

# Elections 2030

A Nonpartisan Blueprint  
For Effective U.S. Election Administration

December 2020





## About the OSET Institute

The Open Source Election Technology (“OSET”) Institute is a 501(c)(3) tax-exempt nonpartisan, nonprofit election technology research corporation chartered with research, development, and education in election technology innovation.

The Institute’s flagship effort, the [TrustTheVote™ Project](#) is developing [ElectOS™](#) a next generation higher integrity, lower cost, easier to use election administration and voting technology framework freely available for any election jurisdiction to adopt, and have professionally adapted and deployed. ElectOS and all open source election technology is being designed and engineered per the requirements and specifications of election officials, administrators, and operators through a Request For Comment (RFC) process.

As part of our research, development and education mission, from time to time, the Institute produces Briefings and other content to inform stakeholders, supporters, and the public about issues of election technology innovation and integrity.

*Threats to our election administration  
technology infrastructure are  
inherently threats to our democracy*

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## Executive Summary

With the completion of the 2020 Electoral College vote in all 50 states, the nation’s worst fears appear to be subsiding. Chaos has not ensued; no dramatic cyber-attacks have emerged; and despite ongoing political debates and litigation, it seems the transition to a new administration is proceeding relatively peacefully (which is not to dismiss the high levels of political polarization that persist). By most accounts, the *mechanics* (if not the politics) of the 2020 presidential election have been relatively smooth and transparent—notwithstanding much anxiety associated with dramatic changes caused by the global Covid-19 pandemic.

Robust voter participation in 2020 and methodical certification of results suggests that the U.S. system of election administration is working—but it is under significant strain. Elections continue to suffer from challenges that have existed for years: a lack of sustained funding for state and local election officials, vulnerable technology, and threats from foreign nation-states. The pandemic has proved to be a “stress test” for virtually every aspect of U.S. election administration, highlighting both resilience and the continuing challenges that demand attention in the future.

The purpose of this paper is to assess the current state of election administration in the U.S by examining an array of factors impacting the accuracy, reliability, accessibility, and security of U.S. elections. We do so with an eye toward improving the nation’s overall state of readiness by 2030—though some of the recommendations herein will require even more time to fully implement. Most importantly, the ultimate aim of this exercise is to identify future changes in policy, practice, and technology that can enhance the American public’s confidence in the integrity and legitimacy of U.S. elections.

We also emphasize that protecting American democracy must be a nonpartisan effort. If ever there were a mission exemplifying the idea of “country over party,” this is it. With that in mind, we have conscientiously crafted our recommendations to appeal to a “middle ground” acceptable to all who care about *both* access to the ballot box *and* the integrity of the vote. We believe concrete, meaningful changes which “move the needle” beyond the status quo, toward more uniform advancement, are not only feasible but imperative, and can be implemented while respecting rights in our Union of fifty unique states.

Perhaps the single most important lesson the nation must learn from 2020 is how little it takes to corrode public trust in democratic elections, and how quickly it can happen. Democratic institutions are fragile. They cannot protect themselves; doing so requires ongoing focus, priority, and purpose, by citizens of the nation they serve. This paper is our contribution to that national effort.

We make recommendations in four areas, all of which are essential to effective election administration:

1. Policy, process, and funding of election administration
2. The voting experience
3. Development and certification of voting technology
4. Voter confidence

## Key Findings and Recommendations

### I. Policy, Process, and Funding for Administration of Federal Elections

- Policy is the single most important driver of a voter’s ultimate voting experience—and some states’ policies are more “voter-centric” than others.
- Decentralized election administration leads to a diverse patchwork of voting policies, differing according to the state in which a voter lives. Some state practices create obstacles to ballot access, and/or diminished election integrity.
- Because policy differences can result in dramatically different state-by-state voting experiences, it is reasonable to ask whether steps toward more uniform, voter-centric policies for federal elections would be possible.
- Voter-centric policies which protect access to the ballot and the integrity of the vote advantage the federal government. Therefore the federal government (Congress in particular) has an essential role to play in the promotion of such policies, and in creating sustainable funding for U.S. election administration.

### Recommendations—Voter-Centric Policy Considerations for Federal Elections

1. All of the following minimum standards for federal elections merit consideration and discussion. We believe these standards, if uniformly required and implemented in all states, would ensure election integrity, and protect voter access to the ballot (a win-win for both sides of the aisle):
  - 1.1. At least ten days of in-person early voting before a federal election
  - 1.2. Access to by-mail voting for the general voting population (especially during a public health crisis, which may occur at any time)
  - 1.3. Access to remotely accessible by-mail voting for persons with disabilities
  - 1.4. Deadlines associated with by-mail voting consistent with USPS delivery standards
  - 1.5. Alternatives to delivery by the U.S. Postal Service for voter return of by-mail ballots
  - 1.6. Standardization of signature verification, voter notification of discrepancies, and “cure” procedures for by-mail ballots
  - 1.7. Provision for election officials to begin processing by-mail ballots at least seven days prior to Election Day (election officials are prohibited as usual from releasing results early)
2. Congress should authorize and fund the U.S. Election Assistance Commission (EAC) to continue to serve as a clearinghouse for information exchange between election officials in different states, in order to implement uniformly any policy changes associated with federal elections.
3. Congress should authorize and fund resources to support election administration on a regular basis (e.g. every two years). It is essential that such funding be predictable, and ongoing, relieving state and local election officials of administering in scarcity, in the hope



that every few years there might be some kind of “balloon” appropriation. Regular, sustainable funding supports continuity of operations in election administration.

## II. The Voting Experience

- During the post-HAVA era, in addition to new and more convenient forms of voting, voters have benefited from a focus on usability and other human factors, which impact voter efficiency, satisfaction, and confidence.
- The Covid-19 pandemic has illustrated the importance of online voter services, infrastructure, and ancillary items *associated* with voting, but which *precede* the act of actually casting a ballot (e.g., online voter registration and absentee ballot request services, and access to by-mail envelopes and forms).
- Long lines at in-person polling places discourage people from voting. Furthermore, while long lines inconvenience all voters, research indicates that long lines especially impact Latino and Black voters, and voters with low incomes. Data shows that they have to wait longer to vote than other voters.

### Recommendations—Advancing the Voting Experience in Federal Elections

4. The U.S. Election Assistance Commission should continue to refine best practices associated with information design and accessibility, in partnership with usability and information design experts, for:
  - 4.1. Voter registration and/or change of address forms
  - 4.2. Absentee ballot request forms
  - 4.3. Electronic ballots
  - 4.4. Paper ballots
    - 4.4.1. Traditional hand-marked ballots
    - 4.4.2. Summary format machine-marked records
  - 4.5. Ancillary materials associated with by-mail voting, including envelopes, voter instructions, attestations, and signature and address lines
  - 4.6. Accessible web-based voter services, including voter registration, absentee ballot requests, ballot tracking services, and voter information guides
  - 4.7. Remote accessible vote-by-mail systems, especially for voters with disabilities and overseas/military voters
5. Congress should authorize and fund the U.S. Election Assistance Commission to provide grants in support of private-public partnerships between election officials and usability professionals, to assess, modify where necessary, and overall improve existing designs for ballots, forms, and by-mail ballot materials, in accordance with state-specific laws and rules. Applied case studies which attempt to improve actual materials currently in use are often the most impactful.

6. Congress should authorize and fund the U.S. Election Assistance Commission, National Institute of Standards and Technology (NIST), and the National Science Foundation (NSF) to sponsor research on voter behavior associated with verification of paper ballot records, including both hand-marked paper ballots and machine-marked paper records. One goal of such research should be to identify design practices, and process changes or interventions to increase the likelihood that voters will be able to identify and correct errors or omissions, on all types of paper records, before ballots are cast.
7. Congress should authorize and fund the U.S. Election Assistance Commission, National Institute of Standards and Technology, and the National Science Foundation to sponsor research on best practices in calculating and implementing sufficient resources to avoid long lines. These would include numbers of in-person polling places, numbers of voting machines, poll workers, technical troubleshooting support staff, and other resources which alleviate long lines for in-person voting.
8. Congress should pass minimum uniform standards to make available a range of voting options for voters in federal elections, including by-mail and early voting options, in order to relieve pressures on Election Day in-person polling places, and to avoid long lines.
9. Congress should provide sustainable funding to support election officials' ability to deploy adequate numbers of polling places, voting machines, poll workers, technical troubleshooting support staff, and other resources to avoid long lines for in-person voting.

### **III. Development and Certification of Voting Technology**

- The voting technology marketplace is distorted and dysfunctional. High consolidation among few vendors, combined with the complexity of the federal certification process, creates high barriers to entry, leaving the nation's election officials with limited choices, high costs, and technology that is prematurely obsolete.
- The federal testing and certification program for voting systems, administered by the U.S. Election Assistance Commission, is costly and rigid. Its rigidity prevents agile response to global nation-state threats. Its complexity and costliness creates a distorted incentive for vendors to continue selling outdated voting systems, with designs that do not rise to the level of high-assurance critical infrastructure necessary for defense of national security.

#### **Recommendations—Development and Certification of Voting Technology**

10. Congress should authorize and fund a major initiative on voting technology with the National Science Foundation (NSF) and/or the U.S. Department of Defense (DoD) to develop technology and standards for high-assurance computing in the elections sector.
11. Congress should authorize and fund additional incentives for enhanced public-private partnerships to develop innovative election technologies.
12. A major reinvention is required of both the federal voting system standards-development process and the federal testing and certification process, possibly through a congressionally-authorized successor to the U.S. Election Assistance Commission.

- 12.1. Congress should authorize a successor organization to develop, in collaboration with the National Institute of Standards and Technology (NIST), a new process that allows updates to federal guidelines for voting systems at a more rapid pace than current methods.
  - 12.2. A reinvented testing and certification program should:
    - 12.2.1. Redefine “voting system” to designate only those components of the voting system used to actually *cast* and *count* votes.
    - 12.2.2. Permit more agile “component-level certification.”
    - 12.2.3. Increase incentives for vendors to update voting systems.
    - 12.2.4. Restrict manufacturers’ ability to perpetually modify existing systems currently certified under old standards.
  - 12.3. Require penetration testing of voting systems.
13. We *strongly* caution against simply replicating current voting system testing and certification procedures, or applying them to a wider scope of election-related technology, such as electronic poll books, voter registration databases, and election night results reporting (all of which currently fall outside the scope of the *Voluntary Voting System Guidelines* [VVSG]). The current model is simply broken; it leads to premature obsolescence, and lack of choice for election officials.

#### **IV. Public-Interest Election Infrastructure for National Security**

- Election infrastructure is a national security issue that demands a “whole of nation” response.
- American election infrastructure was never designed for the threats that exist today.
- Election technology vendors, state and local election officials, and poll workers cannot be expected to increase capabilities and resources indefinitely, in order to match increasingly sophisticated cybersecurity adversaries.
- Just as the Defense Advanced Research Projects Agency (DARPA) and the NSF spearheaded revolutionary public technology innovation in the internet, so too will government-funded research and development best address the nation’s long-term election infrastructure needs.

#### **Recommendations—Public-Interest Election Infrastructure for National Security**

14. The President and Congress should announce that election infrastructure (e.g., election technology and the processes to implement it) is fundamental to the nation’s security—and therefore imperative.

15. Congress should authorize and fund a major initiative on election technology with the National Science Foundation (NSF) and/or the U.S. Department of Defense (DoD) to develop technology and standards for high-assurance, transparent, and verifiable computing in the elections sector.
16. Congress should authorize and fund resources to support election administration on a regular basis (e.g., every two years). It is essential that such funding be predictable and ongoing, to support continuity of operations in election administration.
17. Congress should require all voting systems used in federal elections to provide human-readable, voter-verifiable, auditable paper records of each ballot cast.
18. Congress should require routine post-election risk-limiting audits of federal contests in all states, initially with a pilot, leading ultimately to full implementation as a regular practice.
19. Congress should prohibit the use of federal funds for any form of internet voting or online voting in which a voter's marked ballot is returned electronically.
20. Congress should prohibit the use of federal funds for any voting systems configured with wireless modems for the transmission of election results.
21. Congress should authorize and fund the research and development of new technologies which monitor, detect attempts to tamper with, and verify the integrity of data in voter registration databases. Digital ledger technology is one such example.
22. Congress should authorize and fund consistent and sustainable resources for the Cybersecurity & Infrastructure Security Agency (CISA), which works directly with state and local election officials, securing state networks associated with the administration of federal elections.

## **V. Voter Confidence**

- The most significant threat to American elections comes not from cybersecurity threats or outdated voting machines, but from efforts to undermine the legitimacy of election outcomes.
- Efforts to bolster public confidence will require long-term changes on at least two fronts:
  - More consistent, voter-centric policies for federal elections, offering an opportunity for more meaningful participation in civic life, and engendering trust
  - Investment in public election technology R&D to enhance and simplify the administration of elections, for election officials and voters alike.

### **Recommendations—Enhancing Voter Confidence**

23. Congress should require all voting systems used in federal elections to provide human-readable, voter-verifiable, auditable paper records of each ballot cast.
24. Congress should require routine post-election risk-limiting audits of federal contests in all states, initially with a pilot, leading ultimately to full implementation as a regular practice.

25. Congress should authorize and fund predictable and sustainable resources for federal agencies, such as CISA, to continue the important work of educating the public about disinformation, and actively monitoring and “debunking” election-related “rumors.”
26. Congress should pass legislation requiring election-technology and voting-technology vendors *themselves* to undergo a disclosure and certification process, as a supplement to voluntary testing and certification of their technology *products*.
  - 26.1. Election and voting technology vendors should be subject to new reporting requirements concerning:
    - 26.1.1. Details of corporate ownership
    - 26.1.2. Financial disclosures
    - 26.1.3. Cybersecurity incident-response procedures
    - 26.1.4. Personnel requirements and procedures
    - 26.1.5. Supply chains



### Introduction

With the completion of the 2020 Electoral College vote in all 50 states, the nation’s worst fears appear to be subsiding. Chaos has not ensued; no dramatic cyber-attacks have emerged; and despite ongoing political debates and litigation, it seems the transition to a new administration is proceeding relatively peacefully (which is not to dismiss the high levels of political polarization that still persist). By most accounts, the *mechanics* (if not the politics) of the 2020 presidential election have been relatively smooth and transparent—notwithstanding much anxiety resulting from dramatic changes associated with the global Covid-19 pandemic.

Ironically, the national uncertainty created by a months-long pandemic and rancorous attempts to cast doubt on the election has had a silver lining. The intense national scrutiny in its wake has offered election officials and the media an opportunity to educate citizens about how elections are actually run. Voters have responded to that extra focus, passionately. If the 2020 presidential election taught us one thing, it’s this: *Given transparent information and supportive policies, American voters care about voting—a lot.*<sup>1</sup> More than 156 million votes have been cast so far (the most ever in a U.S. presidential election), and the U.S. is on track to

**Running the 2020 presidential election during a pandemic has been a ‘stress test’ for virtually every aspect of U.S. election administration, highlighting both resilience and challenges that demand our attention in the future.**

shatter turnout records as well, with an estimated 66.5% of eligible voters<sup>2</sup> casting a ballot—the most since 1900.

This robust voter participation and the methodical certification of results tells us that the U.S. system of election administration is still working. But it is under significant strain. Elections continue to suffer from the same challenges that have existed for years: a lack of sustained funding for state and local election officials, vulnerable technology, and threats from foreign nation-states. If anything, the pandemic has been a “stress test” for virtually every aspect of U.S. election administration, highlighting both resilience and challenges that demand our attention in the future.

The purpose of this paper is to assess the current state of election administration in the U.S by examining an array of factors impacting the accuracy, reliability, accessibility, and security of U.S. elections. We do so with an eye toward improving the nation’s overall state of readiness by 2030—though some of the recommendations herein will require even more time to fully implement.

<sup>1</sup> <https://www.npr.org/2020/11/25/937248659/president-elect-biden-hits-80-million-votes-in-year-of-record-turnout>

<sup>2</sup> <http://www.electproject.org/2020q>

Most importantly, the ultimate aim of this exercise is to identify future changes in policy, practice, and technology that can enhance the American public’s confidence in the integrity and legitimacy of U.S. elections.

We must also emphasize that protecting American democracy is and must be a nonpartisan effort. If ever there were a mission exemplifying the idea of “country over party,” this is it. With that in mind, we have conscientiously crafted our recommendations to appeal to a “middle ground” that can and should be acceptable to all who care about *both* access to the ballot box *and* the integrity of the vote. We believe concrete, meaningful changes which “move the needle” beyond the status quo, toward more uniform advancement, are not only feasible but imperative, and can be implemented while still respecting rights in our Union of fifty unique states.

Perhaps the single most important lesson the nation must learn from 2020 is how little it takes to corrode public trust in democratic elections, and how quickly it can happen. Democratic institutions are fragile. They cannot protect themselves; doing so requires ongoing focus, priority, and purpose, by citizens of the nation they serve. This paper is our contribution to that national effort.

## 1. Context: Understanding the Current Moment

As more than one observer of the state of U.S. election administration has noted, the ongoing mission to bolster confidence in elections is “a race without a finish line.” There is always more the nation could be doing. Are we making progress? The answer to that question depends on whom you ask. It has been two decades since the controversial presidential election of 2000 reshaped our election technology landscape forever. Opinions differ on how far we have advanced since then. The contested national election between Bush and Gore in 2000 revealed

**It is essential to recognize the difference between short-term progress in the current framework of election administration, and the long-term fixes required by any future framework rising to the level of critical infrastructure.**

the uncomfortable fact that public confidence in the election hung on an outcome which in turn depended upon aging and unreliable voting technology. The public anxiety triggered by uncertainties around punch card voting machines, hanging chads, and confusing butterfly ballots led directly to the passage of the Help America Vote Act (HAVA) in 2002.<sup>3</sup> Congress allocated \$3 billion to “modernize” voting technology, and the outlines of the current election landscape were drawn. On the heels of additional infusions of congressional dollars, in 2018<sup>4</sup> and 2020,<sup>5</sup> some observers<sup>6</sup> of U.S. elections argue innovations in election administration have helped to improve the voting experience. Others assert more pessimistically that even the newest voting technology is “essentially un-

<sup>3</sup> <https://www.eac.gov/about/help-america-vote-act/>

<sup>4</sup> <https://www.reuters.com/article/us-usa-fiscal-congress-cyber/u-s-spending-bill-to-provide-380-million-for-election-cyber-security-idUSKBN1GX2LC>

<sup>5</sup> <https://www.eac.gov/payments-and-grants/2020-cares-act-grants>

<sup>6</sup> <https://www.carnegie.org/news/articles/tech-not-enemy/>



securable.”<sup>7</sup> So, who is right? How worried should we be? And why are the answers apparently so divergent?

Part of the explanation is that election administration is a complex mix of policy,<sup>8</sup> procedures,<sup>9</sup> and technology,<sup>10</sup> all interwoven. But each component also operates independently, and changes at its own pace. Meaningful advancements can take place in some areas at the same time the fundamentals of our election infrastructure remain largely dysfunctional. In the current reality, the glass-half-full perspective *and* the glass-half-empty perspective can *both* be correct, depending on which half is under scrutiny. As a nation, however, we need to be able to see *the whole glass*. And if our national dialogue about reliable, secure, and verifiable elections is to advance meaningfully, it must accommodate the many different elements of election administration that impact the public’s confidence in the outcomes.

Specifically, as we ask, “How are we doing, and what must we do next?” it is essential to recognize the difference between *short-term progress*, which addresses the current framework of election administration, and the *long-term fixes* required by any future framework rising to the level of critical infrastructure.<sup>11</sup> For example, there is much evidence of positive *incremental improvement* in the voting experience over the past ten to fifteen years. Furthermore, the years between 2016 and 2020 witnessed great strides in genuine cybersecurity improvements, thanks to committed and methodical partnerships<sup>12</sup> between federal agencies like the Cybersecurity & Infrastructure Security Agency (CISA) and state and local election officials.

However (and this is where the long-term challenge lies), change is constant. While the rough outlines of the “playing field” shaped by HAVA still exist today, we cannot lose sight of the fact that the watershed Bush v. Gore election was *two decades ago*. And the Covid-19 pandemic has dramatically exposed the need for widespread change, in a very short period of time, to ensure American voters’ access to a wider array of voting options. The pandemic has also highlighted a scarcity of resources in the infrastructure used by election officials, to supply increased demands for more convenient and secure forms of voting. Furthermore—despite a dizzying rate of change in election *policy* and *process* during 2020—the dysfunctional way voting technology is developed, certified, and deployed in the U.S. today has *not* changed.

In short, the world is changing, and how we think about election administration needs to change with it. Even as we recognize the progress of recent years, we must also have the courage to think ambitiously about the paradigmatic changes required to meet future needs; we must engage in the uneasy challenge of straddling past and future. Disentangling the path ahead will require taking a closer look at both the advancements and the challenges of the current environment, and at why the future demands something different.

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<sup>7</sup> <https://homeland.house.gov/imo/media/doc/Testimony-Braun.pdf>

<sup>8</sup> <http://www.ncsl.org/research/elections-and-campaigns.aspx>

<sup>9</sup> <https://www.nased.org/helpfullinks>

<sup>10</sup> <https://www.eac.gov/voting-equipment/managing-election-technology/>

<sup>11</sup> <https://www.dhs.gov/cisa/infrastructure-security>

<sup>12</sup> <https://www.washingtonpost.com/politics/2020/11/02/cybersecurity-202-cisas-political-independence-trump-will-be-an-election-day-asset/>

To do so, this paper will make recommendations in four areas, all of which are essential to effective election administration:

1. Policy, process, and funding of election administration
2. The voting experience
3. Development and certification of voting technology
4. Voter confidence

We begin with an examination of the patchwork of policy and process underlying our decentralized system of election administration—where there is great opportunity for improved national uniformity and sustainability. Those policies affect voters’ access to the ballot, in turn playing a critical role in shaping the voting experience, whether inside the voting booth, or voting from home. Finally, the fundamentals of election technology development and certification require nothing less than complete reinvention. Ultimately, this mix of policies, procedures, and technology together shape Americans’ attitude about voting—either toward confidence in the legitimacy of U.S. elections, or toward doubt, and vulnerability to disinformation.

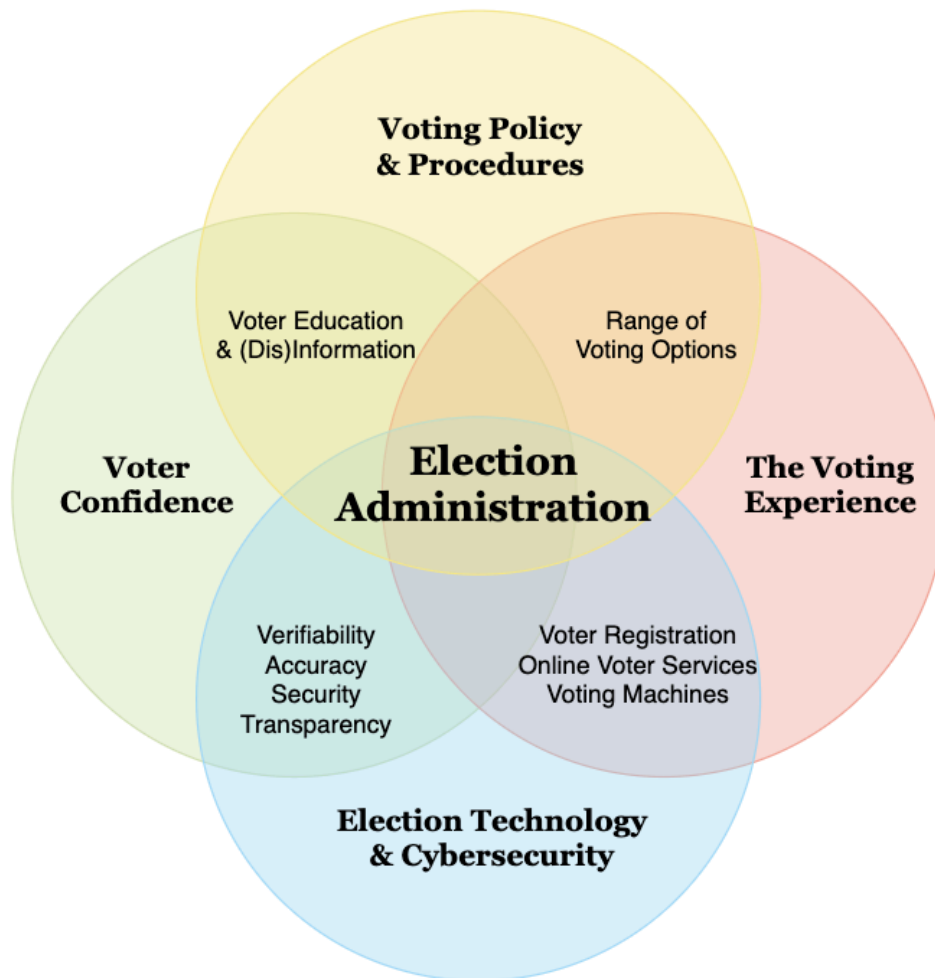


Figure 1. The Ecosystem of Election Administration

## 2. Election Administration Policy, Process, and Funding

The U.S. does not have a single, uniform national election system. Instead, in accordance with the Tenth Amendment of the U.S. Constitution, each state decides individually how to administer its own elections. Each state devises its own policies governing access to the ballot and how voters will vote—resulting in the patchwork of practices across 3,000 counties and 10,000 election jurisdictions so vividly illustrated in the 2020 election. States differ in their policies regulating voter registration and which of the various options for voting to implement. As Amber McReynolds of the National Vote at Home Institute emphasizes,<sup>13</sup> *policy* is the single most important driver of the voting experience voters will ultimately have—and some states’ policies are more “voter-centric” than others.

### 2.1 The Pre-2020 Baseline: Alternatives to Traditional Election Day Voting

In the years since HAVA was passed in 2002, some states have implemented a variety of policy changes, adding innovative new forms of voting to traditional in-person Election Day voting at neighborhood precinct locations, and expanding access and convenience<sup>14</sup> for voters. These include “convenience voting,” such as early voting<sup>15</sup> and Election Day vote centers,<sup>16</sup> expanded by-mail voting and “no-excuse”<sup>17</sup> absentee voting, and online,<sup>18</sup> same-day,<sup>19</sup> or automatic voter registration.<sup>20</sup> Also note that implementing each of these changes has required new forms of technology to make policy a reality, thereby making election administration more complex—in order to make it more convenient. That new technology includes software to manage diverse ballot styles at one location, on-demand ballot printing, enhanced digital imaging, high-speed scanning for paper ballots, and new developments in electronic poll books. Those innovations have been impactful in providing greater access to more convenient forms of voting for more voters. But they are just the beginning; the 2020 pandemic has brought dramatic changes in policy—and new political debates.

### 2.2 The 2020 Pandemic: Rising to Meet New Demands

After many years of steady progress toward greater access and convenience in voting, the Covid-19 pandemic challenged policymakers and election officials to raise the bar like never before. In many states—red and blue alike—they responded with additional access to by-mail voting

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<sup>13</sup> <https://time.com/5901694/amber-mcreynolds-vote-by-mail-2020-election/>

<sup>14</sup> <https://www.americanprogress.org/issues/democracy/reports/2018/07/11/453319/increasing-voter-participation-america/>

<sup>15</sup> <https://www.ncsl.org/research/elections-and-campaigns/early-voting-in-state-elections.aspx>

<sup>16</sup> <https://www.ncsl.org/research/elections-and-campaigns/vote-centers.aspx>

<sup>17</sup> <https://www.ncsl.org/research/elections-and-campaigns/vopp-table-1-states-with-no-excuse-absentee-voting.aspx>

<sup>18</sup> <https://www.ncsl.org/research/elections-and-campaigns/electronic-or-online-voter-registration.aspx>

<sup>19</sup> <https://www.ncsl.org/research/elections-and-campaigns/same-day-registration.aspx>

<sup>20</sup> <https://www.brennancenter.org/our-work/research-reports/automatic-voter-registration-summary>

options<sup>21</sup> and expanded in-person early voting (in order to reduce crowded polling places during the public health crisis).

The year 2020 revealed that voters also appreciate having a range of options for how to vote. In the presidential election, *voters cast more than 101 million ballots before Election Day*:<sup>22</sup> 65 million by-mail, and 36 million in person. The 2020 election could change voting in the U.S. forever, by resetting voter expectations of convenience, and perhaps nudging state policies toward an “election month,” offering more ways to vote securely in the future. In short, after 2020, the singular mystique of Election Day may be gone. However, a political backlash<sup>23</sup> has also emerged *against* 2020’s more convenient voting methods. The future might instead bring retrenchment and a return to more restrictive voting policies. That remains to be seen.

The need for policy changes—both to protect public health and to respond to voter demands for expanded services—has resulted in both cooperation and controversy. On the one hand, by and large, legislatures and secretaries of state from *both parties* have implemented helpful, voter-centric policies for early voting and expanded access to mail ballots. Many also responded to U.S. Postal Service (USPS) challenges with drop boxes and greater flexibility in ballot return deadlines. On the other hand, in marked contrast to bipartisan cooperation at state and local levels, extreme rancor ruled at the national level, where for months the president actively worked to undermine the legitimacy of by-mail voting. Furthermore, some states illustrated the problem with adhering to outdated policies. Both Pennsylvania and Wisconsin, for example, prevented election officials from processing mail-in ballots before Election Day—which, in 2020, extended the ballot counting process and created new opportunities for doubt, litigation, and outright disinformation. Other states, like Florida, illustrated how the U.S. could reduce the likelihood of “election weeks” in the future, if more states implement policies to allow officials to process mail-in ballots early.

**Because policy differences can result in dramatically different voting experiences depending on the state in which voters live, it is reasonable to ask whether steps toward greater uniformity in voter-centric policies for federal elections are possible.**

Finally, the 2020 presidential election demonstrated that while the decentralized system of election administration designated by the U.S. Constitution has its strengths, it is also messy, and confusing for voters—and the nation-wide variety of sometimes-arcane practices can offer incentive to deliver a “thousand cuts of doubt,” through litigation in different states. The 2020 election witnessed a dizzying array of disputes related to differing state requirements: absentee ballot request forms; acceptable voter criteria to vote by mail; signature verification of mail-in ballots; voter notification of opportunities to “cure” discrepancies; deadlines for receipt of mail ballots; use of drop boxes as an alternative to USPS; and extended periods for in-person early voting, to cite just a few.

<sup>21</sup> <https://www.osetfoundation.org/research/2020/28/05/bp-vbm>

<sup>22</sup> <https://electproject.github.io/Early-Vote-2020G/index.html>

<sup>23</sup> <https://www.nytimes.com/2020/12/10/us/mail-voting-absentee.html?referringSource=articleShare>

Such concerns highlight how different state-by-state policies can result in dramatically different voting experiences, depending on the state in which voters live. So, it is reasonable to ask whether steps toward greater uniformity in voter-centric policies for federal elections are possible. Conversely, it is not an exaggeration to say an ongoing absence of voter-centric policy can rapidly become a national security concern. Widespread lack of election participation, and real or perceived exclusion from civic life, can undermine public confidence in the legitimacy of election outcomes—which is itself harmful to our national security, because a divided nation is a weaker nation.<sup>24</sup>

Efforts to promote greater uniformity in voter-centric policies for federal elections need not impinge upon the 10<sup>th</sup> Amendment prerogative of states to run elections in the manner they choose. Just as the Federal Highway Administration (FHA)<sup>25</sup> sets standards for road marking and traffic controls in an Interstate Highway system while states own and operate their own highways, setting their own speed limits, etc., so too the federal government could play a beneficial role, in a nonpartisan way, by setting minimum standards for elections, to enhance access to the ballot box as well as to protect the integrity of the vote. It has been done before. The 2002 Help America Vote Act is a good example of how bipartisanship can help shore up federal standards for voting, without threatening a “federal takeover” of state elections. Indeed, today’s state-to-state diversity has persisted alongside the uniform requirements HAVA implemented, without infringing upon the rights of individual states. We believe that the secret to enabling bipartisan progress on the enactment of reformed standards for federal elections is to stick to a relatively short list of “high level” policy concerns which benefit *all* voters, regardless of party, without dictating the minutiae of how each state will *implement* the policies. (Again, think of the FHA example above; each state sets its own speed limits.)

Furthermore, while we do have strong reservations about keeping the U.S. Election Assistance Commission (EAC) as the locus for the federal *certification* of voting technology (for reasons we explain later in this paper), we do believe that the EAC functions effectively as a *clearinghouse of information* about election administration in general, and could be helpful to election officials as they address any potential policy changes. More specifically, the EAC could play a valuable role in brokering information and learning exchange between election officials in different states, about how to implement procedures associated with any changes in federal election policy.

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<sup>24</sup> More specifically, an ongoing absence of voter-centric policies can rapidly become a national security concern because voter-centric policies alleviate various elements that discourage people from voting. Those who *do not* or *cannot* participate in elections may feel excluded and/or become aggrieved and adversarial. The aggrieved also become psychologically available to bad actors who would manipulate them, potentially through disinformation, for example. Thus factionalized, the nation turns on itself as bad actors exploit the divide, which is harmful to national security. See, for example, Finifter, Ada W. (June 1970), “Dimensions of Political Alienation,” *The American Political Science Review*. <https://bit.ly/CambArticle>

<sup>25</sup> <https://www.transportation.gov/transition/FHWA/Understanding-FHWA>

## 2.3 Sustainable Funding for U.S. Election Administration

Needless to say, the federal government has an interest in promoting voter-centric policies that protect access to the ballot and the integrity of the vote—which means the federal government (and Congress in particular) has a role to play in creating sustainable funding for U.S. election administration.

**In 2020, the nation saw that election administration is a skilled profession, essential not only to the preservation of our democracy, but to our national security itself—and hence deserving of federal support.**

If ever the country needed proof that state and local election officials are essential—and highly capable—the 2020 presidential election demonstrated that. The crucible of this election allowed election officials to prove their mettle, and they outperformed. The nation can vividly see that election administration is a skilled profession, essential not only to the preservation of our democracy, but to our national security itself—hence deserving of federal support.

It is no exaggeration to say that in 2020, election officials' ability to count ballots quietly and efficiently, with a high degree of transparency and integrity, prevented the nation from descending into chaos after the presidential election. We need to remember this when Congress passes the national budget.

A lack of regular, sustainable resources for U.S. election administration adversely impacts all of the following:

- Central election office facilities
- Secure warehousing for election technology assets
- Adequate staffing—at the central office, and at in-person polling places
- Poll worker recruitment
- Poll worker training
- Poll worker pay
- Election technology maintenance, upgrades, and replacement
- Postal and printing needs (for voter communications, by-mail voting, etc.)

Finally, note that a lack of resources contributes to this related concern: if state and local election offices are not self-sufficient, and if their capacity to administer elections is limited, then state and local election officials may have to be over-dependent on private vendors and excessive “outsourcing” of election administration functions—which practices may not have sufficient transparency or accountability.

### **Summary—Policy, Process, and Funding for Administration of Federal Elections**

- Policy is the single most important driver of a voter's ultimate voting experience—and some states' policies are more “voter-centric” than others.
- Decentralized election administration leads to a diverse patchwork of voting policies, differing according to the state in which a voter lives. Some state practices create obstacles to ballot access and/or diminished election integrity.



- Because policy differences can result in dramatically different state-by-state voting experiences depending on the state in which voters live, it is reasonable to ask whether steps toward more uniform, voter-centric policies for federal elections would be possible.
- An ongoing absence of voter-centric policies can rapidly become a national security concern, because widespread lack of participation and real or perceived exclusion from civic life can undermine public confidence in the legitimacy of election outcomes—and that is itself harmful to national security.
- Local election officials often lack adequate staffing and resources, and are routinely hampered in their work by the lack of predictable and robust funding for election administration operations.
- The federal government (Congress in particular) has an essential role to play in creating sustainable funding for U.S. election administration, because the federal government has an interest in promoting the voter-centric policies, which protect access to the ballot and the integrity of the vote.

### **Recommendations—Voter-Centric Policy Considerations for Federal Elections**

1. All of the following minimum standards for federal elections merit consideration and discussion. We believe these standards, if uniformly required and implemented in all states, would ensure election integrity, and protect voter access to the ballot (a win-win for both sides of the aisle):
  - 1.1. At least ten days of in-person early voting before a federal election
  - 1.2. Access to by-mail voting for the general voting population (especially during a public health crisis, which may occur at any time)
  - 1.3. Access to remote, accessible by-mail voting for persons with disabilities
  - 1.4. Deadlines for by-mail voting consistent with USPS delivery standards
  - 1.5. Alternatives to delivery by the U.S. Postal Service for voter return of by-mail ballots
  - 1.6. Standardization of signature verification, voter notification of discrepancies, and “cure” procedures for by-mail ballots
  - 1.7. Provision for election officials to begin processing by-mail ballots at least seven days prior to Election Day (and election officials are prohibited as usual from releasing results early)
2. Congress should authorize and fund the U.S. Election Assistance Commission to continue to serve as a clearinghouse for information exchange and learning between election officials in different states, in order to implement uniformly any policy changes associated with federal elections.
3. Congress should authorize and fund resources to support election administration on a regular basis (e.g., every two years). It is essential that such funding be predictable and ongoing, relieving state and local election officials of administering in scarcity in the hope

that every few years there might be some kind of “balloon” appropriation. Regular, sustainable funding supports continuity of operations in election administration.

As noted above, policy and procedural considerations are the bedrock of how voters experience the act of marking a ballot—whether in-person, or at home. In this context, we turn now to an assessment of recent trends and developments in the voting experience, before and after the pandemic—and what is required for future progress.

### 3. The Voting Experience

#### 3.1 Pre-2020 Baseline: Post-HAVA Progress In Usability

Looking on the bright side of election administration and improvements in the voting experience, we can point to significant progress since HAVA was passed in 2002. Over the past eighteen years, as election officials have developed more home-grown experience with their federally-funded voting systems, the post-HAVA era has seen a broad blossoming of new learning, research, and practical changes in election administration, much of which has been beneficial to voters.

In addition to expanded access to new and more convenient forms of voting, as described above, voters have also benefited from a renewed focus on the quality of the voting experience itself. Disciplined research in civic design and human factors has greatly improved the usability and accessibility of electronic user interfaces,<sup>26</sup> paper ballots,<sup>27</sup> voter information guides,<sup>28</sup> and plain language<sup>29</sup> communication in general. Notably, many of these guidelines and best practices have also filtered down (though slowly) into the design of voting devices manufactured by major commercial vendors. Technology has been shaped by, and has been used to support, new learning and best practices developed by the greater election administration community.

Technology has also been used to increase accessibility for voters with disabilities beyond HAVA’s vision of private and independent voting in brick-and-mortar polling places. With the development of remote ballot marking systems<sup>30</sup> and national vote at home<sup>31</sup> initiatives, efforts toward greater access are continuing steadily.

#### 3.2 The 2020 Pandemic: Beyond Traditional Ballot Design

Changes implemented in election administration due to the pandemic have illustrated the critical importance of usability in some areas that previously garnered less attention, demonstrating how, for example, information design and plain language goes beyond traditional ballot design. Many voters who voted by mail for the first time in 2020 had to navigate an often complex set of statutory and process requirements. On absentee ballot request forms, or on

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<sup>26</sup> <https://civicdesign.org/projects/anywhere-ballot/>

<sup>27</sup> <https://www.brennancenter.org/publication/better-ballots>

<sup>28</sup> <https://civicdesign.org/projects/how-voters-get-information/>

<sup>29</sup> <https://www.interaction-design.org/literature/article/plain-language-picking-the-right-words-keeps-users-coming-and-growing>

<sup>30</sup> <http://www.ncsl.org/research/elections-and-campaigns/the-canvass-june-2018.aspx#RBM>

<sup>31</sup> <https://www.voteathome.org/>



multi-part ballot return envelopes<sup>32</sup> with signature lines and dense text, the presence or absence of plain language instructions and good information design could make the difference<sup>33</sup> between having one's ballot counted, or not. On the other hand, recent evidence suggests that when done properly, particularly in a year like 2020, rife with change, voter education and outreach can play a critical role in reducing the number<sup>34</sup> of rejected by-mail ballots.

**2020 illustrated the importance of online voter services and infrastructure that precede the act of actually casting a ballot.**

The public health crisis of 2020 and the need for “social distancing” also illustrate the importance of both online voter services and infrastructure that are *associated* with voting, but which *precede* the act of actually casting a ballot. For example, online voter registration, online absentee ballot request services, ballot tracking services, and online voter information (essential in the face of many new policies and service changes) were more important in 2020 than ever before.

Due to concerns about new technology deployed since 2016, the voting experience has not been without controversy. As more and more jurisdictions replaced paperless voting machines in response to

the Mueller Report's revelations about the “sweeping and systematic fashion”<sup>35</sup> in which Russia interfered in the 2016 presidential election, some jurisdictions elected to use ballot marking devices (BMDs) for the general population of voters, rather than hand-marked paper ballots. The idea of using BMDs for all in-person voters introduced new concerns about security and usability, not only because BMDs are complex computing machines with electronic interfaces, but especially because little research has been done on voter behavior associated with the verification of machine-marked paper records.<sup>36</sup> A significant concern is assessing with confidence whether machine-marked printed records can meaningfully reflect voters' intent, since computerized BMDs could conceivably misprint voter choices, due to errors or even malicious tampering. The concept of “voter intent” itself deserves special scrutiny, if voters never verify the printed record before casting their vote. The early findings in a much-discussed 2020 University of Michigan study<sup>37</sup> suggest that, in the absence of proactive procedural interventions from poll workers, many voters do not verify their machine-marked paper records, and/or they do not identify mistakes or omissions in the paper record. Accordingly, additional research is needed in the future to better understand what types of design changes or interventions could be most effective in encouraging voters to verify their choices—which is essential to meaningful post-election audits.

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<sup>32</sup> <https://civicdesign.org/projects/vote-by-mail/>

<sup>33</sup> <https://www.washingtonpost.com/graphics/2020/national/beat-bad-ballot-design-and-make-sure-vote-counts/>

<sup>34</sup> <https://www.nytimes.com/2020/11/02/us/election-ballots-rejections.html>

<sup>35</sup> [https://www.washingtonpost.com/world/national-security/mueller-report-highlights-scope-of-election-security-challenge/2019/04/20/4b256304-62bc-11e9-9ff2-abc984dc9eec\\_story.html](https://www.washingtonpost.com/world/national-security/mueller-report-highlights-scope-of-election-security-challenge/2019/04/20/4b256304-62bc-11e9-9ff2-abc984dc9eec_story.html)

<sup>36</sup> <https://www.osefoundation.org/research/2019/02/01/pvrprinciples>

<sup>37</sup> <https://jhalderm.com/pub/papers/bmd-verifiability-sp20.pdf>

### 3.3 The Perennial Challenge of Long Lines

The use of complex technology at in-person polling locations can also contribute to a perennial concern about the voting experience: long lines.<sup>38</sup> Although the 2014 Presidential Commission on Election Administration specified “no citizen should have to wait more than thirty minutes<sup>39</sup> to vote,” consistently achieving this benchmark remains an unrealized goal. The serious issue of long lines is more complex than may appear at first blush, as it involves a multi-layered set of variables, including overall numbers of polling locations for a given population, potential consolidation of precinct voting locations, arrival rate of voters, total quantity of available polling place staff, total quantity of electronic poll book and/or voting devices that poll workers must set up, overall ballot length, and time of day. Long lines are a serious issue because they discourage people from voting. Furthermore, while long lines inconvenience all voters, research indicates this issue has a disparate impact:<sup>40</sup> long wait times are a chronic problem for Latino and Black voters, and for voters with low incomes. Data shows that they have to wait longer to vote than other voters.

**Long lines are a serious issue as they discourage people from voting. There is a direct and dynamic relationship between the “nuts and bolts” of staffing and resourcing polling places, and the broader policies that shape the availability of additional options for voting.**

While recent research on long lines provides some guideposts for the decade ahead, additional guidelines based on future research, including best practices for the allocation of equipment, staff, and other resources, would benefit election officials everywhere. Finally, it must be emphasized that there is a direct, dynamic relationship between the “nuts and bolts” of staffing and resourcing polling places and the broader policy environment. Voter-centric policies or the absence of them is precisely what determines the array of voting alternatives to Election Day voting, and which ultimately determines how much pressure is placed on polling places, and whether long lines are likely to ensue. In the 2020 presidential election, many states made available several options for casting a ballot before Election Day (whether in-person, or by-mail), which seems to have played a significant role in minimizing long lines on November 3, the last the day of voting.

### 3.4 Additional Challenges: Accessibility and Remote Ballot Marking

Finally, the changes in election administration implemented due to the pandemic have highlighted additional challenges for voters who vote remotely. As many states promoted alternatives to in-person voting, new attention focused on the need to ensure all voting options are accessible<sup>41</sup> to persons with disabilities, with additional emphasis on the need for

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<sup>38</sup> <https://bipartisanpolicy.org/report/the-2018-voting-experience/>

<sup>39</sup> <http://web.mit.edu/supportthevoter/www/>

<sup>40</sup> <https://kinder.rice.edu/urbanedge/2020/07/13/racial-inequality-why-does-it-take-so-long-vote-Black-communities>

<sup>41</sup> <https://www.ndrn.org/resource/vote-by-mail-must-be-accessible-to-voters-with-disabilities/>

accessibility not merely in the voting process itself,<sup>42</sup> but also in a wide range of voter services, including absentee ballot applications.<sup>43</sup>

Remote ballot marking systems, for both voters with disabilities and overseas/military voters, also raised additional security concerns, as electronic return of voted ballots is widely regarded<sup>44</sup> among computer science and election security experts as being insecure. CISA’s risk-assessment for remote ballot marking systems<sup>45</sup> characterized the return of voted ballots via the Internet while ensuring ballot integrity and maintaining voter privacy as “difficult, if not impossible, at this time.” CISA also classified electronic transmission of voted ballots as “high risk.” Many technological challenges must be solved<sup>46</sup> before electronic mobile voting can be implemented on a wide scale—and it will likely be years before that can happen. In the meantime, remote ballot marking technology and procedures should always result in the printing of marked paper ballots returned through the mail (not email or fax). For similar security reasons, we further recommend that, for the foreseeable future, the use of remote ballot marking systems should be limited to voters with disabilities and overseas/military voters, and not used for the general voting population.

### Summary—The Voting Experience

- The post-HAVA era has seen a broad blossoming of new learning, research, and practical changes associated with election administration, much of which has been beneficial to voters.
- In addition to expanded access to new, more convenient forms of voting, voters have benefited from a renewed focus on usability and human factors, which impact voter efficiency, satisfaction, and confidence.
- Technology has increased accessibility for voters with disabilities beyond HAVA’s vision of private and independent voting in brick-and-mortar polling places, primarily through the development of remote ballot marking systems.
- The Covid-19 pandemic illustrated the importance of online voter services, infrastructure, and ancillary materials that are *associated* with voting, but which *precede* the act of actually casting a ballot (e.g., online voter registration and absentee ballot request services, and by-mail envelopes and forms).
- In the context of technology deployed since 2016, the voting experience has not been without controversy, as some jurisdictions replaced paperless voting machines with ballot marking devices for all voters, raising concerns about both usability and security.

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<sup>42</sup> <https://www.americanprogress.org/issues/disability/news/2020/05/19/485218/vote-mail-one-many-ways-ensure-disability-community-included-next-election/>

<sup>43</sup> <https://time.com/5894405/election-2020-absentee-ballot-applications-disability-rights/>

<sup>44</sup> <https://www.politico.com/news/2020/06/08/online-voting-304013>

<sup>45</sup> [https://s.wsj.net/public/resources/documents/Final\\_Risk\\_Management\\_for\\_Electronic-Ballot\\_05082020.pdf](https://s.wsj.net/public/resources/documents/Final_Risk_Management_for_Electronic-Ballot_05082020.pdf)

<sup>46</sup> <https://www.osefoundation.org/research/2020/28/05/mobilevotechallenges>

- Long lines at in-person polling places discourage people from voting. Furthermore, while long lines inconvenience all voters, research indicates that long lines especially impact Latino and Black voters, and voters with low incomes. Data shows that they have to wait longer to vote than other voters.

### **Recommendations—Advancing the Voting Experience in Federal Elections**

4. The U.S. Election Assistance Commission should continue to refine best practices associated with information design and accessibility, in partnership with organizations with expertise in usability and information design, for:
  - 4.1. Voter registration and/or change of address forms
  - 4.2. Absentee ballot request forms
  - 4.3. Electronic ballots
  - 4.4. Paper ballots
    - 4.4.1. Traditional hand-marked ballots
    - 4.4.2. Summary format machine-marked records
  - 4.5. Ancillary materials associated with by-mail voting, including envelopes, voter instructions, attestations, and signature and address lines
  - 4.6. Accessible web-based voter services, including voter registration, absentee ballot requests, ballot tracking services, and voter information guides
  - 4.7. Remote accessible vote-by-mail systems, especially for voters with disabilities and overseas/military voters
5. Congress should authorize and fund the U.S. Election Assistance Commission to provide grants in support of private-public partnerships between election officials and usability professionals, to assess, modify where necessary, and overall improve existing designs for ballots, forms, and by-mail ballot materials in accordance with state-specific laws and rules. Applied case studies which attempt to improve actual materials currently in use are often the most impactful.
6. Congress should authorize and fund the U.S. Election Assistance Commission, National Institute of Standards and Technology, and the National Science Foundation to sponsor research on voter behavior associated with verification of paper ballot records, including both hand-marked paper ballots and machine-marked paper records. One goal of such research should be to identify design practices and process changes or interventions to increase the likelihood that voters will be able to identify and correct errors or omissions on all types of paper records before ballots are cast.
7. Congress should authorize and fund the U.S. Election Assistance Commission, National Institute of Standards and Technology, and the National Science Foundation to sponsor research on best practices in calculating and implementing sufficient resources to avoid long lines. These would include numbers of in-person polling places, numbers of voting machines, poll workers, technical troubleshooting support staff, and other resources which alleviate long lines for in-person voting.

8. Congress should pass minimum uniform standards to make available a range of voting options for voters in federal elections, including by-mail and early voting options, in order to relieve pressures on Election Day in-person polling places, and to avoid long lines.
9. Congress should provide sustainable funding to support election officials' ability to deploy adequate numbers of polling places, voting machines, poll workers, technical troubleshooting support staff, and other resources to avoid long lines for in-person voting.

#### 4. Interlude: Election Infrastructure “Triage” 2016-2020

Collectively, the policy and technology design initiatives described above—before and during the pandemic—were aimed at making the voting experience more convenient and usable. They illustrate disciplined efforts by election officials to treat voter service as “customer service.” This also reflects efforts to further professionalize<sup>47</sup> the discipline of election administration. Thousands of professionals in the elections community work tirelessly to improve the voting experience for millions of Americans, including state and local election officials, election judges, citizen poll workers, academics, civic advocacy groups, and technology providers. All receive critical support from the U.S. Election Administration Commission, the National Institute of Standards and Technology, and the Department of Homeland Security. The nation owes them a debt of gratitude for their dedication and stamina. They are working in a challenging and imperfect environment.

The same professionals responsible for many significant improvements in the voting experience have also been hard at work performing “triage” on election infrastructure since 2016. With a specific focus on improving security in time for the 2020 elections, concrete incremental changes have been implemented in recent years. Most recent efforts to bolster the nation’s aging elections infrastructure have correctly focused on much-needed changes, like replacing outdated voting equipment,<sup>48</sup> ensuring voting devices have a durable paper trail<sup>49</sup> (in contrast to paperless electronic machines), and implementing post-election audits,<sup>50</sup> to verify that voting systems are accurately recording and counting votes. The NIST has also created a cybersecurity framework<sup>51</sup> with recommendations that critical infrastructure owners and operators can apply, in order to evaluate and improve the cybersecurity of their systems. All of these topics are comprehensively addressed in a recent report<sup>52</sup> from the National Academies of Science, Engineering, and Medicine (a compendium of the latest best practices and recommendations for election security). They should be part of any future congressional legislation to enhance the security of federal elections.

Since 2016, the EAC, the DHS, and especially the Cybersecurity & Infrastructure Security Agency (CISA) have elevated their focus on election security. Among other efforts, they have

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<sup>47</sup> <https://bit.ly/AuburnEAP>

<sup>48</sup> <https://www.politico.com/interactives/2019/election-security-americas-voting-machines/>

<sup>49</sup> <https://www.ncsl.org/research/elections-and-campaigns/voting-system-paper-trail-requirements.aspx>

<sup>50</sup> <https://verifiedvoting.org/audits/>

<sup>51</sup> <https://www.nist.gov/cyberframework>

<sup>52</sup> <http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=25120>

provided guidance to the election officials who received federal grants for cybersecurity improvements from a \$380 million fund appropriated in 2018. Election officials and DHS agree, after a rocky start in 2017, communication between DHS and state election officials has improved greatly,<sup>53</sup> as demonstrated through greater sharing of threat information, and pooling of security resources. This robust coordination culminated in the #Protect2020 campaign<sup>54</sup> and strategic plan,<sup>55</sup> a national call to action initiated by CISA “to enhance the integrity and resilience of the Nation’s election infrastructure, and ensure the confidentiality, truthfulness, and accuracy of the free and fair elections necessary for our American way of life.”

**Election officials and security experts made great progress in shoring up the nation’s defense and resiliency in preparation for 2020; but they cannot solve fundamental issues with the nation’s election infrastructure in a matter of months or a few years.**

In short, in the same way that the elections community has made great strides in voter service since HAVA was passed, so too, election officials and security experts made great progress in shoring up the nation’s defenses and resiliency, in preparation for 2020. Once again, state and local election officials, the EAC, and the CISA deserve the nation’s recognition and gratitude. They are helping to illuminate the path ahead. All of their coordinated preparation and resilience planning prevented a meltdown<sup>56</sup> in the 2020 presidential election, despite the threats of foreign interference and vast uncertainty due to the pandemic.

On the other hand, even the most dedicated election officials and security experts need more than a matter of months to solve the fundamental problems in the nation’s election infrastructure. As in a real-world emergency room, triage is not a solution; it is simply an attempt to stabilize the situation by assigning priority to the most pressing needs in the near term. And despite much progress in resiliency and cybersecurity planning in preparation for 2020, what has *not* changed is the dysfunction of how voting technology is developed, certified, and deployed in the U.S. today.

## 5. Development and Certification of Voting Technology

### 5.1 Trapped in the Past: A Dysfunctional Voting Technology Marketplace

As emphasized earlier, election administration is a complex mix of policy, procedures, and technology. Because each element has some independence from each other, each can differ in its pace of change. In recent years, for example, meaningful advancements in election administration have taken place on top of technology foundations that remain fundamentally flawed, and in need of reinvention. Indeed, when speaking of “triage,” the patient on the table is nothing less than the whole landscape of current voting technology itself. Election officials, the

<sup>53</sup> <https://editions.lib.umn.edu/electionacademy/2018/06/08/dhs-matt-masterson-in-electionlineweekly-on-changing-threat-environment/>

<sup>54</sup> <https://www.cisa.gov/protect2020>

<sup>55</sup> [https://www.cisa.gov/sites/default/files/publications/ESI%20Strategic%20Plan\\_FINAL%202.7.20%20508.pdf](https://www.cisa.gov/sites/default/files/publications/ESI%20Strategic%20Plan_FINAL%202.7.20%20508.pdf)

<sup>56</sup> <https://www.governing.com/now/How-Government-Officials-Delivered-a-Disaster-Free-Election.html>



EAC, the DHS, and the commercial technology vendors all inhabit that same landscape, but they did not create it, and no single actor owns it. In the absence of change, election officials, the EAC, and the DHS continue to have very limited influence over the business decisions private commercial vendors make, at both federal and state levels, about the voting systems they develop and submit for certification. Those decisions are shaped by a distorted operating environment, and they have a distorted logic of their own.

In other words, the nation remains dependent upon a small number of technology vendors to update our election infrastructure—but in 2020, those vendors and the EAC still follow the dynamics and (dis)incentives set in place almost two decades ago. Those broken market dynamics are the crux of the voting technology problem facing the nation today.

**The nation remains dependent on a small number of technology vendors to update our election infrastructure, but in 2020, those vendors and the EAC remain mired in broken dynamics that were set in place almost two decades ago, in response to HAVA requirements from another era.**

Despite technology advancements that have improved the voting experience, and despite a renewed focus on cybersecurity since 2016, none of those efforts substantially change the fact that current market structures for election technology in the U.S. are dysfunctional. “Dysfunctional” is a strong word, but it is appropriate. While the Brennan Center for Justice notes substantial progress made<sup>57</sup> in recent years in replacing antiquated equipment and reducing the use of paperless voting machines, many states still use voting systems at least a decade old, or no longer manufactured. Some of those voting systems run on software that vendors have left unchanged or “unpatched” for almost 15 years. Some states’ voting systems still rely on the Windows 2000 operating system, or on parts now available only in second-hand or discount electronic stores. One of the most telling symptoms of dysfunction is that even the newest voting

systems being sold today were designed to comply with federal standards adopted 15 years ago.<sup>58</sup> In a world where consumers and commercial enterprises are used to “upgrading” their technology frequently, the aging of election technology is an anomaly.

To be clear, the failing voting technology market is not due to wrongdoing by any particular stakeholder. The market is failing largely because the market dynamics of the current voting technology landscape were structured to meet the requirements of a different era, 18 years ago, when HAVA first became law. As a result, continuing to triage current technology framework with large sums of federal dollars is not likely to produce the long-term solutions we need, for newly emerging hazards in a far more threatening national security environment.

Lest we leave an impression this is simply a problem of cash-strapped jurisdictions with inadequate funding to buy new voting equipment, we emphasize that, even when states do have the foresight and funds to invest in new voting technology (as did Michigan, Pennsylvania and Georgia in recent years, for example), election officials still have sharply limited choices.

<sup>57</sup> <https://www.brennancenter.org/our-work/analysis-opinion/voting-machine-security-where-we-stand-six-months-new-hampshire-primary>

<sup>58</sup> <https://www.eac.gov/documents/2017/03/15/vvsg-10-vol-1-voluntary-voting-system-guidelines-vvsg>

According to *The Business of Voting*,<sup>59</sup> a 2017 industry analysis conducted by the University of Pennsylvania Wharton School (in collaboration with the OSET Institute), approximately 80% of eligible voters in the U.S. are serviced by just *two* voting system vendors (another 12% are covered by a third, smaller vendor). Furthermore, in the past 10 years there has been only *one* meaningful new entry to the vendor community, bringing the total to three major vendors, plus one distant upstart. Thus, today's voting technology marketplace is highly concentrated, with high barriers to entry.

Part of the explanation for the concentrated market, limited choices, and long lags between voting technology updates is the complexity and cost of federal and state certification processes. In varying degree, more than forty states rely on federal *Voluntary Voting System Guidelines* (VVSG<sup>60</sup>), devised by the NIST<sup>61</sup> and adopted by the EAC, to certify voting systems before they can be used in the states. The EAC federal certification of a voting system is merely the prerequisite (i.e., “table stakes”) for an *additional* round of certification, required in each state where the system will be used. Adding together the time required for new development of voting technology, plus federal and state certification, voting system manufacturers typically need to allow each major release a minimum of two to four years in advance of the time they wish to have it certified and available for purchase, in states that will seek new voting technology. Like steering an aircraft carrier, it is a slow and deliberate process that cannot be accomplished on short notice.

**Even the “new” voting equipment deployed in recent years as a “modernization” to replace outdated, insecure equipment was designed to comply with standards adopted fifteen years ago, in 2005.**

Advance planning like this also requires a high degree of clarity and stability in the federal standards, in order for compliant technology to be developed and delivered to election officials when they need it. Unanticipated institutional disruptions or delays in the standards-setting process can cause extreme ripple effects—even when they are due to politics beyond the EAC's control. To illustrate this point, during a period of time<sup>62</sup> when the EAC had either no commissioners at all, or the lack of a quorum, the oversight body was unable to formally adopt even a minor update to the federal standards (VVSG version 1.1) for a period of *6 years*, from 2009 to 2015. From 2005 to 2015, there were no officially updated standards at all.

Currently, the standards-setting process appears to have ground to a halt, yet again, due to institutional dysfunction at the EAC.<sup>63</sup> An initial optimism attended the most recent update of federal standards (VVSG 2.0,<sup>64</sup> started in 2016 and currently in progress), in the hope that it would result in better voting technology. But

<sup>59</sup> [https://trustthevote.org/wp-content/uploads/2017/03/2017-whartonoset\\_industryreport.pdf](https://trustthevote.org/wp-content/uploads/2017/03/2017-whartonoset_industryreport.pdf)

<sup>60</sup> <https://www.eac.gov/voting-equipment/voluntary-voting-system-guidelines/>

<sup>61</sup> <https://www.nist.gov/itl/voting>

<sup>62</sup> <https://bit.ly/NASEDvscs2015>

<sup>63</sup> <https://www.osetfoundation.org/blog/2019/12/10/challenging-times-at-americas-election-assistance-commission>

<sup>64</sup> <https://www.federalregister.gov/documents/2020/03/24/2020-06086/proposed-voluntary-voting-system-guidelines-20-requirements-request-for-public-comment>



now, unless significant changes occur, it is unlikely vendors will deliver VVSG 2.0-compliant technology before 2023 at the earliest. Much work remains to be done. The EAC must adopt detailed functional requirements, a new certification program, and new accreditation procedures for Voting System Test Laboratories (VSTLs) which test systems for compliance with applicable standards. Only after all of those tasks are complete will manufacturers have the specific requirements they need to develop systems to the newer standard. That development is likely to take years, given the complexity of the certification process.

As a result of these distorted market dynamics, even the so-called “latest-greatest” or newest releases from the major vendors—in other words, the very same voting systems that jurisdictions have spent millions of dollars to implement from 2017 to 2020—have all been certified<sup>65</sup> to comply with a federal standard that is 15 years old. Read that again: *The so-called “modernization” of election equipment in recent years replaced outdated, insecure equipment with equipment designed to comply with 2005 standards* (coincidentally, the same year that a search-engine company called Google launched a service<sup>66</sup> to host and search video clips online). Granted, the latest voting system releases include updated features and more modern best practices for software development. And, as election administrators frequently point out, security does not rely on technology alone; it must be supported by robust procedures and trained personnel.

Be that as it may, the fundamental architecture of current voting systems remains insecure, as it still relies on commodity hardware components and commercially available operating systems. Mitigating security risks in the uncontrolled supply chain<sup>67</sup> for commercially available components is extremely challenging, even for the Department of Defense. For all these reasons, the newest releases of voting technology from major vendors still contain worrisome vulnerabilities, as revealed in state-conducted penetration testing.<sup>68</sup> Even “air-gapped” voting systems (not connected to any other network infrastructure) remain vulnerable, as any component with an external USB port presents an attack vector. (The “Stuxnet” cyber-weapon<sup>69</sup> that U.S. Intelligence used to sabotage Iranian nuclear centrifuge capabilities was transferred using a USB stick.)

In sum, the combination of a concentrated marketplace of few vendors, the complexity of certification, and a standards-setting process that moves more slowly than emerging national security threats, has left our election infrastructure trapped in the past—hence vulnerable. These dynamics have largely “frozen” vendors’ incentive for making meaningful new investment in technology research and development rising to the level of critical infrastructure to protect national security.

Ironically, perhaps the most significant consequence of these market dynamics is that a well-intentioned set of post-HAVA regulatory structures, meant to assist election officials in

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<sup>65</sup> <https://www.eac.gov/voting-equipment/certified-voting-systems/>

<sup>66</sup> <https://www.newscientist.com/article/dn8519-2005-the-year-in-technology/>

<sup>67</sup> <https://www.wired.com/story/supply-chain-hacks-cybersecurity-worst-case-scenario/>

<sup>68</sup> <https://www.sos.ca.gov/elections/ovsta/voting-technology-vendors>

<sup>69</sup> <https://www.cnet.com/news/stuxnet-delivered-to-iranian-nuclear-plant-on-thumb-drive/>

improving elections administration and help voters participate, may have effectively *increased the power of vendors*—leaving state and local election officials (and the nation as a whole) even more dependent upon them. From the standpoint of the three major vendors, the current distorted conditions continue to be a functional business model, in which vendors command the domain expertise in a sector with high barriers to entry. As privately held companies, they are not subject to the same disclosure requirements as public ones. (Which creates new avenues for disinformation and public doubt, due to lack of transparency.<sup>70</sup>) They already have certified systems, developed to old standards, which they can continue to sell (regardless of whether they are adequate for current national security needs). Newer federal standards remain several years away. And election officials have no choice but to purchase their technology from this small group of vendors, who have proven themselves to be the only parties committed to navigating the cumbersome EAC certification process. Under the distorted logic of this regulated technology environment, vendors have no reason to do the hard work of fundamentally re-thinking high-assurance computing required for critical infrastructure architecture, because they can continue to generate revenue for their shareholders by marketing newer versions of systems informed by circa-2002 HAVA-era standards.

**Additional large expenditures of federal dollars to continue triage of the current technology framework are not likely to produce long-term solutions to newly emerging hazards in today's far more threatening national security environment.**

These are the symptoms of a marketplace with broken fundamentals. As noted earlier, these are largely structural problems. One need not assume wrongdoing by any particular actor, or by vendors, to conclude that outcomes in the voting technology marketplace do not match what the nation needs today. These conditions persist essentially because the development and certification of voting technology in the U.S. still follows a process created eighteen years ago, to solve problems different from the ones the nation currently faces. Nothing less than a reinvention of the EAC<sup>71</sup> is required, to address emerging threats to election security with the agility the operating environment demands.

The Help America Vote Act of 2002, which authorized the allocation of \$3 billion for new voting machines, was not designed to incentivize the development of voting technology capable of withstanding foreign cyber-attacks from countries like Russia, North Korea, Iran, and China. Instead, it was designed to correct the flaws of an election system that made it difficult to count votes reliably and to clearly determine voter intent. After the national spectacle of hanging chads, butterfly ballots, and outdated punch card voting systems in the 2000 presidential election,<sup>72</sup> HAVA's goal was to step out of the Dark Ages of voting technology, into usability, accessibility, and a modest baseline of enhanced security.

However, the world of 2020 is a different place. The (lack of) engineering appetite in the voting technology industry and the national security needs of the country are rapidly diverging. As

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<sup>70</sup> <https://www.washingtonpost.com/politics/2020/12/10/cybersecurity-202-security-advocates-see-possible-silver-lining-trumps-election-assaults/>

<sup>71</sup> <https://www.osetfoundation.org/research/2019/08/08/reinventingeac>

<sup>72</sup> <https://www.nytimes.com/2000/11/27/us/counting-vote-overview-bush-declared-winner-florida-but-gore-vows-contest.html>

noted in the Wharton Report above,<sup>73</sup> the voting technology industry is small; it earns an estimated \$300 million in revenue annually, in comparison to federal IT expenditure (estimated to be about \$80 billion per year), or state IT expenditure (about \$30 billion per year).

As it exists today, the small voting technology industry in the U.S. is quite simply under-sized, under-resourced, and technologically outgunned by the nation-state threats of today's world. Furthermore, that small group of vendors is dependent upon a small oversight institution (the U.S. Election Assistance Commission) with a small budget<sup>74</sup> of approximately \$10 million per year, and a relatively small staff. During an EAC certification campaign, commercial vendors typically interact with only two to three project managers from the EAC, and staff from one of two third-party Voting System Test Laboratories. And these are the institutions upon which the nation's election infrastructure currently depends.

Whether or not the nation's legislators yet realize it, all of this suggests it is unrealistically optimistic to expect election technology vendors to break out of the dysfunctional dynamics of the past 18 years, and rapidly develop technology innovations to meet the high-assurance needs of critical infrastructure, suitable for defense against foreign nation-states. On the contrary, it is realistic to assume vendors will continue to follow the current business model for as long as they can, with the minimum investment necessary in research and development. They would be simply operating under the incentives of marketplace conditions as they exist today.

**In light of recent demands that federal agencies “do more” and “protect more,” our recommendation to legislators for testing and certification of election technology is a modest one: Proceed cautiously. Different technologies and different requirements will require programs very different from the ones we are familiar with today.**

But if we take seriously the Intelligence Community's assessment<sup>75</sup> of hostile actors seeking to attack our election infrastructure and our national sovereignty, then we should recognize the election infrastructure of the past is not enough for the future. It requires a new paradigm, and a new way of thinking.

On an almost daily basis, there is mounting evidence that the scope of “election security” is wider than might appear at first blush. While much attention has been paid to “voting machines” and “voting systems” that capture and tabulate votes, there is growing awareness that other types of election-related software infrastructure are even more vulnerable than (usually) air-gapped voting systems, by virtue of being network-connected. Specifically, voter registration (VR) systems, electronic poll books, and election

night reporting (ENR) systems (which display results over the web, but which do not tabulate votes) have been found to be especially vulnerable.

In light of recent demands that federal agencies “do more” and “protect more,” our recommendation to legislators for testing and certification of election technology is a modest

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<sup>73</sup> Ibid., 32.

<sup>74</sup> [https://www.eac.gov/sites/default/files/eac\\_assets/1/28/EACFY2021CBJ.pdf](https://www.eac.gov/sites/default/files/eac_assets/1/28/EACFY2021CBJ.pdf)

<sup>75</sup> <https://www.intelligence.senate.gov/publications/committee-findings-2017-intelligence-community-assessment>

one: proceed cautiously. Do not assume, for example, that simply “parceling things out” between CISA and the EAC will be easy or straightforward. More specifically, any efforts to expand federal testing and certification programs must be adaptable, and capable of evolving from past practice. Different technologies and different systems will likely require testing and certification programs very different from the ones we are familiar with today. While it may be natural for legislators to think, “*give this task to the EAC,*” or “*give this task to CISA,*” assuming current procedures can be retro-fitted for new needs, we instead recommend new certification programs<sup>76</sup> be devised thoughtfully and methodically, with fresh eyes.

We believe the changing cyber-threat landscape requires wholly new testing and certification programs in answer to a wider scope of election-related technology. But we strongly caution: the answer is not simply to “*do more of what HAVA said,*” or “*do more of what the EAC is already doing.*” Creating compliance standards for VR systems, digital poll books, and ENR systems, and devising new cybersecurity requirements not just for these but also for voting systems, is new territory. Accordingly, it requires new, different institutional responses.

### **Summary—Development and Certification of Voting Technology**

- The voting technology marketplace is distorted and dysfunctional. High consolidation among few vendors, combined with the complexity of the federal certification process, creates high barriers to entry, leaving the nation’s election officials with limited choices, high costs, and technology that is prematurely obsolete.
- Over 90% of the nation’s votes are counted with technology from just three vendors; the top two account for approximately 80%.
- Although substantial progress has been made in recent years in replacing antiquated equipment and reducing the use of paperless voting machines, many states still use voting systems that are at least a decade old or that are no longer manufactured. Some of those voting systems have software that vendors have left unchanged or “unpatched” for almost fifteen years.
- The federal testing and certification program for voting systems, administered by the U.S. Election Assistance Commission (EAC) is costly and rigid; it does not permit agile responses to global nation-state threats; and it creates distorted incentives for vendors to continue selling outdated voting systems with designs that do not rise to the level of high-assurance critical infrastructure suitable for defense of national security.
- Ironically, the market inertia created by the dysfunction of the EAC testing and certification program actually *increases* the power of the three main voting technology vendors—because even without making substantial investments in innovative research & development, they can *still* generate revenue for their shareholders, by marketing newer versions of systems based on fifteen-year-old standards. Election officials across the nation are “captive buyers.”

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<sup>76</sup> <https://www.osefoundation.org/research/2019/05/30/rethinktestcert>

## Recommendations—Development and Certification of Voting Technology

10. Congress should authorize and fund a major initiative on voting technology with the National Science Foundation (NSF) and/or the U.S. Department of Defense (DoD) to develop technology and standards for high-assurance computing in the elections sector.
11. Congress should authorize and fund additional incentives for enhanced public-private partnerships to develop innovative election technologies.
12. A major reinvention is required of both the federal voting system standards-development process and the federal testing and certification process, possibly through a congressionally-authorized successor to the U.S. Election Assistance Commission.
  - 12.1. Congress should authorize a successor organization to develop, in collaboration with the National Institute of Standards and Technology (NIST), a new process that allows updates to federal guidelines for voting systems at a more rapid pace than current methods.
  - 12.2. A reinvented<sup>77</sup> testing and certification program should:
    - 12.2.1. Redefine “voting systems,” to designate only those components of the voting system used to actually *cast* and *count* votes.
    - 12.2.2. Permit more agile “component-level certification.”
    - 12.2.3. Increase incentives for vendors to update voting systems.
    - 12.2.4. Restrict manufacturers’ ability to perpetually modify existing systems currently certified under old standards.
  - 12.3. Require penetration testing of voting systems.
13. We *strongly* caution against simply replicating current voting system testing and certification procedures, or applying them to a wider scope of election-related technology, such as electronic poll books, voter registration databases, and election night results reporting (all of which currently fall outside the scope of the VVSG standards). The current model is simply broken; it leads to premature obsolescence, and lack of choice for election officials.

## 5.2 A Changed World: Publicly-Funded Election Technology

American election infrastructure was never designed for today’s threats. Technology vendors, state and local election officials, and poll workers cannot be expected to increase their capabilities and resources indefinitely, in order to match increasingly sophisticated cybersecurity adversaries. The threats that exist today are national security threats, and they require and deserve an appropriate national response. To solve the existing problems with current election infrastructure, groundbreaking technological innovations<sup>78</sup> in electronic system security and hardware architecture are required. But those innovations will not be developed by

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<sup>77</sup> [https://trustthetvote.org/wp-content/uploads/2019/05/29May19\\_OSET-VVSG2-CommentsSubmission.pdf](https://trustthetvote.org/wp-content/uploads/2019/05/29May19_OSET-VVSG2-CommentsSubmission.pdf)

<sup>78</sup> <https://www.darpa.mil/news-events/2017-04-10>

private commercial vendors working in isolation. On the contrary, they require a national priority commitment and government-funded research and development.

Models like these currently exist. Perhaps the greatest example of a public technology innovation that expanded the nation's capabilities is the development of the internet, which

**The nation's long-term election infrastructure needs are best addressed with public technology investment informed by a paradigmatic shift in how we think about election technology, and the nature of the threats that it must protect against.**

relied on the Defense Advanced Research Projects Agency (DARPA<sup>79</sup>) and the National Science Foundation (NSF<sup>80</sup>) for its technological foundations. In the early 1990s after the development of packet-switching and TCP/IP protocols, which formed the foundation of the revolutionary new network, the technological backbone of the Internet was turned over to the private sector, which commercialized it through the invention of the World Wide Web. In this way, government-funded public technology was transformed<sup>81</sup> into a global phenomenon and created an entirely new digital economy.

The development of election technology infrastructure needs to be rethought along the same lines. None of the vendors who carved out their marketplace positions in the post-HAVA era ever anticipated being on the front lines, in 2020 and beyond, protecting our sovereignty and democracy from foreign cybersecurity attacks. But those vendors *do* possess a vast

amount of domain expertise about the administration of elections, and about the technology needed to support those activities. Vendors also play a critical role in supporting the nation's election officials. So there is a natural complementarity with the public technology model. With appropriate national investment, that model allows the private sector to build upon, and benefit from, government-funded support for the development of high-assurance trusted computing systems.<sup>82</sup> This approach also recognizes the role of election technology vendors in commercializing and supporting new architecture<sup>83</sup> for voting systems, based on their knowledge of certification, implementation, and support for the nation's state and local election officials. Investments in public election technology need not, and should not, be construed as a replacement for market structures. On the contrary, they are in partnership with the private sector, for the purpose of elevating the nation's overall security capabilities. Furthermore, the system security innovations that could be developed would be applicable not only to election infrastructure, but also to many other critical infrastructure sectors, such as air traffic control, healthcare systems, industrial controllers, power grid systems, and others facing nation-state threats which current commodity hardware cannot overcome.

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<sup>79</sup> <https://www.darpa.mil/about-us/about-darpa>

<sup>80</sup> <https://www.nsf.gov/about/>

<sup>81</sup> <https://www.theguardian.com/technology/2016/jul/15/how-the-internet-was-invented-1976-arpa-kahn-cerf>

<sup>82</sup> <https://www.militaryaerospace.com/trusted-computing/article/14176906/trusted-computing-hardware-and-software-command-and-control>

<sup>83</sup> <https://www.osetfoundation.org/research/2019/04/03/newvstarch>



Funding for this type of research and development, which addresses fundamental weaknesses in current election technology infrastructure, and which would benefit *all* sectors of critical infrastructure, is a smart long-term investment. Election technology is a perfect example of public interest technology.<sup>84</sup> Public funding in research and development for election

**Election technology is public interest technology, which generates public benefits and promotes the public good.**

infrastructure offers an impactful return on investment because election infrastructure will benefit the nation’s defenses for years to come. In the near-term, federal investment in assisting states to eliminate paperless systems and implement post-election audits is essential right now—but those expenditures should be moderated by a sober recognition that current commodity technology is inherently limiting. The nation’s long-term election infrastructure needs will be best addressed with public technology investment informed by a paradigmatic shift in our thinking about election technology, and the nature of threats that it must protect against.

In light of the Intelligence Community’s (IC) 2017 assessment<sup>85</sup> that Russia attempted to influence the 2016 presidential election, it should be clear that the world has changed—and how we develop and protect election technology needs to change with it. Clearly, elections are a national security issue that demands a “whole of nation” response. Since 2016, coordinated efforts<sup>86</sup> by the Department of Defense, Department of Homeland Security, Federal Bureau of Investigation, National Security Agency, US Cyber Command, and CISA have enhanced the nation’s readiness and may have had a deterrent effect that helped to avoid large-scale disruptions<sup>87</sup> related to cyber-attacks from foreign powers in 2020.

It is now clear not only that state and local election officials cannot defend the front lines of national security on their own, but also that the scope of technology required to protect elections continues to expand. Incidents in 2020 illustrated how infrastructure like general county IT networks<sup>88</sup> could, outside the election office, be vulnerable to cyber-attacks and have implications for election security. The need to rapidly adapt election operations during the pandemic also demonstrated that even non-election-specific technology and operations, like USPS<sup>89</sup> mail sorting machines and delivery practices, could impact election security and readiness.

### **Summary—Public-Interest Election Infrastructure for National Security**

- Election infrastructure is a national security issue that demands a “whole of nation” response.
- American election infrastructure was never designed for the threats that exist today.

<sup>84</sup> <https://wearecommons.us/2020/10/29/election-technology-for-the-common-good/>

<sup>85</sup> [https://www.dni.gov/files/documents/ICA\\_2017\\_01.pdf](https://www.dni.gov/files/documents/ICA_2017_01.pdf)

<sup>86</sup> <https://www.fbi.gov/news/pressrel/press-releases/joint-statement-from-doj-dod-dhs-dni-fbi-nsa-and-cisa-on-ensuring-security-of-2020-elections>

<sup>87</sup> <https://www.nytimes.com/2020/11/09/us/politics/cyberattacks-2020-election.html>

<sup>88</sup> <https://www.nbcnews.com/tech/security/software-provider-u-s-counties-says-it-was-hacked-n1240953>

<sup>89</sup> <https://www.brennancenter.org/our-work/research-reports/what-postal-service-crisis-means-november-election>

- Election technology vendors, state and local election officials, and poll workers cannot be expected to increase capabilities and resources indefinitely, in order to match increasingly sophisticated cybersecurity adversaries.
- To solve the existing problems with current election infrastructure, groundbreaking technological innovations in electronic system security and hardware architecture are required.
- Just as DARPA and the NSF spearheaded public technology innovation in the internet, so too will government-funded research and development best address the nation’s long-term election infrastructure needs.
  - The system security innovations that could be developed are applicable not only to election infrastructure, but also to many other critical infrastructure sectors, such as air traffic control, healthcare systems, industrial controllers, power grid systems, and others facing nation-state threats which current commodity hardware cannot defend overcome.

### **Recommendations—Public-Interest Election Infrastructure for National Security**

14. The President and Congress should announce that election infrastructure (e.g., election technology and the processes to implement it) is fundamental to the nation’s security—and therefore imperative.
15. Congress should authorize and fund a major initiative on election technology with the National Science Foundation (NSF) and/or the U.S. Department of Defense (DoD) to develop technology and standards for high-assurance, transparent, and verifiable computing in the elections sector.
16. Congress should authorize and fund resources to support election administration on a regular basis (e.g., every two years). It is essential that such funding be predictable and ongoing, to support continuity of operations in election administration.
17. Congress should require all voting systems used in federal elections to provide human-readable, voter-verifiable, auditable paper records of each ballot cast.
18. Congress should require routine post-election risk-limiting audits of federal contests in all states, initially with a pilot, leading ultimately to full implementation as a regular practice.
19. Congress should prohibit the use of federal funds for any form of internet voting or online voting in which a voter’s marked ballot is returned electronically.
20. Congress should prohibit the use of federal funds for any voting systems configured with wireless modems for the transmission of election results.
21. Congress should authorize and fund the research and development of new technologies which monitor, detect attempts to tamper with, and verify the integrity of data in voter registration databases. Digital ledger technology is one such example.



22. Congress should authorize and fund consistent and sustainable funding for the Cybersecurity & Infrastructure Security Agency (CISA), which works directly with state and local election officials, securing state networks associated with the administration of federal elections.

## 6. Voter Confidence

The most significant threat to American elections comes not from cybersecurity threats or outdated voting machines, but from efforts to undermine the legitimacy of election outcomes.

**Perhaps the single most important lesson the nation must learn from 2020 is how little it takes to corrode public trust in democratic elections, and how quickly it can happen.**

Disinformation campaigns and baseless attacks on the legitimacy of U.S. elections—coming from either domestic or foreign actors—threatens civic stability and national security. Perhaps the single most important lesson the nation must learn from 2020 is how little it takes to corrode public trust in democratic elections, and how quickly it can happen.

Democratic institutions are fragile. They cannot protect themselves. In what would have seemed unimaginable only a few years ago, even *domestic* actors are systematically attacking the legitimacy of U.S. elections and mobilizing

doubt in democracy as a political weapon. These activities will have lasting damage on the nation’s social fabric. And the Herculean task of attempting to mend those divisions in the years ahead is a mission whose requirements far exceed the issue of how elections are administered. However, as 2020 demonstrated, the nation’s election officials can help to prevent additional wounds. This year in particular, election officials performed their mission competently, transparently, and with honor. They demonstrated they have the capability to count ballots and arrive at evidence-based outcomes, which can be defended against political noise, even in the most trying circumstances. For that, the nation owes them a debt of gratitude.

**Ongoing systematic attacks on the legitimacy of U.S. elections, and the mobilization of doubt in democracy as a political weapon, do lasting damage to the body politic.**

Having said that, maintaining the status quo is not an acceptable option, and the vulnerabilities undermining public confidence in elections are not going to be resolved overnight. As described above, efforts to bolster public confidence should work on at least two fronts, which will require long-term changes, such as more consistent voter-centric policies that offer additional options for meaningful and trusted participation in civic life, and investment in public election technology R&D to enhance and simplify the administration of elections, for election officials and voters alike.

Until these efforts bear fruit, one of the most far-reaching things we can do in the interim is to continue to refine uniform best practices for risk-limiting audits and to mandate their use more widely. Risk-limiting audits can identify an incorrect outcome by comparing a human review of a sample of paper ballots with the voting system’s reported results. Currently only a handful of states require risk-limiting audits.

Finally, Congress should provide additional funding for resources and training<sup>90</sup> of federal, state, and local officials, to combat misinformation and disinformation, promoting public education campaigns to mitigate its impact. Noteworthy examples of such efforts include the #TrustedInfo2020 initiative<sup>91</sup> from the National Association of Secretaries of State (NASS), CISA’s Countering Foreign Influence Task Force (CFITF),<sup>92</sup> and CISA’s “Rumor Control” website,<sup>93</sup> which described common security controls and election administration processes to voters in plain language. CISA’s achievements in debunking emerging misinformation and disinformation narratives in near real-time were highly effective. One “silver lining” from the pandemic and the many changes it produced is that federal agencies and election officials rose to the challenge. They responded to increased scrutiny and potential voter confusion with disciplined efforts to communicate and educate.<sup>94</sup> And those efforts appear to have made a difference. Communication plus transparency is beneficial to voter confidence.

### Summary—Voter Confidence

- The most significant threat to American elections comes not from cybersecurity threats or outdated voting machines, but from efforts to undermine the legitimacy of election outcomes.
- Ongoing systematic attacks on the legitimacy of U.S. elections, and the political weaponization of public doubt in democracy, do lasting damage to the body politic.
- Efforts to bolster public confidence will require long-term changes on at least two fronts:
  - More consistent voter-centric policies for federal elections offering an opportunity for more meaningful participation in civic life, and engendering trust
  - Investment in public election technology R&D to enhance and simplify the administration of elections for election officials and voters alike
- Two of the most far-reaching things that can be done in the interim are to continue to refine uniform best practices for risk-limiting audits and to mandate their use; and to provide additional funding, training, and resources in support of public education efforts to combat misinformation and disinformation.

### Recommendations—Enhancing Voter Confidence

23. Congress should require that all voting systems used in federal elections to provide human-readable, voter-verifiable, auditable paper records of each ballot cast.
24. Congress should require routine post-election risk-limiting audits of federal contests in all states, initially with a pilot, leading ultimately to full implementation as a regular practice.

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<sup>90</sup> <https://cdt.org/insights/helping-election-officials-combat-election-misinformation-a-course-developed-by-cdt-and-ctcl/>

<sup>91</sup> <https://www.nass.org/initiatives/trustedinfo-2020>

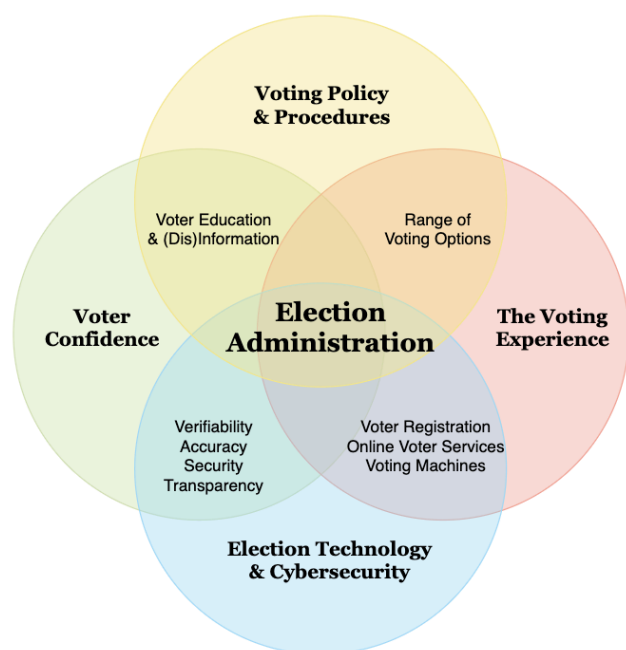
<sup>92</sup> <https://www.cisa.gov/cfi-task-force>

<sup>93</sup> <https://www.cisa.gov/rumorcontrol> (as of last verification of site availability on 21.Dec.2020)

<sup>94</sup> <https://www.cyberscoop.com/election-arizona-protest-trump-misinformation/>

25. Congress should authorize and fund predictable and sustainable resources for federal agencies such as CISA, to continue the important work of educating the public about disinformation, and actively monitoring and “debunking” election-related “rumors.”
26. Congress should pass legislation requiring election-technology and voting-technology vendors *themselves* to undergo a disclosure and certification process, as a supplement to participating in voluntary testing and certification programs of their technology *products*.
  - 26.1. Election and voting technology vendors should be subject to new reporting requirements concerning:
    - 26.1.1. Details of corporate ownership
    - 26.1.2. Financial disclosures
    - 26.1.3. Cybersecurity incident-response procedures
    - 26.1.4. Personnel requirements and procedures
    - 26.1.5. Supply chains

## 7. Facing the New World: A Nonpartisan Mission



The story of election administration in the U.S. in the “modern” era has a long arc dating back almost two decades, to the controversies of the 2000 presidential election and the Help America Vote Act. Since that time, dedicated professionals in the elections community have worked tirelessly to improve voter service and protect the security of our elections, and their progressive accomplishments are numerous. But two decades is a long time.

Expectations about the voting experience and the verifiability of elections continue to evolve, and our nation’s adversaries are not standing still. As technology advances, so also do the tools of cyber-warfare and influence operations with which foreign and domestic

actors seek to undermine our democracy, pit us against each other, and diminish the public’s confidence in election outcomes. In 2020, federal, state, and local election officials demonstrated that years of hard work performing triage since 2016 appear to have paid off. Still, although those efforts are necessary and valuable, as this paper has shown, there is much work to be done in the realm of policy, improving the voting experience, and escaping the broken market dynamics of the election technology industry. Rethinking election administration as a national security issue, and election infrastructure as critical democracy infrastructure,<sup>95</sup> is what the future requires.

<sup>95</sup> <https://www.osefoundation.org/research/2020/04/05/cdi-v2>

What has not changed, however, is the reason we struggle. In 2000, the nation tiptoed up to the precipice of a presidential election with no clear winner. The year 2020 has witnessed the unprecedented case of a losing party who apparently will not concede easily. The possibility that America could face a truly failed election in the future, and the need to avoid that disastrous and dangerous scenario, has not disappeared.

The factors that could create such a meltdown continue to evolve. Twenty years ago, threats to public perception of legitimate election outcomes stemmed from outdated technology and equipment with questionable reliability. The vulnerabilities that existed then still exist today; they have been greatly escalated by the fact that disinformation and cyberwarfare actors seek to disrupt our domestic elections directly, by sowing doubt about election outcomes. Most troubling of all, such doubts do not have to be based on facts or evidence in order to be corrosive to democracy. If malicious actors are able to lead a sizeable portion of the American electorate even to *perceive* that malfeasance has occurred and that election outcomes cannot be believed, then the disinformation attack has been successful and harmful, if not destructive. In a country whose very identity and history have been inseparable from democratic principles that rest upon public confidence in the legitimacy of election outcomes, the possibility of uncertainty about the peaceful transfer of power constitutes an existential threat to national security.

The most important change that needs to happen, in order to allow the nation to address and mitigate risks to our elections, is a collective acceptance of the proposition that, as Americans,

**The most important change that needs to happen to allow the nation to address and mitigate risks to our elections is a collective acceptance of the proposition that, as Americans, threats to democracy impact all of us. Not one party or the other; not “some of us,” but all of us. This is a nonpartisan issue that goes to the heart of our national security.**

threats to democracy impact all of us. Not one party or the other, not “some of us,” but all of us. This is a nonpartisan issue that goes to the heart of our national sovereignty. Threats to election administration and election technology infrastructure are inherently threats to our national unity and security. Reflecting on critical democracy infrastructure, William P. Crowell, former Deputy Director of the National Security Agency observed, “*Unfortunately, partisan polarization has made this topic and conversation on how to protect our election infrastructure difficult, if not nearly impossible. This must change. . . Our adversaries have no partisan preference; they are opportunists. Therefore, a patriotic approach must prevail.*”<sup>96</sup> At this critical juncture, the patriotic approach demands a sober and optimistic realization that the nation is at a turning point. We are in

a post-HAVA world, and the 2020 presidential election demonstrates a current election infrastructure straining at its very limits. We have the capacity and the imperative to rethink what is required of election administration in a rapidly changing global environment. The good news is that as more citizens engage in this national conversation about protecting the security and legitimacy of our elections, we all build up increasingly large reserves of the spirit and national resolve necessary to defend our national sovereignty.

This is the work to be done.

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<sup>96</sup> <https://www.osetfoundation.org/research/2017/9/11/critical-democracy-infrastructure>

## About the Author



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Mr. Perez brings a wealth of expertise in election systems design, implementation, security, usability, and standards. He is a veteran of the commercial election technology industry and formerly served as director of product management for one of the three major voting systems vendors in the U.S. Working closely with election officials across the U.S. for over 15 years before joining the OSET Institute, Edward utilized his skills to drive voting technology design, federal and state certification, field service and support, and voter education initiatives.

Mr. Perez is an NBC News contributing analyst on election systems and a regular contributor to media outlets such as The Washington Post, The Associated Press, Politico, and The MIT Technology Review. He also speaks regularly on election technology and administration, including most recently, public testimony before the U.S. Election Assistance Commission, April 2019; the National Academies of Sciences, Engineering, and Medicine (NASEM), Committee on the Future of Voting, December 2017; and the National Conference of State Legislatures (NCSL), Future of Elections: Technology Policy and Funding Conference, June 2017.

Edward is co-inventor of U.S. patents US8985435B2 and US10438433B2 in the domain of voting technology assigned to Hart InterCivic, Inc. He earned his Master's degree (Political Science) from the University of California, Berkeley and his undergraduate degree (Government) from Georgetown University. Edward is also a regular contributor on Twitter ([@eddieperezTX](https://twitter.com/eddieperezTX)).

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