4	3	7	5	2	11	4	2	8
No opinion	13	7	22	20	5	44	7	4	11

Data Table for Figure 6: Importance of Issue Areas within the Factor "Need for Voting Equipment to Meet Federal, State, and Local Voting System Standards and Requirements," for Jurisdictions and States

		95% Confidence interval						
Issue area	Percent of nationwide population represented by jurisdictions that rated issue as "very important"	Lower Bound	Upper Bound	Percent of nationwide population represented by jurisdictions that ranked issue as one of the "most important"	Lower Bound	Upper Bound	Number of states that rated issue as "very important"	Number of states that ranked issue as one of the "most important"
Need for equipment to meet state and local requirements and standards	87	81	91	36	26	46	18	7
Need for equipment to meet state and local mandated changes	86	80	90	13	8	20	11	1
Need for equipment to meet federal guidelines	80	72	87	30	20	40	17	8
HAVA requirements for voting equipment	77	69	83	19	11	29	17	7

Data Table for Figure 7: Importance of Issue Areas within the Factor "Cost to Acquire New Equipment and Availability of Funding," for Jurisdictions and States

		95% Confidence interval						
Issue area	**Percent of nationwide population within jurisdictions that rated factor as "very important"**	**Lower Bound**	**Upper Bound**	**Percent of nationwide population represented by jurisdictions that ranked issue as one of the "most important" issues**	**Lower Bound**	**Upper Bound**	**Number of states that rated issue as "very important"[a]**	**Number of states that ranked issue as one of the "most important" issues[b]**
Availability of state and local funds	62	53	71	18	11	27	20	9
Costs to acquire or lease new equipment	61	52	70	16	11	21	19	6
Costs of training election workers and voters on new equipment	57	47	66	3	2	6	6	0
Availability of remaining HAVA funds	43	34	53	9	4	18	5	0

Data Table for Figure 8: Importance of Issue Areas within the Factor "Ability to Maintain Equipment and Receive Timely Vendor Support," for Jurisdictions and States

		95% Confidence interval						
Issue area	**Percent of nationwide population represented by jurisdictions that rated issue as "very important"**	**Lower Bound**	**Upper Bound**	**Percent of nationwide population represented by jurisdictions that ranked issue as one of the "most important"**	**Lower Bound**	**Upper Bound**	**Number of states that rated issue as "very important"[a]**	**Number of states that ranked issue as one of the "most important"[b]**
Sufficiency of vendor support and problem resolution	81	74	87	7	4	11	15	0
Availability of replacement parts	70	61	78	4	1	8	13	3
Costs to maintain equipment	58	49	68	5	3	10	13	1
Costs to operate equipment	50	41	60	7	4	11	9	1

Issue area	Percent of nationwide population represented by jurisdictions that rated issue as "very important"	Lower Bound	Upper Bound	Percent of nationwide population represented by jurisdictions that ranked issue as one of the "most important"	Lower Bound	Upper Bound	Number of states that rated issue as "very important"[a]	Number of states that ranked issue as one of the "most important"[b]
Level of in-house technical expertise about voting equipment	44	35	54	1	0	2	8	0

Data Table for Figure 9: Importance of Issue Areas within the Factor "Overall Performance and Features of Voting Equipment," for Jurisdictions and States

95% Confidence interval

Issue area	Percent of nationwide population represented by jurisdictions that rated issue as "very important"	Lower Bound	Upper Bound	Percent of nationwide population represented by jurisdictions that ranked issue as one of the "most important"	Lower Bound	Upper Bound	Number of states that rated issue as "very important"	Number of states that ranked issue as one of the "most important"
Overall performance of the voting equipment	83	76	88	20	14	27	18	4
Accessibility of voting equipment for disabled or impaired voters	77	68	84	4	2	7	21	2
Concerns about adequacy of physical security of equipment	70	61	78	5	2	11	11	1
Concerns about adequacy of cyber security of equipment	67	57	76	4	2	7	11	1
Equipment has outdated software	67	58	76	2	0	5	15	3
Availability of equipment that better meets jurisdiction needs	65	56	75	7	4	10	11	3
Age of equipment	62	52	71	6	3	9	15	6
Vendor demonstrations of new voting equipment	62	53	71	2	0	6	6	0
Whether the equipment provides a voter verifiable paper trail	46	36	56	12	4	24	9	0

Issue area	Percent of nationwide population represented by jurisdictions that rated issue as "very important"	Lower Bound	Upper Bound	Percent of nationwide population represented by jurisdictions that ranked issue as one of the "most important"	Lower Bound	Upper Bound	Number of states that rated issue as "very important"	Number of states that ranked issue as one of the "most important"
Feedback from voters or the public on the voting equipment	34	26	43	1	0	2	5	0
Capability to use COTS components	19	11	29	1	0	2	2	0

Data Table for Figure 10: Year of First Use of Predominant Voting Equipment Used in 2016 General Election

95% Confidence interval

Year	Percent of population	Lower Bound	Upper Bound
Before 2002	4.7	2.7	7.5
Between 2002 and 2006	51.4	42.2	60.6
Between 2007 and 2011	8.7	5.2	13.5
Between 2012 and 2016	27.7	19.4	36
Don't know	7.5	3.7	13.2

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