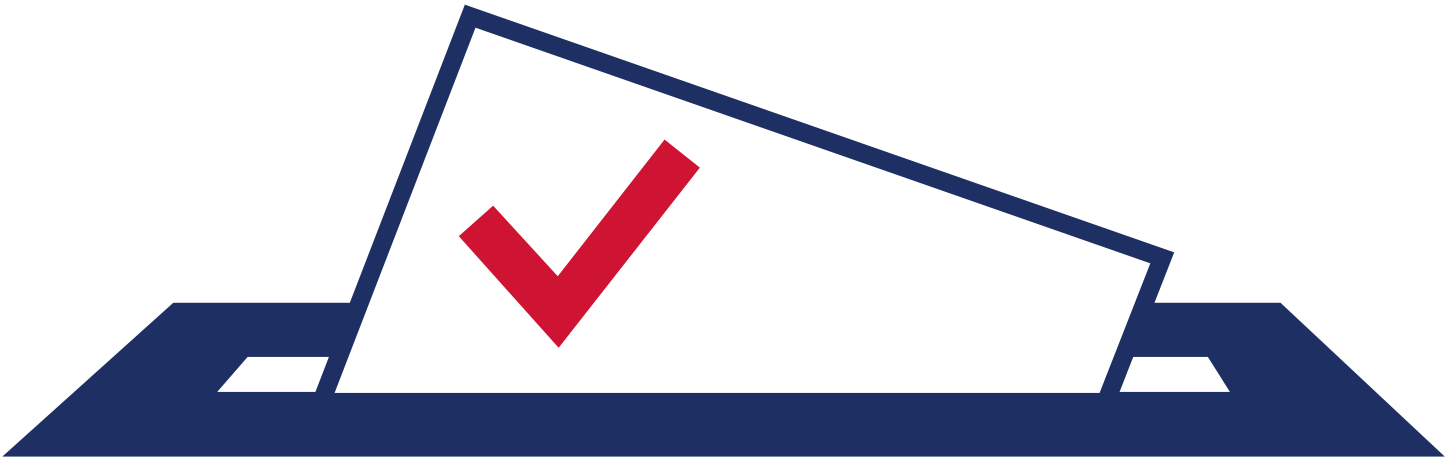


The Road to Widespread Deployment of Next Generation VVSG 2.0-Certified Voting Systems

Table of Contents

The U.S. Election Assistance Commission would like to thank William T. Adler and Theo Menon of the Bipartisan Policy Center for their contributions to the development of this report.

Executive Summary

The transition to next-generation voting systems that conform with the federal Voluntary Voting System Guidelines (VVSG) version 2.0 represents a critical opportunity to strengthen the security and accessibility of U.S. elections. VVSG 2.0, which was adopted by the U.S. Election Assistance Commission (EAC) in February 2021, establishes the most rigorous federal standards for certifying voting systems to date. More than five years later, two systems have been certified to VVSG 2.0, and multiple systems are in the pipeline.

Even after a voting system has been federally certified, deployment does not happen overnight. States first have to certify it, procure it, integrate it into existing systems, and train workers to use it. This report describes the path from VVSG version adoption to widespread deployment of certified systems and identifies obstacles in that path. It also analyzes the age of voting equipment across the country, projects how long it will take to replace this equipment and estimates how much replacement will cost.

Key Findings

- ✓ **Many states need to replace their voting equipment soon.** A significant portion of the nation's voting devices are approaching the end of their typical and recommended service lifespan. By the 2028 presidential election, the average age of voting equipment, if not replaced, will be about 9.3 years old. While 9 years may not sound old, aging voting systems face real risks: hardware becomes harder to source, software loses support, and maintenance grows more costly for both manufacturers and jurisdictions. Historically, jurisdictions have replaced voting equipment when it reaches about 9.7 years of service. Notably, some states have jurisdictions that continue to use equipment that is nearly 30 years old.

- ✓ **Certification, procurement, and deployment take years.** Federal and state certification processes are complex and time-consuming. Even after certification, procuring and deploying systems can present additional challenges.

- ✓ **Widespread replacement will be costly.** If all voting systems (including direct recording electronic machines, ballot marking devices, hand-fed optical scanners, and batch-fed optical scanners) were replaced in 2028 with VVSG 2.0-certified systems, the total cost would be roughly $2.71 billion, based on historical pricing and manufacturers' pricing projections. However, this price does not reflect the cost of all election technology required to run an election or the overall cost of conducting elections. All these costs are substantial and ongoing and should be factored into any long-term investment in the nation's election infrastructure.

- ✓ **Funding is the most important lever for change and advancement of technology.** Large-scale adoption of VVSG 2.0-certified systems will take longer in the absence of sustained, predictable federal investment to supplement local election budgets. Past bursts of the Help America Vote Act (HAVA) grant funding — after the 2000 presidential election and during the COVID-19 pandemic — spurred some equipment upgrades, but irregular and insufficient federal funding has made it difficult for state and local officials to plan replacements in sync with equipment life cycles. Consistent funding for the EAC and its Testing and Certification Program is also essential for ensuring that standards are periodically updated, and systems are certified in a timely and accurate manner.

- ✓ **State policymakers play an important partnership role in voting system upgrades.** State policymakers ultimately determine how voting system certification and procurement takes place; absent federal funding, state and local governments will have to bear the cost of procuring new systems.

✓ **Widespread deployment may be years away.** Based on historical replacement trends, more than half of voting equipment will be replaced between 2026 and 2032. However, the timing of replacement does not necessarily mean jurisdictions will replace that equipment with VVSG 2.0-certified systems, especially if federal funding is limited.

Introduction

Modern voting system technology is a key element of American election infrastructure. Although election officials have used computerized tabulation technology in some form for decades — going back to early punch-card scanners — contemporary voting systems perform far more functions than their predecessors. These systems help ensure that ballots are counted accurately and efficiently, facilitate unofficial results on election night, and enable strong post-election audits. They not only improve private and independent access for voters with disabilities but are necessary to help jurisdictions meet federal accessibility requirements.

They also address a challenge unique to the United States: the extraordinary complexity of its elections. Unlike most other democracies around the world, U.S. ballots often contain contests for federal, state, and local offices, as well as numerous ballot measures — all of which must be counted accurately, often across thousands of jurisdictions using different ballot styles. Computerized voting systems make it possible to manage this scale and complexity efficiently while reducing the risk of human error that can accompany manual counts.

Keeping voting systems up to date is essential not only for a smooth voting experience but also to guard against evolving security threats.

In a decentralized election system where states and localities choose, procure, and operate their own voting equipment, federal standards set a nationwide baseline for security, usability, accessibility, and reliability. Clear and testable standards give manufacturers a target to design toward and help election officials evaluate their options with confidence.

Congress recognized the value of establishing standards and certification by passing the Help America Vote Act of 2002 (HAVA). HAVA set minimum standards for all voting systems nationwide and established a framework for certifying voting systems to a more comprehensive set of guidelines. It created the Election Assistance Commission (EAC) and tasked it in part with developing and administering that certification framework. The core of this effort is the Voluntary Voting System Guidelines (VVSG). Since 2009, 81 voting systems have been certified as compliant with the VVSG and deployed across the country. VVSG 2.0 defines a voting system as:

> ***Equipment (including hardware, firmware, and software), materials, and documentation used to enact the following functions of an election:***
>
> 1. *Define elections and ballot styles.*
> 2. *Configure voting equipment.*
> 3. *Identify and validate voting equipment configurations.*
> 4. *Perform logic and accuracy tests.*
> 5. *Activate ballots for voters.*
> 6. *Record votes cast by voters.*
> 7. *Count votes.*
> 8. *Label ballots needing special treatment.*
> 9. *Generate reports.*
> 10. *Export election data including election results.*
> 11. *Archive election data.*
> 12. *Produce records in support of audits.*

The EAC adopted VVSG 2.0 in 2021. At the time of writing, the EAC has certified two systems under VVSG 2.0, and multiple systems are in the testing pipeline.

This report examines what motivates election officials to upgrade or replace their voting systems and the challenges they face in doing so. We estimate when voters are likely to be voting on these new systems and how much the transition will cost. To gather information for this report, we interviewed and surveyed state and local election officials, testing laboratories, and voting system manufacturers; analyzed publicly available documents and statements from events; and conducted quantitative analysis on publicly available data.

The Voluntary Voting System Guidelines

The EAC develops the Voluntary Voting System Guidelines with assistance from the Technical Guidelines Development Committee (TGDC). Although federal law does not require states[1] to use the VVSG or to only use systems that the EAC has certified as compliant with the VVSG, the guidelines shape the voting system landscape by providing a testable benchmark for voting system security, accessibility, and reliability.

Voting system manufacturers can voluntarily submit their systems for certification under the EAC's Testing & Certification Program, which relies on federally accredited private Voting System Test Laboratories (VSTLs) to assess whether a system meets the VVSG requirements. The process can take months or years, depending on the scope of the submission and the manufacturer's preparation, potentially requiring changes from manufacturers.

The VVSG has gone through several iterations in the decades since Congress passed the Help America Vote Act. From its adoption in 2005 through 2025, VVSG 1.0 was the only version to which any systems were certified.[2] VVSG 1.1 was adopted in 2015, but no systems were submitted to be certified to it. VVSG 2.0, adopted in 2021, represents the most significant revision and update to date. Compared with 1.0, 2.0 includes enhanced cyber and physical security features, upgraded usability and accessibility standards for persons with disabilities, enhanced ballot secrecy, and greater interoperability across different election technologies.

Although VVSG 2.0 was adopted in February of 2021, systems built to its specifications are still undergoing development and testing in preparation for certification. The first VSTL was accredited to test to the standard in December of 2022. The first VVSG 2.0 system application was submitted in February of 2023. The first system (Hart InterCivic's Verity Vanguard 1.0) was certified in July 2025, and a second system (Smartmatic's VSR1 2.1) was certified in November 2025. Five manufacturers (VotingWorks, Liberty Vote USA Inc., Hart InterCivic Inc., Election Systems & Software Inc. [ES&S], and Unisyn Voting Solutions) either have systems under test or have submitted an application to begin the testing process. As of publication, the EAC is receiving comment from the HAVA federal advisory committees to a draft VVSG 2.1.

States vary widely in how they use the Voluntary Voting System Guidelines. Some require full federal certification for all voting systems; others only require testing to the VVSG or by federally accredited laboratories. Some others do not incorporate any element of the EAC Testing & Certification Program into their state certification framework. As a result, the adoption and implementation of federally certified systems remain uneven across the country.

---

[1] Throughout this report, the term "state" refers to the 50 U.S. states, the District of Columbia, and the five permanently inhabited U.S. territories (American Samoa, Guam, the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands).

[2] As recently as 2012 the EAC did, however, certify several systems to the 2002 Voting System Standards (the predecessor to the VVSG) promulgated by the Federal Election Commission

How are new systems developed, certified, and deployed?

Adopting a new version of the VVSG is only the first step in a lengthy process. Certification and deployment of compliant systems do not happen immediately. Instead, it takes years of system development, testing, and coordination across federal, state, and local levels before new systems reach voters.

Below, we outline the steps that must be completed after the EAC adopts a new version of the VVSG and before a jurisdiction deploys a system: system development, VSTL testing and federal certification, state certification, procurement, and training and deployment.

System development

After the VVSG is updated, the responsibility for developing compliant systems shifts to voting system manufacturers. Upon review of the new requirements, manufacturers may adapt existing platforms to meet them, or they might choose to build new systems from the ground up.

Manufacturers face different timelines for VVSG 2.0 submissions based on their product portfolios, customer commitments, and operational demands from states and localities. In some cases, smaller manufacturers may be able to focus more quickly on VVSG 2.0 submissions, while larger manufacturers may need to balance new certification work with support, maintenance, and other obligations of existing systems and customers. This dual focus on supporting current systems while investing in next-generation development can slow progress and lengthen development timelines.

As a result, the time between VVSG version adoption and submission to testing can vary significantly across manufacturers based on differences in capacity, business strategy, and existing obligations.

VSTL testing and federal certification

HAVA tasks the EAC with providing a process for the testing and certification of voting systems by accredited laboratories. The EAC details these processes in the Voting System Testing and Certification Program Manual, briefly summarized here.

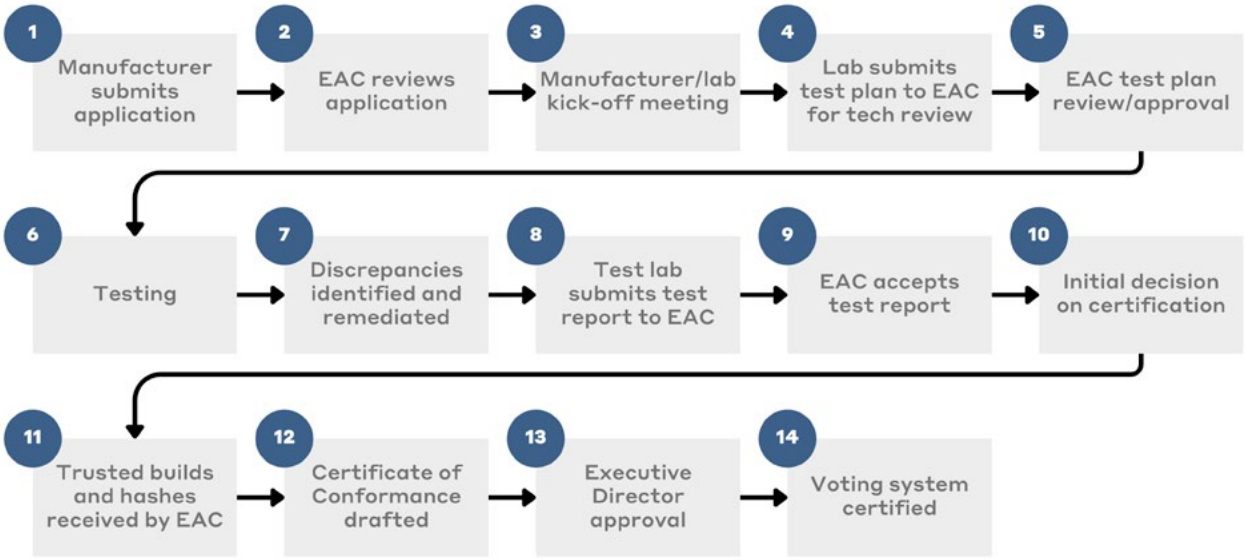
When a manufacturer is ready to begin the federal certification process, it submits an application to the EAC. Once the EAC reviews and approves the application, the manufacturer works with a federally accredited VSTL to develop a detailed test plan. The EAC then reviews and approves the plan before testing can proceed.

Testing is extensive. VSTLs evaluate the system's performance across a wide range of categories, including accessibility, accuracy, durability, software integrity, and security. According to one lab, SLI Compliance, a system may be assessed against about 1,200 VVSG requirements. Because these requirements can apply to multiple system components, a new certification campaign can involve 6,000-8,000 individual tests. In the case of Hart InterCivic's Verity Vanguard system, testing against VVSG 2.0 reportedly required more than 6,000 VSTL project hours (the cumulative number of hours that testing staff devoted to the work). Sources interviewed for this report suggest that manufacturers typically pay the labs about $1 million to test a new system for EAC certification.

Throughout the testing process, VSTLs or manufacturers may submit a Request for Interpretation (RFI) to the EAC for clarification on specific VVSG requirements. An RFI is a means by which manufacturers and VSTLs may request the EAC to provide a definitive interpretation of VVSG requirements, when in the course of developing

or testing a voting system, the meaning of a particular requirement is ambiguous. Resolving RFIs can be time consuming, but it is essential for completing testing or making adjustments to system features in line with the standards.

Figure 1. *The process for federal voting system testing and certification. Adapted from EAC.*



After testing is complete and all discrepancies have been remediated, the VSTL submits a test report to the EAC indicating that the system meets all requirements. The EAC then conducts a technical review to determine whether to approve the test report. If approved, the manufacturer provides a "trusted build," a secure, verified version of the voting system software compiled under controlled conditions. The trusted build is accompanied by a digital hash, or fingerprint, used to verify the software's integrity. The trusted build is retained by the EAC and serves primarily to create a documented chain of evidence that allows stakeholders to have an approved model to use for verification of a certified voting system.

Once these steps are complete, the EAC issues a Certificate of Conformance indicating that a system has received federal certification.

It often takes several years for these first two steps (system development and VSTL testing and federal certification) to be completed. In July 2025, more than four years after VVSG 2.0 was adopted, the first voting system (Hart InterCivic's Verity Vanguard) was certified to meet the new requirements. This timeline is on par with VVSG 1.0, which was adopted in 2005: The first system was certified just over three years later. However, testing and certification for future systems is expected to take less time as requirements are made more clear to the VSTLs and manufacturers, in part through the RFI process.

State certification

Almost every state has laws, regulations, and policies governing the process by which the state certifies voting equipment for procurement and use in its jurisdictions. Some states require full EAC certification before a system can be state-certified. Others only require testing by a VSTL, so theoretically the state certification process can begin before the system is EAC certified. In one state that requires VSTL testing to state standards (rather than to the VVSG), a state official said that, practically speaking, a manufacturer cannot come to the state

without being federally certified first. This underscores the foundational role of VVSG certification even in states where VVSG is not a required prerequisite.

State certification can be a lengthy process. It may involve in-state testing that goes beyond VVSG requirements, opportunities for public input, and additional statutory or regulatory steps. These procedures influence the pace and feasibility of transitioning to systems certified to VVSG 2.0.

In some states, the chief election official may certify multiple systems, allowing localities to choose from a set of certified voting systems. In Texas, for example, manufacturers may apply to have their systems considered for state certification. In addition to requiring federal certification, Texas employs its own detailed inspection process. Systems are subjected to physical review by an independent panel of examiners. Examiners also question the manufacturers about functionality, security, and legal compliance. The examiners then issue written reports summarizing the testing results and recommending whether the system can be certified as compliant with Texas law. After the testing process, the state holds public hearings before the secretary of state issues a certification or not. To date, the secretary of state has never overruled the panel's recommendation.

In other states, the process is more centralized, with the state certifying only one system to be used statewide. In Maryland, the State Board of Elections is required by law to select and certify a single voting system to be deployed statewide. It solicited proposals in 2014 from system manufacturers and evaluated these proposals with input from local boards. Ultimately, it selected a system, issuing a certification report detailing how the system is compliant with each element of state law.

States often charge manufacturers a modest fee to cover the cost of testing. For example, in Texas, manufacturers pay $3,000 per voting system component, such as a scanner or ballot marking device (BMD). Such fees are typically required regardless of whether the system is ultimately certified. Some states like North Carolina require manufacturers to post a bond or letter of credit to cover "damages resulting from defects in the voting system," such as "any costs of conducting a new election attributable to those defects."

These costs and timelines are not limited to initial certification. Updates and modifications, such as engineering change orders (ECOs), require additional review and testing, and larger changes that result in new system versions are treated as new submissions for certification. Because state certification processes can vary so much (according to one manufacturer, "no state does it the same way,") certification may take weeks or months.

Procurement

Once a voting system has received state certification (if required), manufacturers can begin selling their systems to jurisdictions. But how these procurements are made — and who pays for them — varies significantly from state to state.

In some states, the state government handles procurement directly. These states negotiate contracts and pricing with manufacturers at the state level. This centralized approach allows the state to standardize equipment, control costs, and ease the administrative burden on counties. But even in this case, there is variance in terms of who pays. For example, in Georgia, the state pays the entire cost of the voting system. But other states may split costs. Even in Maryland, where a single system is certified and procured, counties are statutorily required to pay 50% of the cost.

In other states, procurement is left largely or entirely to counties or municipalities. Even when the state manages certification or testing, local officials are responsible for selecting, funding, and purchasing systems, often from a list of state-certified options. Some states establish a permanent funding stream to help jurisdictions pay election-related costs, including equipment. Minnesota, for example, has a voting operations, technology, and election resources (VOTER) account that the secretary of state distributes to counties based on the number of

registered voters. Occasionally, states or the federal government will offer one-time funding opportunities, typically in response to security concerns or broader system modernization goals. Such funding may also carry reporting and other administrative requirements for jurisdictions.

Regardless of which level of government provides the funding, these resources ultimately come through public appropriations at the state, local, or federal level.

Training and deployment

Once a new system is certified and procured, it still cannot be safely deployed until election officials and workers are trained to operate it. The cost and complexity of the training vary depending on state and local factors and on how different the new equipment is from existing systems. Several state officials interviewed for this report indicated that training would require additional time and resources that are scarce in smaller and less well-resourced jurisdictions. Officials also emphasized the importance of integrating new systems well in advance of elections to give local officials ample time to train their teams.

In addition to training election officials and poll workers, jurisdictions may also need to invest in voter education and public outreach before deploying new systems. These efforts can include public demonstrations, educational materials, outreach events, and staff time to ensure voters receive accurate information about how to use the new equipment and the reason for replacement. The cost and complexity of voter education vary based on the size of the jurisdiction, whether the rollout is statewide or local, and how different the new system is from the one voters previously used.

What is the state of voting equipment in the U.S.?

Election officials we interviewed generally reported that the voting systems currently deployed across the United States are serving them and their voters well; however, in some jurisdictions, the equipment is approaching or past its typical lifespan. Aging equipment can be more difficult to maintain, more expensive to repair, and less secure against physical and cyberattacks. To ensure that elections continue to be secure, trustworthy, and accessible, jurisdictions recognize the need to update their software and hardware to the newest versions but also recognize that aging hardware and legacy systems will ultimately require replacement.

Voting equipment is, on average, approaching the end of its lifespan.

Most American voting equipment[3] is now approaching the end of its typical and recommended lifespan. Unless widespread replacement occurs, voting system equipment in use for the 2028 presidential election will average about 9.3 years old — nearly as old as it has ever been since 2006, which was the second highest average in available data.[4] The highest average age came in 2018, when Americans voted on equipment averaging 10.3 years old.

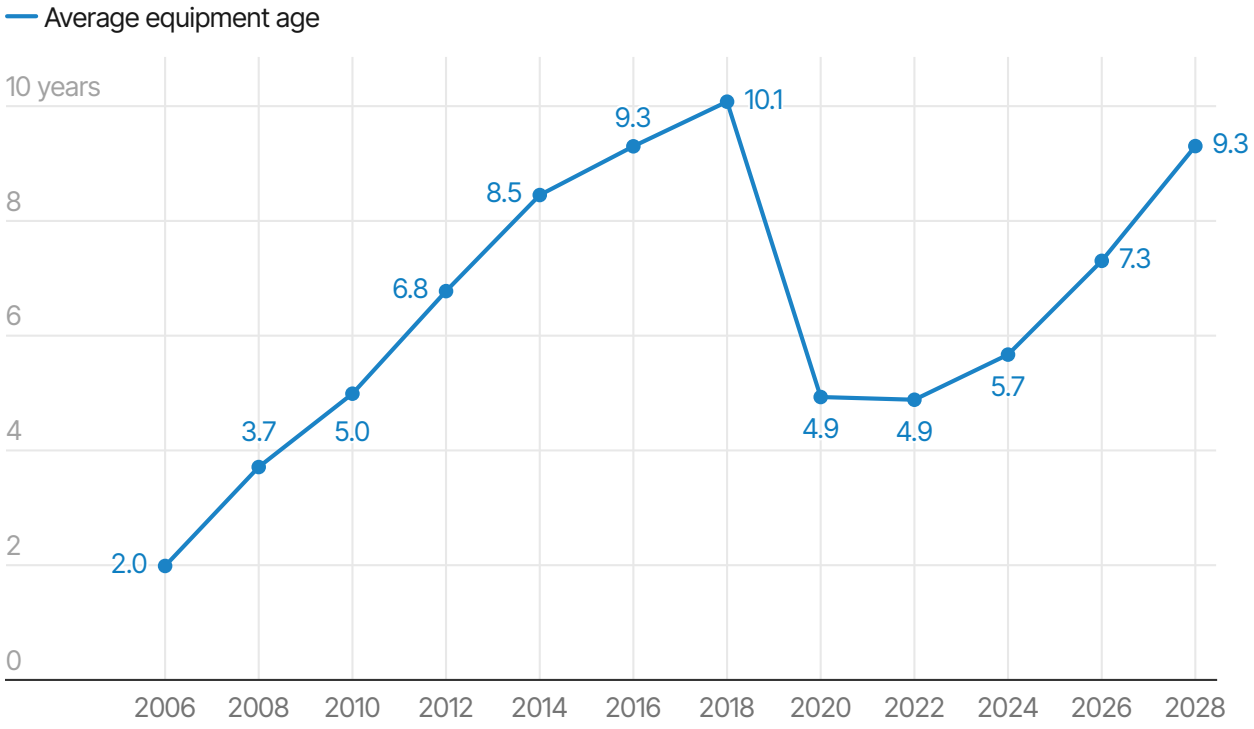
---

[3] In this report, our quantitative analyses of voting equipment include four categories of devices: ballot marking devices, direct recording electronic machines, hand-fed optical scanners (sometimes called precinct-count scanners), and batch-fed optical scanners (sometimes called central-count scanners). Equipment in these categories is within the scope of the VVSG. Data on usage of equipment in these categories is available in both Verified Voting's Verifier dataset and in the EAVS, where jurisdictions report how many devices they deploy for use during a given general election.

[4] These estimates are based on Verified Voting data, which reflects available information about which systems will be in use in 2026. However, some jurisdictions may plan to procure new systems before 2026, and the data might not reflect this.

Figure 2. In 2028, voting equipment will be nearly as old as at any point since 2006.

The average age of modern voting equipment reached a peak in 2018. It dropped sharply in 2020, mostly because of the acquisition of new ballot marking devices. It has been steadily rising since 2020.



Average equipment age is weighted by the estimated number of devices (ballot marking devices, optical scanners, and direct recording electronic machines) in use.

Source: *U.S. Election Assistance Commission, Verified Voting*

It is important to note that the age of the nationwide inventory varies depending on the equipment type. For instance, in 2028, ballot marking devices (BMDs) and batch-fed optical scanners will be 8.2 and 8.7 years old, respectively.[5] In contrast, the average direct recording electronic machine (DRE) will be 18 years old, with some deployed machines reaching 30 years old.

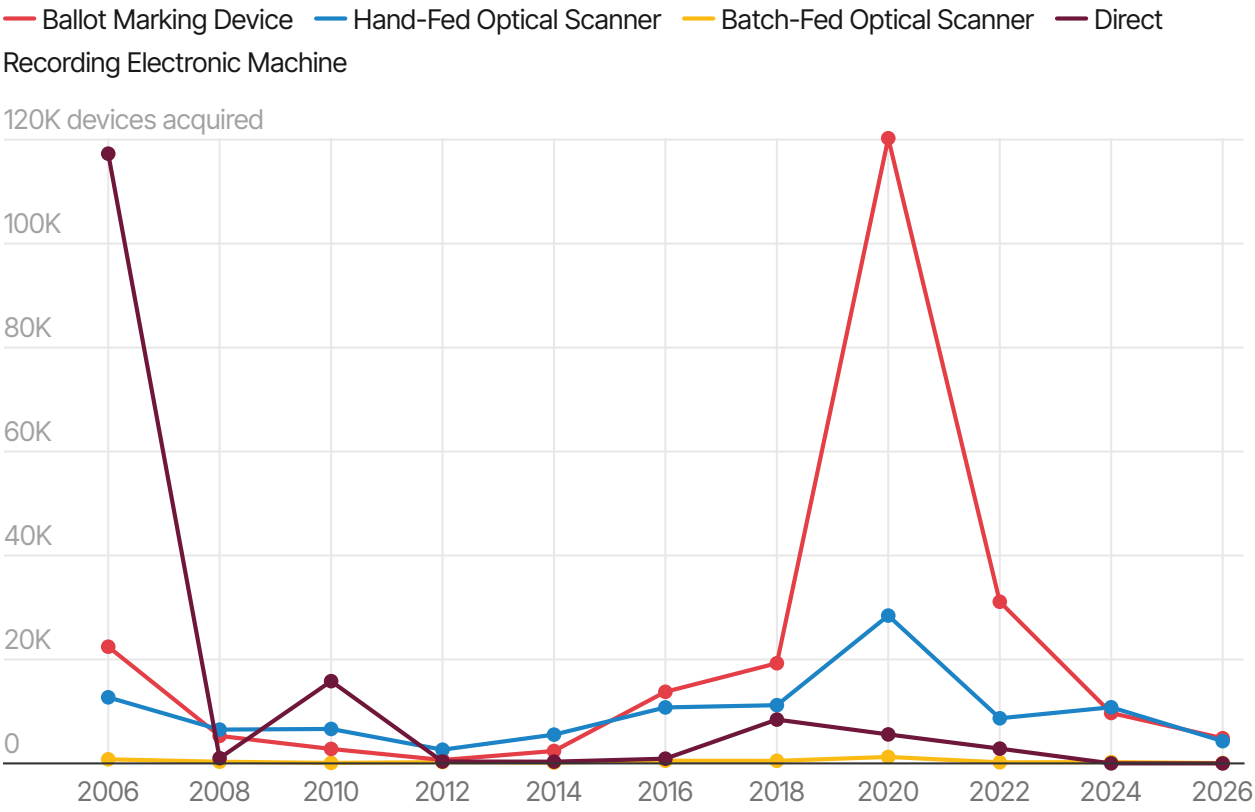
The age of equipment is a result of historical voting equipment purchasing trends. In the years immediately after Congress passed HAVA in 2002, election officials were provided with $3.65 billion in federal funding. The legislation did not require funding to be spent on voting systems, but much of the money was used to procure new DREs, BMDs, and hand-fed optical scanners. After that infusion of funding, officials generally deferred purchasing new equipment until 2014-2016, when they began to procure new hand-fed optical scanners and BMDs. From 2018-2020, Congress authorized $1.205 billion in additional HAVA funds, which corresponded with more equipment acquisitions, including batch-fed optical scanners to aid with the rise of mail-in ballots,

[5] In 2020, Georgia, South Carolina, and several large counties began to use BMDs for all in-person voters on Election Day (i.e., they became "BMD-for-all" jurisdictions). Accordingly, the number of voters living in BMD-for-all jurisdictions went from 1.6% to 17.7%. Unrelatedly, jurisdictions also acquired batch-fed optical scanners to accommodate the COVID-19-related increase in mail-in ballots.

and widespread replacement of paperless DREs.[6] Since then, acquisitions of new equipment have markedly decreased, and inventory overall is aging.

Figure 3. New equipment acquisitions have slowed.

After a wave of new equipment acquisitions from 2018-2022, acquisitions have slowed in recent years. This trend may reflect the timing of VVSG 2.0 adoption and implementation, as many jurisdictions and manufacturers may have expected VVSG 2.0-certified systems to become available and delayed some purchasing decisions during the transition period.



Equipment acquisitions are estimated based on the per-capita number of devices reported by jurisdictions in the 2024 EAVS, and historical data from Verified Voting.

Source: *U.S. Election Assistance Commission, Verified Voting*

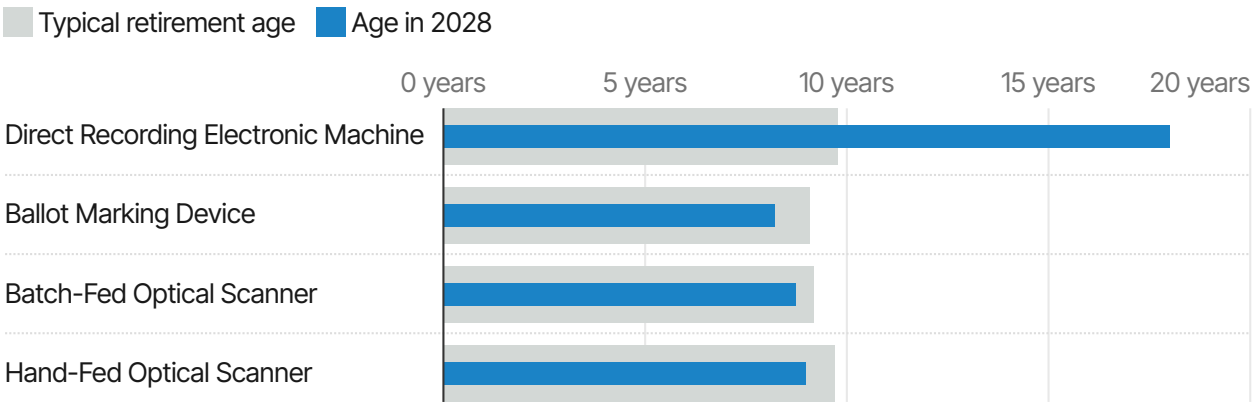
Manufacturers typically describe their equipment as having a life expectancy of about 10 years, and in interviews, election officials generally said they plan on replacing equipment every 10-15 years. (Several officials said they hope to use their current system until it is about 20 years old.) In practice, equipment is

[6] This most recent wave of acquisitions also may have corresponded with the end of life of many of the systems acquired immediately after HAVA was passed. It is not easy to disentangle the impacts of system end of life, new federal funds, and COVID-19 on new equipment acquisitions.

replaced slightly more often than that: Since 2003, equipment (excluding outdated lever and punch-card voting systems, which are no longer used) has been retired on average after 9.7 years. However, the average retirement age varies depending on equipment type. In 2028, optical scanners (both hand-fed and batch-fed) and BMDs will be within one year of their average retirement age, and DREs are already well beyond their average retirement age.

Figure 4. Voting equipment is approaching its typical retirement age.

In 2028, direct recording electronic machines in use will be on average 8.3 years past their typical retirement age. Ballot marking devices and ballot scanners will be within one year of their typical retirement age.



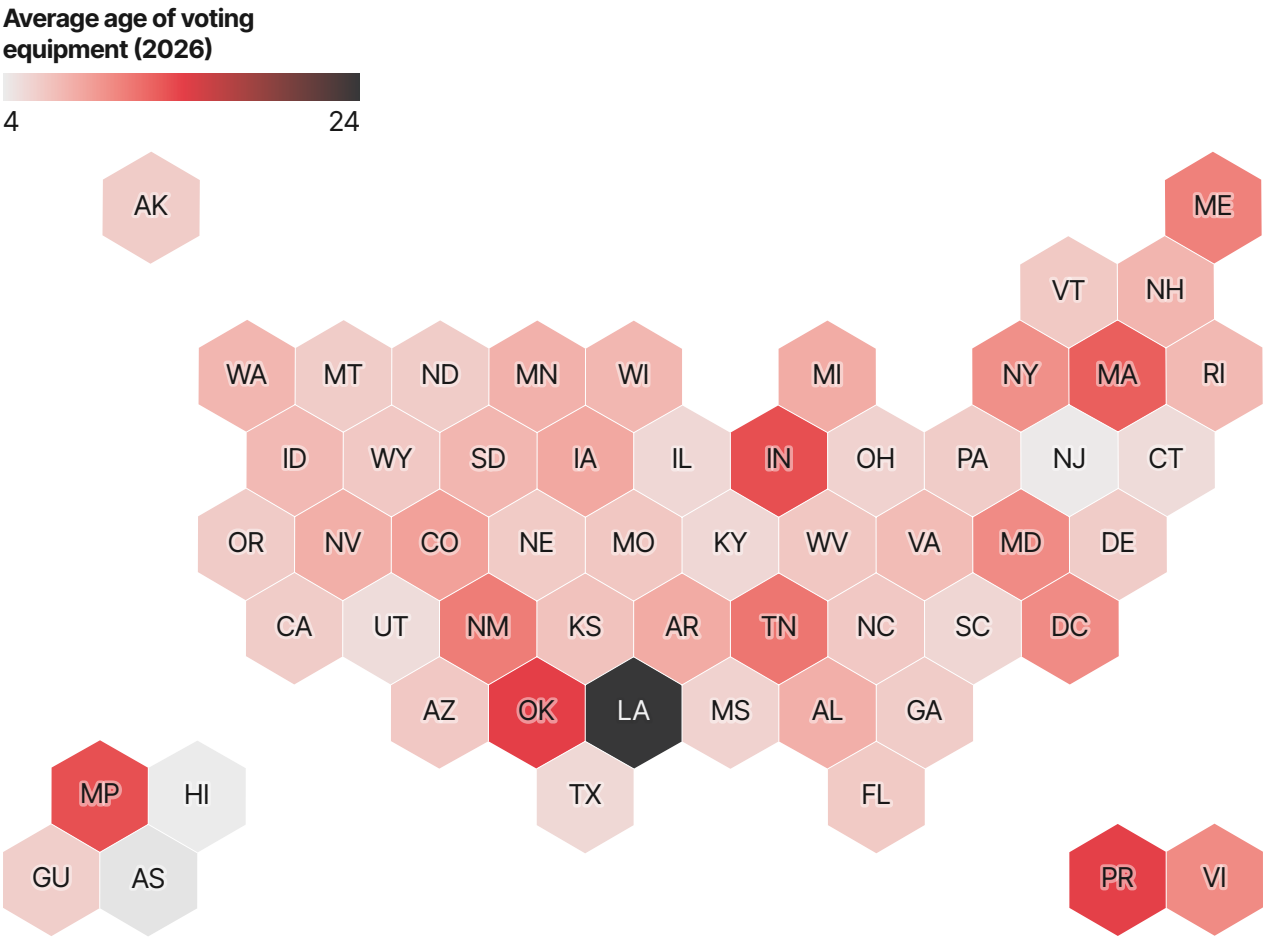
Average equipment ages are weighed by the estimated number of devices in use.

Source: *U.S. Election Assistance Commission, Verified Voting*

The age of voting equipment varies across states.

In 2026, the average age of voting equipment by state will vary from about four years in Hawaii, Mississippi, and South Carolina to about 14 years in Oklahoma, Puerto Rico, Louisiana, and Massachusetts. This, too, varies by equipment type, as some states have a mix of old and new equipment. For instance, some Tennessee counties in 2026 will use DREs that are about 20 years old as well as BMDs that are only about five years old.

Figure 5. The age of voting equipment varies across states.



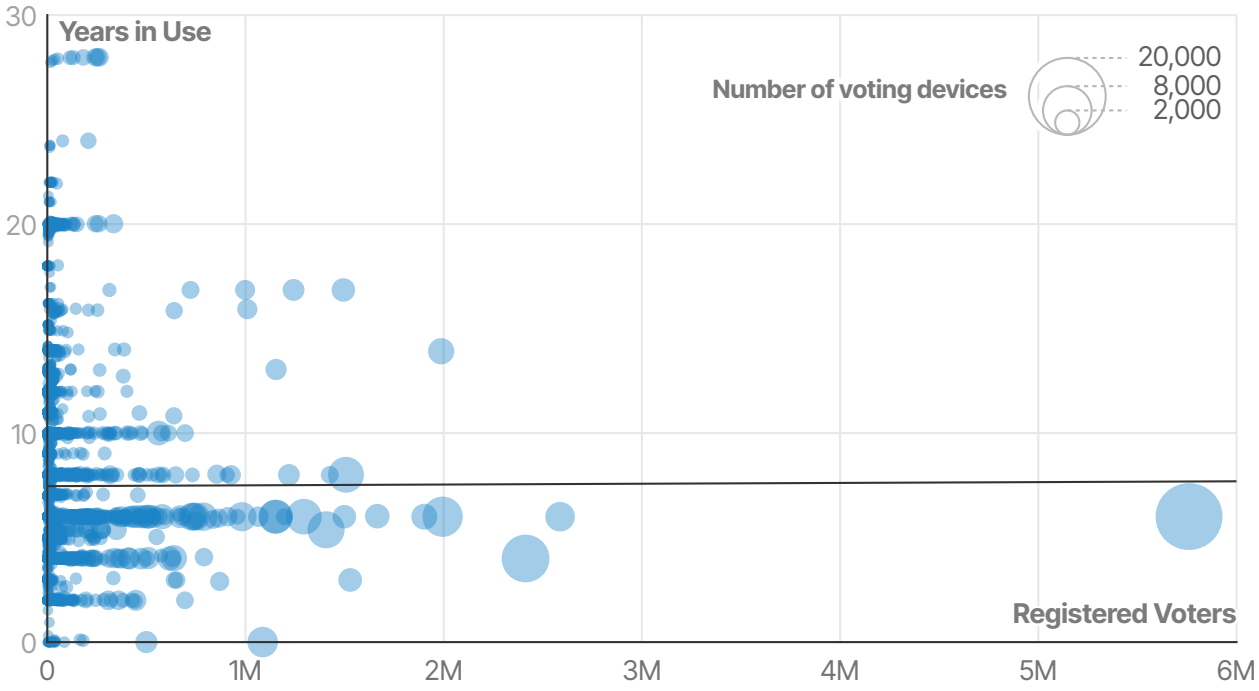
Map data: Tilegrams/NPR

Source: *U.S. Election Assistance Commission, Verified Voting*

Although equipment age varies across states and jurisdictions, it is not easy to predict this variation. For example, one might expect that larger (and often better-resourced) jurisdictions would tend to replace equipment more frequently and therefore have newer equipment in 2026. But this is not the case: The number of registered voters in a jurisdiction is not a good predictor of average equipment age.

Figure 6. Larger jurisdictions do not have newer equipment, on average.

Each point represents one jurisdiction in the national dataset. The trend line shows only a weak relationship between jurisdiction size and age of equipment.



Source: *U.S. Election Assistance Commission, Verified Voting*

What motivates officials to adopt new voting systems?

Even though the nation's voting equipment inventory is diverse, consisting of both old and new systems, many jurisdictions are due for equipment replacements. Officials are indeed interested in upgrading or replacing their systems: In a recent survey of local election officials, which asked what they would invest in if their budget grew, voting equipment topped the list, tied with hiring poll workers.

Which voting system to adopt and when to adopt it is a complex and high-stakes decision for any election jurisdiction. A jurisdiction may use a system for a decade or more, so officials take great care to make sure that a new system meets their needs.

Aging equipment inventory

The primary motivating factor for replacing voting systems is equipment age. Manufacturers and election officials generally assess the lifespan of the average voting system to be about 10 to 15 years. As described above, equipment is typically replaced after 9.7 years on average.

As equipment ages, it becomes more prone to malfunction, more difficult to repair, and less likely to have the latest functionality. This year, Louisiana Secretary of State Nancy Landry said that "it's impossible to find parts" for the state's old voting equipment. Officials we interviewed expressed interest in replacing their equipment long before the point where repair becomes difficult. Some officials pointed to specific equipment components

like battery backup, saying that when battery backups expire, it may be prudent to buy new equipment rather than new batteries for aging equipment due to costs and ability to find replacements.

One official reported that in their state, older scanners were more likely to jam and have other issues that could cause them to be down temporarily. They described this equipment as "mission critical," indicating that many counties in their state needed to replace equipment soon. They said that some of these election officials with aging equipment were eyeing 2.0-certified systems as possible replacements, if such systems were to be certified and available whenever the jurisdiction had funding and was ready to replace their aging equipment.

Voter confidence

For some officials, one of the main reasons to upgrade or replace their equipment is to improve public perception and voter confidence. Even though these benefits can be partly achieved by purchasing a new system certified to VVSG 1.0, officials generally agreed that a 2.0-certified system would further improve voter confidence. One state official reported that local officials are not interested in replacing their systems with new systems certified to the previous version of the VVSG. Instead, with a 2.0-certified system, officials can credibly tell voters that their elections are being conducted with the newest and most secure technology.

One report notes that voter confidence is "based in part on their own experiences with the electoral process and election administration," and is only weakly related to policy (such as voting equipment choices). Indeed, some officials reported to us that new equipment may in fact reduce trust among voters who have grown used to using a particular kind of equipment. But one official explained that public confidence in elections was shaken following an election-related error several years previously. To the extent that outdated equipment is causing errors (or is visibly slow or malfunctioning), upgrading to more reliable equipment may improve trust.

Upgraded accessibility, security, and auditability features

A 2018 Government Accountability Office (GAO) survey of election jurisdictions found that overall performance, accessibility, physical security, and cybersecurity were the most important voting equipment features for respondents.

VVSG 2.0 enhances the requirements for these categories, but officials interviewed and surveyed for this report varied widely in their familiarity with the content of VVSG 2.0. This variation appeared across both state and local officials. A few officials who were familiar with the requirements in VVSG 2.0 highlighted some of the new principles and specifications that seemed most valuable to them. One official said that the auditability improvements were "pretty huge." Another said that the improvements to accessibility would be welcome. Multiple officials said that the new requirements that voting systems use common data formats could be beneficial, either by making it easier for their systems to interoperate or by simplifying results reporting.

However, most officials were only vaguely familiar with the requirements in VVSG 2.0. At the time the interviews were conducted, no VVSG 2.0-certified system was on the market. Some of the officials interviewed believed they would learn more about the system once more certified systems became available. According to one manufacturer, there is a general feeling among election officials that the new guidelines are good and, when informed of the details, they like what they hear, but added that local officials tend to be more focused on their immediate needs.

State certification laws

As described above, most states have a process for certifying voting systems for use. For some states, state certification requires that voting systems be tested to the VVSG[7] or certified by the EAC to conform to the VVSG.

A few states go further, requiring that voting systems be tested under or EAC certified to meet the *most recent* VVSG version. In these states, state certification statutes may be a significant factor driving adoption of VVSG 2.0 systems, because the state is effectively barred from certifying any new systems that are not 2.0-certified. But even in these states, it may be a long time before 2.0-certified systems are certified at the state level or deployed for use because state approval, funding, procurement, and implementation all take time.

What are the challenges to widespread adoption of VVSG 2.0-certified systems?

Despite the above factors that motivate state and local election officials to upgrade or replace their voting systems, several major challenges must be overcome before 2.0-certified systems are deployed widely.

Increased and uncertain costs

Election officials are deeply cost-conscious when they make decisions about equipment. Among election officials interviewed and surveyed for this report, cost was the most frequently cited barrier to adopting 2.0-certified systems. One statewide election official noted that local officials need to answer voter questions about equipment "every day," and that numerous county election officials would replace their systems if financial considerations were not a factor.

Adopting new voting systems has always been an expensive undertaking, and while 2.0-certified systems promise security and usability improvements, they are also estimated to be more expensive than previous systems. Most state officials interviewed supported updating their voting systems to 2.0-certified systems, but all acknowledged the sobering financial realities of replacing systems.

Meanwhile, manufacturers reported some uncertainty about how they will price their products, in part because of fluctuating component costs and how this could affect the industry in the coming years. One manufacturer noted that sourcing parts is already difficult, so increased costs alone would likely not be enough to force a change in suppliers. Another said they would try to absorb cost increases rather than pass them on to jurisdictions, but it is unclear if all manufacturers will adopt the same approach.

State legislation adds another layer of uncertainty. Some lawmakers have proposed requiring that all voting system components be manufactured in the United States. Manufacturers reported increasing attempts to source U.S.-produced parts based on supply chain security concerns to comply with potential state laws or potential federal regulations, but they stressed that achieving fully U.S.-manufactured systems would be extremely challenging, if not impossible.

[7] Some states require testing to the VVSG or testing by VSTLs to state guidelines, but do not require EAC certification.

Episodic and unpredictable federal funding

State and local budgets are often insufficient for supporting the large-scale replacement of voting equipment.[8] Federal funds have played a crucial role, but appropriations have been episodic and unpredictable. This lack of sustained investment makes it hard for jurisdictions to plan for long-term system replacements, because they do not know if or when additional support will arrive. The GAO survey of election jurisdictions found that in some places, a lack of HAVA funding delayed equipment replacement or made it so they were unable to acquire new equipment that would meet their needs.

Voting equipment replacements have often followed influxes of federal funding. The first modern wave of voting system acquisitions came in the wake of HAVA, which allocated billions of dollars for states to replace antiquated machines that were problematic in the 2000 election. Another wave of equipment replacements (see Figure 3) roughly coincided with increased federal funding for elections in the form of HAVA Election Security Grants, of which over $138 million were spent on voting equipment between 2020 and 2023. The CARES Act, passed during the pandemic, included $400 million to help election officials respond to COVID; some officials used these funds to buy batch-fed ballot scanners to aid in processing the influx of mail-in ballots. However, because these funds are typically allocated across the entire country, the amount available to any one state or jurisdiction is often not enough to support full equipment replacement.

Election officials have long stressed the importance of consistent, ongoing investment in election infrastructure — not just during high-profile moments like the aftermath of the 2000 election or a global pandemic. A consistent federal funding stream would enable jurisdictions to upgrade or replace their systems earlier and in accordance with equipment life cycles.

There appears to be an industry trend toward spreading the cost of voting systems over time through leasing or amortized payment plans rather than paying the full cost up front, and a consistent federal funding stream would also support jurisdictions that go this route.

Lengthy state certification processes

As described above, every state maintains its own regulatory and technical review process governing the use of voting systems. Many states require their own independent certification or technical review process before they certify a system for usage in their jurisdictions, and this review may include additional requirements not covered at the federal level. Several state officials interviewed for this report described their certification processes as lengthy, sometimes adding months or even a year to the overall timeline for deployment.

State requirements that may be misaligned with VVSG 2.0

In some states, laws specifically reference outdated federal standards, such as VVSG 1.0 (2005), VVSG 1.1 (2015), or even the Voting System Standards (the VVSG predecessor) adopted by the Federal Election Commission. Because these older versions may include requirements that conflict directly with those in VVSG 2.0, such statutes could effectively prohibit the use of newer, 2.0-certified systems.

Other states may not require specified versions of standards but still impose statutory requirements that are incompatible with VVSG 2.0. These legal constraints can also present obstacles to adoption of 2.0-certified systems.

---

[8] Local jurisdictions generally pay these costs. A 2018 GAO survey of election jurisdictions found that jurisdictions with 79% of the population nationwide use local funds to pay part of the cost of new voting equipment. Only 11 states indicated that they cover all costs for acquiring new equipment.

In certain cases, election officials may be able to work around these obstacles, including through administrative interpretation. However, in states where election law is interpreted very narrowly or applied very strictly, state legislators may need to take action to ensure that jurisdictions can adopt the most modern, secure, and accessible voting systems.

Small manufacturer pool

At the time of publication, only two manufacturers (Hart InterCivic and Smartmatic) have completed certification to VVSG 2.0. The limited pool of available manufacturers restricts procurement options for election officials across the country. This challenge is exacerbated when jurisdictions are reluctant to switch manufacturers; officials cited training demands, familiarity with existing systems, long-standing relationships, and the ability to get a deal when trading in old equipment to the same manufacturer.

Even if a system receives federal certification, the manufacturer's interest and capacity may also be an obstacle to pursuing sales. From the manufacturer's perspective, entering a new market (whether state or local) can be time-consuming and may not be a priority compared with servicing existing clients. State certification is a costly and time-consuming process, and even once state certified, expanding into new local markets may not be worth it. One state official described an attempt to expand a manufacturer's presence in their state but said that the manufacturer only appeared interested in servicing the largest county.

Procurement

Even after systems are certified and funding is secured, procurement remains a barrier to expedient system replacements. Government procurement is notoriously complex, requiring officials to navigate public bidding requirements, state regulations, and local approval processes. These hurdles can slow or derail upgrades to voting systems.

Louisiana, for example, has been attempting for years to replace its now decades-old voting equipment. The state selected a manufacturer through a bidding process in 2018, but the governor voided the contract after "the state's chief procurement officer [said] the secretary of state's office mishandled the bid process, not following legal requirements." A 2021 state law then created a new requirement that systems be assessed for compliance with a set of certification standards before bidding, further delaying procurement. At the time of writing seven years later, the state is now conducting public testing of six voting systems from manufacturers who intend to bid for the contract.

Public speculation further complicates the already lengthy procurement process as well; voting system manufacturers have been a frequent target of public scrutiny since 2020, making it difficult for election offices to select a voting system that satisfies the varied interests of stakeholder groups. Even after procurement, voting systems often continue to be the target of litigation.

When will VVSG 2.0-certified systems be widely deployed?

Now that two systems have been certified to VVSG 2.0 and other systems are being tested, it is reasonable to ask: *When will we see the widespread deployment of 2.0-certified systems? When will election officials and voters begin to see the security and usability benefits?*

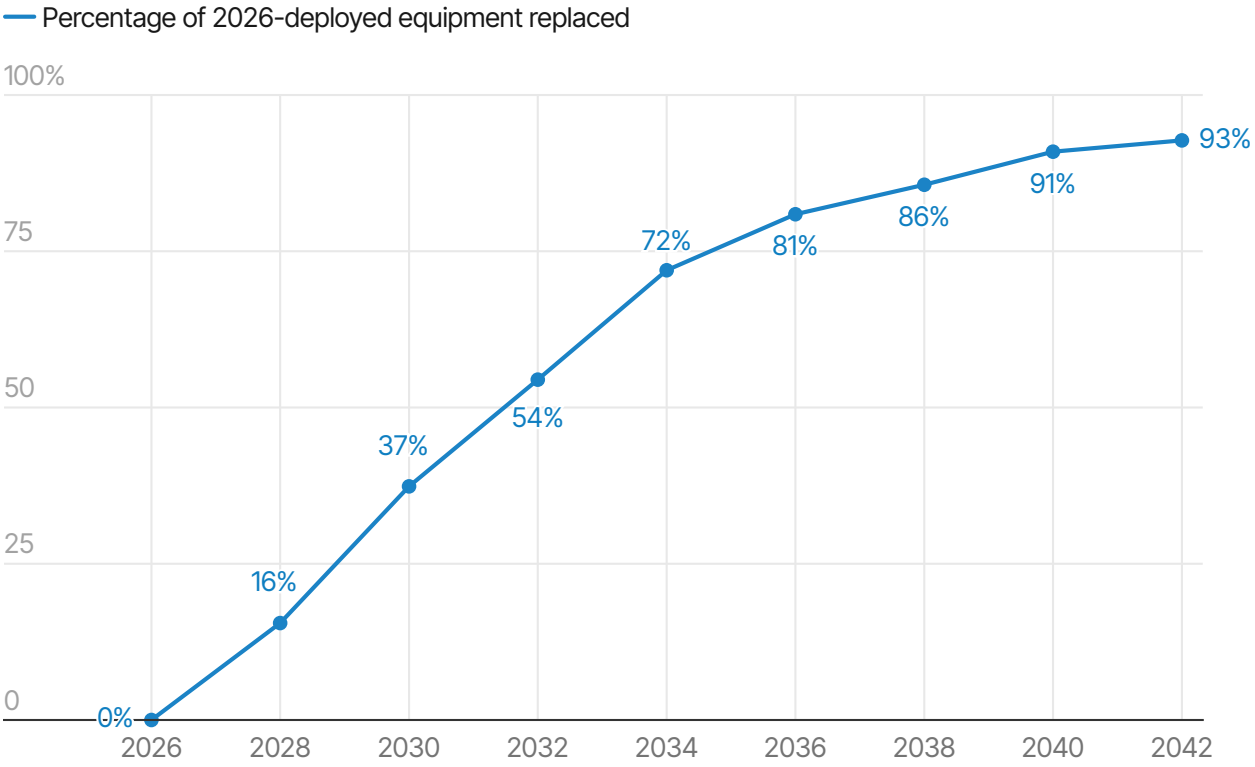
As discussed above, deployment does not immediately follow federal certification. Instead, a number of factors affect purchasing decisions and timelines, most significantly the age of existing equipment and the availability of funding.

At the National Association of State Election Directors (NASED) Winter Conference in February 2025, the American Council for Election Technology (ACET), a trade association representing voting system manufacturers, projected that "several" systems would be certified by 2027, with "full scale, nationwide deployment and use in elections" beginning around 2029. In this section, we expand on that industry estimate by examining historical replacement patterns and forecasting when VVSG 2.0-certified systems are likely to be widely deployed.

More than half of voting equipment will be replaced by 2032, but not all replacements will be 2.0-certified.

One important factor influencing deployment timelines is the age of existing equipment in the field. Officials feel pressure to replace aging systems, which may be costly to maintain or not have modern security, accessibility, and usability features. We analyzed historical patterns of equipment retirement and replacement. By applying those patterns to the current landscape (see Methods), and by projecting forward from the systems expected to be in use in 2026, we conducted a simulation to estimate when jurisdictions are likely to retire their current equipment and acquire new ones.

Figure 7. More than half of voting equipment in use in 2026 will be replaced by 2032.



Forecasted equipment replacement rates are based on historical patterns, which may not reflect future trends.

Source: *U.S. Election Assistance Commission, Verified Voting*

This simulation accounts for the age of each piece of currently deployed voting equipment and estimates the likelihood that it will be replaced in coming years. It shows that about 16% of the voting equipment inventory

is likely to be replaced by the 2028 presidential election, about 37% will be replaced by the 2030 midterm election, and the majority (over 54%) will be replaced by 2032.

It is not clear, however, that these replacements will be with 2.0-certified equipment. Not all manufacturers have yet submitted systems for testing to VVSG 2.0. These manufacturers (and even the manufacturers who have submitted or had systems certified) will continue to sell and support their 1.0-certified systems. Some jurisdictions replacing their systems may want to stay with their current manufacturer, which may not yet sell a 2.0-certified system (see above, *Small manufacturer pool*).

Some other factors might cause equipment to be replaced on a slower timeline than we forecast here. First, the forecast assumes that historical replacement trends will continue. But equipment deployed in the last 10 years or so may prove more reliable, potentially leading jurisdictions to keep it in service for longer. Second, funding may be more of an obstacle than it has been in the past. As of the date of publication, ACET estimates that VVSG 2.0 systems are expected to cost 20%-50% more than previous generations. State and local funding might not be enough to enable widespread replacement.

On the other hand, some jurisdictions have delayed replacement until 2.0-certified systems became available. If so, there may be pent-up demand for 2.0-certified systems, leading replacement to happen faster than projected; however, interviews with election officials do not suggest that this would be a widespread trend.

This forecast provides a data-driven baseline estimate for when we might expect large-scale replacement of currently deployed, mostly VVSG 1.0-certified voting equipment. The likelihood of system replacements in the coming years presents an opportunity: Jurisdictions may be in a position to choose VVSG 2.0-certified systems and gain the associated benefits. Whether they ultimately do so will depend on the availability of state and federally-certified systems, funding levels, and other challenges described above.

How much will it cost to deploy VVSG 2.0-certified systems nationwide?

Despite the challenges that must be overcome before VVSG 2.0-certified systems are adopted on a large scale, we can forecast what it would cost for VVSG 2.0-certified equipment to be purchased by every jurisdiction nationwide.

Replacing all voting equipment with VVSG 2.0-certified equipment in 2028 would cost about $2.71 billion.

We estimate that if every jurisdiction were to replace all their BMDs, hand-fed ballot scanners, batch-fed ballot scanners, and DREs with VVSG 2.0-certified equipment in 2028, it would cost $2.71 billion.

Table 1. Voting equipment cost

Estimate of the cost of purchasing new VVSG 2.0-certified BMD's, hand-fed scanners, and batch-fed scanners across the U.S.

Jurisdiction type	Jurisdictions	Registered voters	BMDs (cost)	Hand-fed scanners (cost)	Batch-fed scanners (cost)	Total cost
BMD/DRE-for-all jurisdictions	838	71.98M	$1.08B	$264.19M	$66.18M	$1.41B
HMPB+BMD jurisdictions	5.62K	163.09M	$455.73M	$639.58M	$208.86M	$1.3B
Total	**6.46K**	**235.07M**	**$1.53B**	**$903.77M**	**$275.04M**	**$2.71B**

BMD/DRE-for-all jurisdictions are jurisdictions that currently use BMDs or DREs for all in-person voting on Election Day.

Source: *U.S. Election Assistance Commission, Verified Voting*

We determined the number of pieces of equipment that would need replacement by using the equipment reported in the 2024 release of the Election Administration and Voting Survey, the EAC's biennial survey of election officials. To estimate the cost of each piece of equipment, we used the results of an informal survey of its members that ACET conducted.

Finally, we computed our total cost estimates by multiplying the number of pieces of equipment by the per-unit cost estimates (see Methods for more detail).

To our knowledge, this is the first time that the cost of replacing all voting equipment with VVSG 2.0-certified equipment has been estimated. But the number is compatible with previous estimates of the cost of replacing some subsets of voting equipment. A 2022 MIT report estimated that it would cost between $1 billion and $3 billion to buy new equipment.[9]

Our estimate is also plausible in light of previous public contracts. For example, Georgia's 2019 contract for a new statewide system cost $107 million (or $146 million in projected 2028 dollars)[10]; we estimate that new BMDs and scanners in 2028 would cost the state $182 million.

Our estimate carries several important caveats:

- ✓ For simplicity's sake, we estimate the cost of replacement as if it were to occur all at once in 2028, but this is unlikely to reflect how replacement will happen in practice. Not all jurisdictions will replace their equipment at once; those jurisdictions with older equipment (and sufficient available funding) will likely replace their equipment first. Moreover, the jurisdictions that replace their equipment may spread the cost over several years through a lease or a multiyear purchase agreement. A more detailed analysis could combine

[9] A 2024 Brennan Center analysis looked at the cost of replacing smaller subsets of devices: $203 million to replace devices first fielded in 2014 or earlier; or $150 million to replace devices that are no longer being manufactured.
[10] Note that this amount appears to include contracted costs for scanners, BMDs, electronic pollbooks, an election management system, training, and 10 years of license fees. An alternative figure for comparison could be the initial outlay of $69 million (or $94 million in projected 2028 dollars) for BMDs and scanners.

these cost estimates with a model of likely equipment replacement (along the lines of what we provided in the section above), producing an annual appropriations profile to guide funding decisions.

- ✓ Our estimate is based on the current number of registered voters and deployed devices. It does not account for potential population growth that could increase the number of devices needed in the future.
- ✓ The per-unit cost estimates we rely on reflect the upfront cost of BMDs and scanners only. They do not include hardware and software costs related to election management systems or electronic pollbooks. Nor do they include annual fees related to service, maintenance, training, or software licensing, which might be paid to a manufacturer as part of a voting system replacement.
- ✓ Our estimate assumes the replacement of every BMD, DRE, or scanner currently deployed. However, some newer currently deployed voting system components may only require minor updates to bring them into compliance with 2.0. Achieving 2.0 compliance should be cheaper and easier for jurisdictions with these newer components.
- ✓ The per-unit cost estimates are derived from current equipment pricing and adjusted using manufacturer estimates of expected VVSG 2.0 cost increases.

Additionally, it is important not to mistake our estimate for a comprehensive accounting of what it costs to run elections, or even all the costs associated with acquiring and using new equipment. Our estimate does not include, for example:

- ✓ Other election technology, such as election management systems, electronic poll books, or ballot-on-demand printers
- ✓ Operational expenses for deploying, storing, and maintaining equipment
- ✓ Annual fees paid to voting system manufacturers for support, maintenance, and software licensing and maintenance (which, over the lifespan of a voting system, may match or exceed the cost of the initial acquisition)
- ✓ Labor for programming devices, training poll workers, troubleshooting problems, or educating voters on how to use new systems, or
- ✓ Future price increases related to market conditions, tariffs, supply chain disruptions, or sourcing changes.

All these costs are substantial and must be factored into any long-term investment in the nation's election infrastructure.

Congress should consider providing sustained funding for voting system upgrades and replacements to supplement local and state support.

The transition to VVSG 2.0-certified systems would be accelerated if Congress made sufficient federal funds available to support the cost of voting system replacements. Local and state governments bear the vast majority of ongoing election administration costs, but many officials interviewed for this report stated that past rounds of federal funding made it possible to replace aging devices, given high upfront costs.

[11] Election Systems & Software (ES&S) has indicated that some of its equipment is "VVSG 2.0-compatible" (even though it has not yet been certified) and that therefore customers will "not necessarily" need to purchase an entirely new system to achieve 2.0 compliance.

But federal support has been episodic. Since the passage of the Help America Vote Act in 2002, federal funding for election equipment has come in unpredictable waves, leaving states and local jurisdictions uncertain about if or when they can count on outside support.

The move to VVSG 2.0-certified systems represents a generational shift in voting technology, one that brings with it both new security protections and implementation costs. If Congress intends for this next generation of systems to be widely adopted, it should consider making federal funding available on a long-term basis, allowing state and local governments to plan ahead. A sustained, flexible approach to funding would help ensure that no part of the country is left behind: Jurisdictions with older inventory could replace systems sooner, while those with newer inventory or slower certification and procurement processes could transition over a longer timeline, and states and localities could better plan phased replacements around the amount and timing of allocations.

Consistent funding for the EAC is also essential for ensuring that systems are certified in a timely and accurate manner, and that funds are delivered to states for purchasing them. The Testing and Certification Program requires resources to operate effectively. Moreover, if Congress provides new grants for voting system upgrades and replacements, the EAC will be responsible for administering those funds, a task that requires its own staffing and operational capacity. Without stable funding for these functions, even well-funded jurisdictions could face delays in obtaining certified systems.

Conclusion

The transition to VVSG 2.0-certified voting systems is one of the most important modernization efforts in U.S. election infrastructure in the coming decade. As detailed in this report, VVSG 2.0 sets a higher bar for security, accessibility, and auditability. Even though a few systems have been certified to VVSG 2.0 and more are in the pipeline, the path from certification to nationwide deployment remains long and complex.

The findings above point to a clear reality: Voting systems are at or nearing their expected lifespan, and many jurisdictions are considering or will soon consider replacement systems. The choices made now — by manufacturers, state and local officials, and Congress — will determine whether VVSG 2.0-certified systems will be broadly in place by the end of the decade, or whether jurisdictions will continue relying on legacy systems.

An infusion of federal money could accelerate the transition to VVSG 2.0-certified systems, but sustained and predictable federal investment would go even further to support American elections. Previous rounds of federal funding have enabled system replacements, but this model of episodic appropriations leaves jurisdictions unable to plan or budget for system replacements in sync with equipment life cycles. A reliable funding stream would allow officials to plan upgrades and replacements as needed and train staff well ahead of deployment.

Although the road to widespread deployment remains complex, clear federal leadership can help election officials transition to 2.0-certified systems in a way that strengthens the resilience, security, and accessibility of elections for years to come.

Methods

Quantitative analyses

All code and data for quantitative analyses are available on GitHub.

Current equipment age and typical retirement age

To analyze the age and typical retirement age of voting equipment, we used two datasets: historical voting equipment data collected in the Verified Voting Verifier (downloaded on September 15, 2025), and voting equipment counts reported by election officials in the 2024 Election Administration and Voting Survey, the EAC's biennial survey of election officials. The datasets complement each other: The Verifier has clean historical data but no equipment quantities, and EAVS has some information on equipment quantities.

The Verifier dataset includes, for every nationwide federal election year since 2006, a description of the make and model of various categories of election equipment (e.g., ballot marking device or hand-fed optical scanner) for every election jurisdiction. It also indicates the first year that the equipment was in use, allowing us to analyze the age of the devices, as well as the typical age at retirement.[12] It also indicates the "Election Day Marking Method" for a particular jurisdiction and year, which has a large impact on equipment counts (e.g., a jurisdiction that uses BMDs for all voters has far more BMDs per voter than a jurisdiction that uses hand-marked paper ballots for most voters).

We restricted our analysis to equipment types that are both quantified in EAVS and typically included as components in voting systems submitted for certification to the VVSG (i.e., we included BMDs, optical scanners, and DREs and excluded electronic poll books).

To determine the age of a piece of equipment when it was retired, we grouped the dataset by jurisdiction and equipment model. We flagged the last year in which each unique equipment model was observed — excluding 2026, the most recent year in the data — as the equipment's final year in use. This approach assumes that if a model was, for a given jurisdiction, observed and then not observed, it was retired.

When calculating overall average equipment age, we weighted equipment age by the estimated number of devices in a given jurisdiction. To estimate the number of devices, we used the 2024 release of EAVS to determine the average number of voters per device. These rates were applied to jurisdictions in Verified Voting's dataset going back to 2006, based on each jurisdiction's Election Day Marking Method and number of registered voters, each year. The following section details how we used the 2024 EAVS data to estimate the number of voters per device.

Estimating number of voters per device

Among other data, EAVS includes jurisdiction-level information on the quantity and model of various types of election equipment deployed in the 2024 general election. However, this data is not reported by all jurisdictions, and some jurisdictions do not report it in a complete fashion. To account for this, we filtered the dataset to the jurisdictions that reported the most complete and generalizable data and, using that data, generalized to the other jurisdictions going back to 2006. We followed this procedure:

- ✓ We applied two filters to the dataset. These filters reduced the dataset to 3,617 of the 6,461 jurisdictions (56%) reporting to EAVS, representing 194.8 million of 235.1 million (82.9%) registered voters.
    - ✓ **Filter 1**: We excluded jurisdictions if they said they used a particular kind of equipment but did not report how many pieces of equipment they had. To be more specific, EAVS questions F3-F6 ask officials if they have DRE machines without a voter-verified paper audit trail (VVPAT), DRE machines

[12] It is possible that in some cases this data slightly overestimates equipment age. A jurisdiction may replace old equipment with new equipment of the same model; the "first year in use" data may still refer to the year that the model was first used, even though the equipment itself may be new.

with VVPAT, BMDs, or scanners. If, for example, a jurisdiction said they had BMDs but did not report quantity for at least one particular model, we excluded that row from the dataset because we could not get a complete picture of that jurisdiction's equipment inventory. This excluded 2,443 jurisdictions, representing 35.3 million voters total.

- ✓ **Filter 2**: We excluded jurisdictions that reported having no equipment. This excluded an additional 401 jurisdictions, representing 4.9 million voters total.

- ✓ For each jurisdiction, we added up the number of pieces of equipment in four categories: DREs with VVPAT, DREs without VVPAT, hand-fed scanners, and batch-fed scanners. Because hand-fed and batch-fed scanners are reported as a single category in EAVS, we manually identified which scanner models are hand-fed or batch-fed.

- ✓ We split the jurisdictions based on the Election Day Marking Method as determined by Verified Voting (e.g., "Hand-marked paper ballots and BMDs," "BMDs for all voters," "DREs with VVPAT for all voters," etc.). We determined, separately for each category, the number of pieces of equipment per registered voter.[13] This information can be seen below.

Table 2. Number of registered voters per device, by election day marking method

For jurisdictions that use assistive devices (BMDs or DREs) for all voters, the number of voters per device is similar, between 319 and 381. Likewise, for jurisdictions that use hand-fed scanners for all voters (i.e., jurisdictions that use "Hand-marked paper ballots and BMDs" or "BMDs for all voters"), the number of voters per scanner is similar, at about 2 thousand.

Election day marking method	BMD	Hand-fed scanner	Batch-fed scanner	DRE with VVPAT	DRE without VVPAT
Hand-marked paper ballots and BMDs	2K	2K	83K	451K	758K
BMDs for all voters	381	2K	117K	28K	85K
DREs with VVPAT for all voters	49K	124K	147K	370	-
DREs without VVPAT for all voters	-	612K	-	-	319
Hand-marked paper ballots; Direct recording assistive interface without VVPAT for accessibility	-	1K	611K	-	-

Only includes "Election day marking method" categories that consist of at least 50 jurisdictions after data pre-processing.

Source: *U.S. Election Assistance Commission, Verified Voting*

[13] Because North Dakota has no voter registration, and therefore zero registered voters in EAVS, we used the number of eligible voters per county as reported by the North Dakota secretary of state.

Equipment replacement timeline forecast

To forecast future equipment replacement, we used survival analysis techniques. Survival analysis is well suited for analyzing data where the event of interest has not yet occurred for all observations. In medical research, the event of interest may be patient death; in our case, the event of interest is equipment retirement. While most of the Verified Voting dataset (which goes back to 2006) consists of equipment that was retired before 2026, a substantial portion (45%) is still expected to be in use in 2026. For these cases, the date of equipment retirement is unknown, making this dataset suitable for survival analysis techniques.

To estimate the likelihood of equipment retirement over time, we initially fit a Cox proportional-hazards model using equipment type and the number of registered voters as covariates. The goal was to assess whether these factors were systematically associated with earlier or later retirement. However, we found no statistically significant relationship between these predictors and the hazard of retirement. As a result, we did not use them to forecast equipment replacement.

Instead, we used a non-parametric approach and fit a Kaplan-Meier estimator for all equipment types combined, weighted by the number of devices. This estimator gives us the survival curve — that is, the probability that equipment remains in use — for each year of age. From the survival curve, we derived the hazard function, which captures the conditional probability that a piece of equipment is retired and replaced in a given year, given that it has been in use up to that point. We then ran a forward simulation starting from the set of equipment expected to be deployed in 2026, using the hazard function to probabilistically determine whether devices would be retired and replaced in each future nationwide federal election year.

Equipment replacement cost estimate

To determine the cost of deploying VVSG 2.0-certified systems nationwide, we estimated (a) the number and type of voting device required to be purchased, and (b) how much it would cost to replace each device with a VVSG 2.0-certified equivalent. To compute our total cost estimates, we multiplied the estimated number of devices by the per-device cost estimates.

Estimating the number of devices to purchase

To estimate the number and type of voting equipment required to be purchased, we used a similar procedure as above to estimate the number of devices used per registered voter. However, the aim this time was not to estimate the historical number of devices used by jurisdictions, but the number of devices jurisdictions will use when using a 2.0-certified system. Because of the paper trail requirements in VVSG 2.0, it is expected that there will be no jurisdictions that use DREs for all in-person voting (i.e., "DRE-for-all" jurisdictions). The equipment inventory in these jurisdictions will not be reflective of the inventory that a jurisdiction using a 2.0-certified system will have. (More specifically, DRE-for-all jurisdictions use far fewer hand-fed optical scanners; see Table 2 above.) To account for this, we added a third filter to the two filters described in the above "Estimating number of voters per device" section:

- ✓ **Filter 3**: We excluded jurisdictions that Verified Voting identifies as a jurisdiction that uses DREs for all in-person voters on Election Day. This excluded an additional 190 jurisdictions, representing 11.3 million voters total.

With this additional filter, the dataset included 3,427 of the 6,461 jurisdictions (53%) reporting to EAVS, representing 183.5 million of 235.1 million (78.1%) registered voters.

We split those jurisdictions based on whether Verified Voting identifies them as using BMDs for all in-person voters on Election Day (i.e., "BMD-for-all" jurisdictions). Of the 3,427 jurisdictions, 539 fall into this category

and 2,888 do not. Separately for BMD-for-all jurisdictions and other jurisdictions, we used the reported number of registered voters to determine the average number of DREs, BMDs, hand-fed scanners, and batch-fed scanners per registered voter. (These rates are similar to those in Table 2.)

Having determined the average per-voter number of BMDs, DREs, and scanners, we now imputed the data in the 3034 jurisdictions that we originally filtered out, using the number of registered voters in those jurisdictions. We treated DRE-for-all jurisdictions as BMD-for-all jurisdictions (using the assumption that DRE-for-all jurisdictions will become BMD-for-all jurisdictions when they move to VVSG 2.0-certified systems). We then treated all DREs as if they were BMDs (using the assumption that DREs in non-DRE-for-all jurisdictions will be replaced with a similar number of BMDs).

The above procedure provided, for every jurisdiction, an estimate of the number of hand-fed scanners, batch-fed scanners, and BMDs that will need to be purchased in a wholesale system replacement. The estimate accounts for the number of registered voters and whether a jurisdiction is BMD-for-all or DRE-for-all.

Estimating the cost of VVSG 2.0-certified devices

To estimate the cost of replacing each scanner and BMD, we first consulted "The Price of Voting" (2021) by Matthew Caulfield, Andrew Coopersmith, et al., which analyzed pricing information sourced from hundreds of election equipment contracts; the report is the most comprehensive source of information on the cost of deployed systems. Appendix B includes, for a variety of equipment models, the median price, and the number of devices included in the contracts they analyzed. We manually categorized each model as a hand-fed scanner, batch-fed scanner, DRE, or BMD. For each category, we computed a weighted average of the median prices, using the number of devices included in the contracts. We checked these numbers against contracts available on the internet and contracts provided to us by election officials that we surveyed.

Replacement equipment is likely to cost more than these historical estimates. To estimate these costs, we contacted the American Council for Election Technology (ACET), a trade association representing voting system manufacturers. ACET conducted an informal survey of its members, directing them toward the historical pricing estimates published in Caulfield, Coopersmith, et al. (2021), and requested that members estimate how much more they expected 2.0-certified models to cost. ACET members indicated that they expected hand-fed and batch-fed scanners to cost 20%-30% more, and BMDs to cost 35%-50% more. We took the average of each cost increase range and multiplied it by the 2021 costs in Caulfield, Coopersmith, et al. We used that result as our estimate of the cost of voting equipment in 2026, roughly when manufacturers expect to start selling their 2.0-certified equipment.

We then took these manufacturer's 2026 cost estimates and estimated the cost in 2028 by using inflation projections from the Congressional Budget Office.

Table 3. Historical and projected voting equipment costs

Mean of median equipment prices identified by Caufield, Coopersmith, et al. (2021), and projected equipment prices for 2028.

Equipment Type	Average cost (2021)	Projected cost (2028)
BMD	$3,665	$5,598
Hand-fed scanner	$5,611	$7,517
Batch-fed scanner	$80,157	$107,388

Mean of median equipment prices identified by Caufield, Coopersmith, et al. (2021), and projected equipment prices for 2028.

Source: *Caufield, Coopersmith, et al. (2021), with cost increase estimates from the American Council for Election Technology and inflation projections from the Congressional Budget Office*

Qualitative information

To better understand the process — and challenges — of designing, testing, certifying, and deploying new voting systems, we received information from subject-matter experts, state and local election officials, and representatives of voting system manufacturers and test labs.

We collected information by reaching out to specific contacts via email, members of the BPC Task Force on Elections, contacts of the EAC Field Services team, and in-person contacts. In some cases, participants responded to a set of questions by email, or they completed a survey. In other cases, we held virtual or in-person interviews. Interviews were semi-structured, working from a set of predefined questions (which we sent ahead of time upon request) but diverging to cover particular subjects of interest and expertise in greater depth.

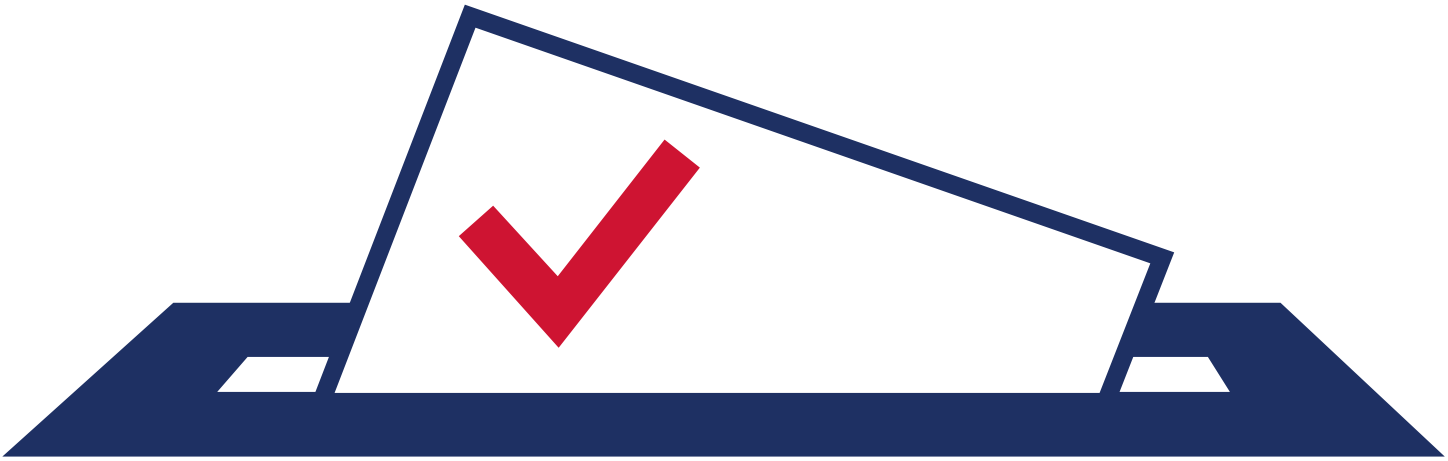
Interviews were conducted both before and after the signing of the "Preserving and Protecting the Integrity of American Elections" executive order on March 25, 2025, which may have affected sources' answers and assessments.

State and local election official interview participants were selected to reflect a diverse cross-section of states, considering election system certification and procurement processes, election authority structures, and population.

For the most part, interviewees were offered anonymity to encourage candor. Assessments made in this report are sometimes derived from interviews and sometimes from public information.

Acknowledgments

We thank everyone who provided their insights via interview or survey. For helpful comments and conversations, we also thank Megan Maier and Warren Stewart of Verified Voting and Matthew Caulfield of the Gabelli School of Business at Fordham University.



EAC.gov
(866) 747-1471 (toll free) or (202) 451-2031

633 3rd Street NW, Suite 200
Washington, DC 20001