



A Tale of Two Paper Trails

A Perspective on the Georgia SAFE Commission Final Report and Its Unlikely Outcome

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U.S. Election Administration Leadership

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Context

The State of Georgia continues to be a fascinating laboratory for items of concern in US election administration practices. In addition to past stories about conflicts of interest,¹ voter suppression,² cybersecurity vulnerabilities,³ and aged paperless voting technology,⁴ given recent developments we can now add a new concern to the list: questionable recommendations from a statewide commission assessing options for a future statewide voting system.

In its January 10, 2019 Final Report,⁵ the Georgia Commission for Safe, Accessible & Fair Elections (SAFE Commission)⁶ *rejected* the recommendations of its own cybersecurity expert and recommended that the state legislature purchase touchscreen ballot marking devices for use by all voters, rather than traditional hand-marked paper ballots.

While both models of voting include “paper trails,” not all “paper trails” are equally effective.

¹ <https://www.atlantamagazine.com/news-culture-articles/the-complicated-business-of-running-for-governor-when-youre-the-states-elections-chief/>

² https://www.washingtonpost.com/news/morning-mix/wp/2018/10/12/georgias-gop-gubernatorial-candidate-brian-kemp-sued-over-claims-of-suppressing-53000-minority-voters/?noredirect=on&utm_term=.60bb4dc061d9

³ <https://www.theverge.com/2018/11/5/18064616/stacey-abrams-midterm-elections-hacking-cybersecurity-georgia>

⁴ https://www.usenix.org/legacy/event/evt07/tech/full_papers/feldman/feldman_html/index.html

⁵ [http://sos.ga.gov/admin/uploads/SAFE_Commission_Report_FINAL_\(1-10-18\).pdf](http://sos.ga.gov/admin/uploads/SAFE_Commission_Report_FINAL_(1-10-18).pdf)

⁶ http://sos.ga.gov/index.php/elections/secure_accessible_fair_elections_safe_commission

Traditional paper ballot implementations and hybrid touchscreen-voting-for-all are different in many important respects, and as this Paper discusses, traditional hand-marked ballots offer many advantages in terms of voter-verifiability, security, cost, and ease of operations.

1. Differences Between Traditional Ballot and Hybrid Marking Solutions

In most traditional paper ballot voting implementations, typical precinct polling places require only two devices to support Election Day Voting:

1. an optical or digital scanner to process hand-marked ballots, and
2. an accessible ballot marking device for voters with disabilities (which includes audio-visual features for voters who are blind or visually impaired, as well as features for voters with dexterity impairments).

That's it. Typically, only two devices. Very large and busy polling places may have twice that many, but those are exceptional. Most voters *hand-mark* their paper ballots with pens, and simply insert the marked ballot into the scanner to cast their vote. The latest traditional ballot solutions from commercial manufacturers even support on-demand printing of many ballot styles, so they are also suitable for Early Voting “super centers” and other forms of convenience voting in countywide polling places. Finally, although traditional ballots with scanners may *appear* “low-tech,” they are actually favored by cybersecurity experts (the OSET Institute among them), as marked paper ballots are transparent and verifiable by voters, and they offer an easily auditable record of voter choices, to ensure the integrity of the results.

An alternative “paper trail” solution to traditional ballot voting is a more “technology-heavy” approach: namely, “universal design” touchscreen hybrid ballot marking devices, which are intended for *all* voters (not simply voters with disabilities). These hybrid marking devices are akin to expensive “pens” that combine a digital display with a printer that produces a record of the voter’s choices. Again, in this model, *all* voters would use a touchscreen device (even voters without disabilities), *regardless* of whether they are capable of marking a ballot with a pen.

Unlike older DRE devices, hybrid ballot marking devices do not store or tabulate votes; they only produce Printed Vote Record (PVRs), which contain a summary record of each voter’s choice(s) in each contest, as well as barcodes or QR codes used for purposes of automatic tabulation (which have inherent issues of their own). Like traditional ballots, Printed Vote Records (which don’t look like ballots) must be inserted into a scanner or ballot box to cast the vote. In a typical hybrid voting polling place, instead of having only two devices (like a traditional ballot polling place), voting machines must be allocated for all voters; accordingly, it would not be unusual for all-hybrid polling places to have 5-10 hybrid devices (*in addition to* the precinct scanner), at a cost of approximately \$3,000 to \$4,000 per hybrid marking device – considerably more than ballpoint pens.

It should come as no surprise that voting system manufacturers welcome these “equipment-heavy” implementations, as they allow vendors to sell more voting units, thereby resulting in more up-front and recurring revenue from the sales contract.

2. The Georgia SAFE Commission’s Recommendation

In advance of issuing its Final Report, the SAFE Commission voted 13-3 ⁷ to recommend that the Georgia state legislature authorize the purchase of touchscreen ballot marking devices for *all* voters, rather than a system that uses hand-marked paper ballots. The estimated cost of a statewide implementation is estimated to be approximately **\$100 million**, versus approximately **\$30 million** for a hand-marked paper ballot system.

3. Our Take

The Georgia SAFE Commission’s report raises important issues related to voting technology that are relevant not only for Georgia, but for legislators and election administrators across the country. At a time when durable, auditable paper trails are being discussed as important enhancements to the security and integrity of our elections, it is important to understand that not all “paper trail” solutions are created equal. Some approaches are simply better than others.

At the OSET Institute, we believe that hand-marked paper ballots, supplemented by select numbers of accessible ballot marking devices, are strongly preferable to touchscreen hybrid devices for general use by all voters. This conclusion is based on concerns in four high-level areas, summarized below:

1. **Voter-verifiability:** Hand-marked or machine-marked traditional paper ballots with oval or rectangular target areas to mark voter choices are directly verifiable by voters in a way that hybrid plaintext “summary formats” are not. With traditional ballots, voters can transparently see (or hear, in the case of an accessible audio paper ballot review) the same mark that the voting tabulation system uses to count the votes. What the voting system “reads” to count votes is the *same* information that the voter sees or hears.

In contrast, all Printed Vote Records (PVRs) produced by current EAC-certified hybrid marking systems are *not* transparent in the same way. Every current EAC-certified system produces Printed Vote Records that embed voter choice information in barcodes or QR codes that are not transparent to the voter, and that are not capable of being easily reviewed—*and the voting system uses those same non-transparent codes for automated tabulation*. As a result, so long as the voter-visible text is not scanned, and so long as voter choices are embedded in non-transparent codes, *even a diligent voter that is checking his/her paper “ballot” for the correct operation of the voting device will be unable to detect errors*. Until more hybrid marking devices tabulate directly from the printed voter-verifiable text (and there are such products coming in the future, and currently under test), current PVRs are effectively “black boxes.” Only traditional ballots offer true voter-verifiability.

2. **Security Risk:** Cybersecurity experts unanimously agree that non-transparent barcodes introduce security vulnerabilities, as they prevent voters and election administrators from detecting errors or malicious tampering in the voting system that could impact the integrity of the vote. Indeed, newer hybrid voting devices are just as

⁷ <https://www.ajc.com/news/state--regional-govt--politics/georgia-panel-backs-new-voting-machines-over-hand-marked-paper-ballots/feF5QiAwnzl2l3BK055dtl/>

susceptible to tampering and software errors as DRE devices. [Dr. Wenke Lee](#), the lone cybersecurity expert on the Georgia SAFE Commission, explained in a recent Op-Ed ⁸ that for these same reasons, even the CIA now holds the most top-secret information on paper only. In sum, we believe it's simply a *bad practice* for the “touchscreen voting-for-all” model to deny many voters the option for a hand-marked ballot that is *inherently secure* compared to current machine-generated PVRs.

3. **Cost:** Traditional paper ballot voting is *significantly lower cost* than “touchscreen devices for all.” While it is true that the cost of paper, printing, and operational support of those activities must be factored into the total cost of ownership, it's still the case that touchscreen hybrid-style voting requires *vastly* more voting devices than traditional paper ballot voting. The SAFE Commission's recommendation to buy a fleet of costly voting machines (for \$100 million), instead of a much less expensive approach (\$30 million) of hand-marked paper ballots and accessible marking machines for those who want (or need) them *deserves much closer scrutiny*.
4. **Cybersecurity investment.** The high cost of acquiring many touchscreen hybrid devices also robs jurisdictions of precious funds that could (and should) be used for another essential function: *cybersecurity*. Cybersecurity is now a required cost element for election operations, in addition to traditional activities associated with the administration of voting systems. The increased costs of acquisition and of ownership represent funds that jurisdictions could have used for much needed cybersecurity upgrades in election IT operations, as well for ongoing increased cybersecurity operational costs.

4. Additional Assertions in the SAFE Commission Report

In addition to the four overarching considerations outlined above, we also have some thoughts about specific assertions made in the SAFE Commission Report. For the most part, the SAFE Commission appears to believe only touchscreen hybrid marking devices can meet their stated preferences or requirements, when in fact, better and less expensive alternatives exist.

Assertion #1: *The SAFE Commission's mission is to thoroughly study and discuss all options for Georgia's next voting system, with a focus on security, transparency, voter experience, accessibility and inclusion, voters' ability to adjust to a new system, and the ability of election officials to adapt to a new system quickly and accurately.*

The SAFE Commission seems unaware that the latest traditional paper ballot voting solutions can meet all of the values described above at least as well, if not better than, touchscreen hybrid ballot marking devices, at significantly lower cost. Let's look at each one, in turn:

- **Security:** Cybersecurity experts unequivocally agree that hand-marked or machine-marked paper ballots (for voters with disabilities) are far more secure and less vulnerable to hacking than hybrid marking systems that embed voter choice information in non-transparent ways.

⁸ <https://www.ajc.com/news/opinion/opinion-making-election-systems-more-secure/cF2euQBCYUiraLjUZXxCJK/>

- *Transparency*: Paper ballots contain contest titles and voter choices, and little other information. They are inherently more transparent than machine-marked records that embed voter choices in barcodes or QR codes. Such paper records are not voter-verifiable.
- *Voter Experience*: Marking a ballot has virtually no learning curve. Most voters will use a pen, and insert the ballot into a scanner. Voters with disabilities will have an accessible ballot marking device (BMD) experience that is similar to how they currently vote on Georgia’s AccuVote accessible DREs.
- *Accessibility*: The latest paper ballot systems from *all* commercial vendors meet federal Voluntary Voting System Guidelines (VVSG 1.0) for accessibility, and are appropriate for voters who are blind or visually impaired, or who have dexterity impairments.
- *Inclusion*: Everyone can hand-mark a ballot or use an accessible ballot marking device. Furthermore, there are paper ballot systems available today where all paper ballots, for all voters – including those marked by accessible BMDs – are the same format, so everyone’s privacy and anonymity is ensured. Everyone’s ballot format can easily look the same.
- *Ability to adjust to new system/ability of election officials to adapt to a new system*. Again, there is essentially no learning curve to mark traditional paper ballots and insert the paper into a scanner. In contrast, a new hybrid system is just that – a new system, with a much heavier “technology footprint.” It will place significantly greater burdens on voters, poll workers, warehouse personnel, and election administrators who must learn how to configure, set up, and use vastly more devices that are different from Georgia’s current DREs. In contrast, as noted above, optical scan systems for paper ballots typically have just two devices per polling place—a scanner and an accessible BMD. That’s far less equipment to learn and set up, and their operation is more straightforward.

Assertion #2: *Georgia should adopt a voting system with a verifiable paper vote record.*

The OSET Institute strongly agrees with this assertion of the Commission— which is precisely why Georgia should not implement hybrid ballot marking devices for all voters.

No currently-federally-certified “universal” ballot marking devices offer voter-verifiable records. (Though future systems might, with optical character recognition). Every currently-EAC-certified hybrid marking device (ES&S ExpressVote, Dominion ImageCast X and Unisyn FreedomVote Tablet) produces “summary ballots” which embed voter choices in barcodes or QR codes, and their contents cannot be reviewed by voters. In contrast, traditional paper ballots, which include voter marks (or machine marks) in boxes or ovals are immediately voter-verifiable.

Assertion #3: *The Commission’s recommendations are focused on the future of voting in Georgia, but in considering the future it must also consider the present voting system as well as past issues with voting in Georgia. The Commission also realizes that time is of the essence in this decision due to multiple lawsuits regarding Georgia’s current voting system and the time to implement any new system; therefore, the Commission must consider the process for implementing its recommendations in a timely manner.*

Let's look at this more closely. If “*time is of the essence*,” then there is no question that adopting a technology-heavy system that requires vast numbers of complex touchscreen devices, instead of papers and pens, results in a more burdensome implementation, not an easier one. Managing thousands of software-driven electromechanical devices that print paper vote records results in more complex operations, and an outlay of significantly more resources (in labor and dollars) – and each one of those thousands of devices will need to be re-set and re-configured in-between each election cycle. Implementing a hybrid system requires more “heavy lifting” (figuratively and literally), and will take longer to accomplish than traditional paper ballot systems. Furthermore, since Georgia’s current system is paperless, the need to write new operational and counting procedures for paper ballots in the polling place is a wash, either way; since those will be needed even with hybrid marking devices, the state is no worse off with a traditional ballot approach.

Assertion #4: *One of the reasons that the state selected the current voting system is because of its ability to prevent overvotes and flag undervotes... The current DRE system in Georgia does not allow for overvotes, but voters are still able to exercise the right not to cast a vote in a particular race resulting in an undervote. The current system will not allow a voter to overvote. The current system also flags undervotes in a mandatory review screen that shows races with an undervote prior to allowing a voter to cast their ballot.*

It appears to us that the SAFE Commission is grasping at straws here, because they profess preferences that are not all that different from capabilities that current paper ballot systems provide. More specifically, the latest paper ballot systems can be configured to flag both overvotes and undervotes at the time that the ballot is scanned, so there is no meaningful advantage to the touchscreen approach. (In fact, so-called “second-chance voting,” which allows voters to make corrections before the ballot is cast and recorded, is *required* by the Help America Vote Act, so all federally certified paper ballot systems have this capability.)

Assertion #5: Georgia also seems to think that their Early Voting practices in countywide polling places can be supported only with touchscreen devices: *The ability for voters to vote at any advance voting location within their county is also popular and should be preserved.*

Here again, the SAFE Commission appears to not have done its homework (or they are willfully ignoring public information about currently-available voting technology.) The latest paper ballot systems have the capacity to manage ballot printing on-demand, including for purposes of Early Voting in countywide “convenience voting centers.” To cite just one example, Denton County, Texas (a large county in the Dallas-Fort Worth area) recently made a smooth transition⁹ to all-paper elections, including on-demand printing for Early Voting. Denton’s implementation was also a transition from paperless DREs, similar to what Georgia currently uses. The transition to all-paper can be done – successfully.

Assertion #6: *Given Georgia’s history as a state that uses DRE’s and the familiarity of voters and election officials with that method of vote casting, Georgia should move to a primarily ballot-marking device with verifiable paper ballots solution for a new voting system.*

⁹ <https://www.hartintercivic.com/wp-content/uploads/DentonTXCaseStudy.pdf>

The Commission’s conclusion seems to ignore the reality that most people use pens, pencils and paper virtually every day of their lives in some way. We make grocery lists and checklists. We fill out forms. We check boxes on a printed page. As a result, marking a ballot has virtually no learning curve. Most voters will use a pen, and insert the ballot into a scanner. (And again, for those voters with disabilities that need an accessible marking device, the experience is similar to current accessible DREs).

In contrast, touchscreen systems and the user experience associated with them – for voters, warehouse personnel, and poll workers alike – varies from system to system. As a result, it’s a bit of a red herring for the Commission to say, “since we’re used to DREs, more touchscreen devices are best.” A new system is still a new system, and user interface design has changed a lot since 2002, when Georgia’s AccuVote system was implemented. Furthermore, since the manufacturer of the AccuVote system (Diebold) has exited the voting technology market, there’s no possibility that a new system will literally re-create features of the current system.

On the whole, voters and election officials will have a *more* to learn – *not less* – with a new hybrid system. To use a wonky human factors phrase, the “*cognitive load*” will be greater than a simple paper ballot system.

5. Our Bottom Line

In any head-to-head contest between current traditional ballot systems and current “touchscreen-for-all” marking systems, the latter approach is simply overkill that cannot match the transparency, security, and cost-effectiveness of traditional paper ballot systems.

The bottom line is, to future purchasers of new voting systems we say: Take note of this tale of two paper trails. Simplicity is your friend, and remember Occam’s Razor.¹⁰

One final thought. Often times we hear from supporters that in order to deliver on our mission as a research institute, we must be looking just over the horizon in terms of innovation direction because there is an entire generation aging into the civic duty to vote that has matured on digital input devices requiring their opposing thumbs on a high resolution bit-mapped display. Sure. But until such time as such a device can be developed for the civic duty and civil right of casting a ballot that is completely verifiable, accurate, secure, and transparent, a manual input device requiring five fingers of the hand of primary dexterity will be the best means available. Of course, handwriting is also under assault and it seems that penmanship or just using a pencil for any writing is becoming a lost art of individual identification and unique expression.¹¹ Perhaps that battle needs to be resolved contemporaneously.¹²

¹⁰ https://en.wikipedia.org/wiki/Occam%27s_razor

¹¹ See generally:

- <https://www.eonline.com/fr/news/481596/cursive-handwriting-will-no-longer-be-taught-in-schools-because-it-s-a-big-old-waste-of-time>
- https://motherboard.vice.com/en_us/article/8q85q4/why-are-we-still-teaching-kids-cursive-handwriting-common-core-curriculum
- https://www.huffingtonpost.com/megan-woolsey/why-are-we-still-teaching_b_12544974.html

¹² <https://education.cu-portland.edu/blog/classroom-resources/5-reasons-cursive-writing-should-be-taught-in-school/>