Statement of

Daniel D. Castro

Senior Analyst

Information Technology and Innovation Foundation

The Importance of Functional Standards to Promote Innovation in Voting System Technology

U.S. Election Assistance Commission Roundtable Discussion of the TGDC Recommended Guidelines

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Good afternoon. I appreciate the opportunity to appear before you today to discuss the next iteration of the voluntary voting system guidelines. I commend you for addressing this important issue.

I am a Senior Analyst with the Information Technology and Innovation Foundation (ITIF), a non-partisan research and educational institute whose mission is to formulate and promote public policies to advance technological innovation and productivity internationally, in Washington, and in the states. Recognizing the vital role of technology in ensuring American prosperity, ITIF focuses on innovation, productivity, and digital economy issues.

At ITIF I have worked on a number of issues relating to IT and public policy including Internet access taxes, Internet radio and copyright issues, the use of IT in health care and electronic voting policy. Previously, I worked as an IT Analyst at the Government Accountability Office (GAO) where I audited IT security and management controls at various government agencies. I have a B.S. in Foreign Service from Georgetown University and an M.S. in Information Security Technology and Management from Carnegie Mellon University.

The intent of this testimony is to detail the important role of innovation in improving voting technology, and to describe how the Election Assistance Commission (EAC) should shape its voluntary voting system guidelines (VVSG) to ensure that it will continue to not only allow but also foster innovation.

The Importance of Innovation

Innovation had led to many improvements in voting technology.[1] Before the mechanization of the industrial revolution, voters relied on paper ballots. In the early 1900s, election officials overwhelmingly decided to begin switching to mechanical voting machines after witnessing years of fraud and error with paper ballots. Election officials favored mechanical lever machines because they did not rely on humans to hand count each ballot. When voters pulled the lever, their ballot was immediately cast and tallied. Voters no longer had to wonder if their ballot would be lost, misinterpreted, or considered a spoiled ballot.

In the late 1950s, as mainframe computers were developed, computerized vote processing was introduced as a more efficient means of vote tallying. By 1982, more than half of the American electorate was using punch-card voting machines, which had replaced lever machines as the dominant voting technology. These machines used the punch-card paper ballots made infamous during the controversial 2000 U.S. presidential election. More recently, election officials have adopted optical scan voting machines and direct recording electronic (DRE) voting machines. As history has shown, not only is no voting system perfect, but voting systems continue to improve with new innovations.

Innovation in voting systems is shaped by three factors: the state of information technology, market demand, and voting system standards. Researchers in both academia and industry influence the state of information technology. For example, researchers have developed new voting protocols which offer end-to-end verifiability. Market demand is shaped by public opinion, public financing and state and federal laws. Finally, voting system standards can be set through both administrative processes (such as the EAC) and federal and state legislation.

Policymakers should carefully weigh the effect on future innovation when making changes to voting system standards. Specifically, policymakers should balance competing goals such as security, usability, accessibility, cost and future innovation when defining standards.

Functional Standards versus Design Standards

A key governing principle of the new economy is that policies should be technology neutral. That means that federal policies should not give an advantage to today's technology winners at the expense of tomorrow's innovators.[2] Competing technologies should be allowed to compete, and public policies should not lock in one technology. Policymakers can achieve this by setting broader functional standards rather than technology specific design standards.

Functional standards define the minimum operational requirements to which a system must conform. Since functional standards do not define any specific technology or process, they are flexible enough to allow researchers to develop new approaches to solve existing problems. Performance requirements define specific benchmarks or metrics by which a system can be evaluated. For example, the new usability requirements create a reporting requirement for an "average voting session time." While the actual average voting session time will vary based on the user population and ballot design, election officials can use this metric to compare competing voting systems.

Design standards define specific technical requirements for voting systems. Some design standards may encourage competition and innovation. For example, the EAC can set common data formats to facilitate transparency and interoperability of voting system technologies and data. However, in general, the EAC should continue to refrain from proscribing standards that limit voting to specific technology. For example, VVSG 2005 restricted but did not prohibit the use of radio frequency wireless. These restrictions balanced both short-term goals of improving voting system security with long-term goals of allowing innovation. In contrast, the TGDC recommended guidelines ban all radio frequency wireless communication in voting systems which presupposes that no future use of wireless communication can ever be conducted securely.

Enacting design standards that prohibit certain technology creates a barrier to innovation. Basically, this is a chicken and egg problem. For example, while a future version of the VVSG could be modified to allow wireless communication, the EAC would likely only modify the VVSG if a vendor could demonstrate a working prototype that securely uses wireless communication. However, a voting system vendor would be less likely to invest in the research and development needed to create such a system since there would be significant risk that the vendor would not be compliant with the VVSG.

Software Independence

The most restrictive design standard in the TGDC recommended guidelines is the new voting system requirement for software independence. The TGDC recommended guidelines reads,

> *Voting systems SHALL be software independent, that is, an undetected error or fault in the voting system's software SHALL NOT be capable of causing an undetectable change in election results.*

While the definition of software independence is couched in language as if it were a functional requirement, the definition of software independence is clearly intended as a design requirement. This requirement would make DRE voting systems (which are software dependent) non-conformant with the TGDC recommended guidelines. However, the TGDC has not provided sufficient rationale to justify the new software independence requirement for voting systems. For example, there is no comparison between the relative security, usability, accessibility and cost of software dependent voting systems versus software independent voting systems. In addition, the VVSG is also arguably not the appropriate mechanism by which to make such a dramatic change to voting system requirements. This change would force many states to replace their existing voting systems and represent a costly unfunded federal mandate.

Furthermore, the TGDC's recommendations appear inconsistent given its definition of software independence. If undetected faults or errors in the voting system's software cannot cause undetectable changes in election results, then for what purpose does the TGDC define additional security standards such as open-ended vulnerability testing?

Moreover, although the TGDC states that a voter-verified paper audit trail (VVPAT) will satisfy the requirement for software independence, as others have noted, a VVPAT does not guarantee that errors in the voting system software will not cause undetectable changes in

election results.[3] This is because every voter must accurately verify the VVPAT for this method to successfully prevent against fraud and error.

If the intent of software independence is to ensure that complex processes, which are difficult to audit, cannot cause an undetectable change in election results, then the scope and definition of software independence should be extended. In fact, as currently defined, the TGDC recommended guidelines seem to indicate that software independence is needed to protect voters from human error or maliciousness during software development. However, there is no need to restrict this protection to only during the software development cycle. Instead, a broader definition of human independence could be defined to replace software independence, such as,

> *Voting systems SHALL be human independent, that is, an undetected error or fault by a human SHALL NOT be capable of causing an undetectable change in election results.*

This definition, for example, would prohibit the use of DREs with VVPAT, since their security depends on election officials maintaining a secure chain-of-custody. While such a definition is not currently feasible, it illustrates the impracticality of the proposed definition of software independence.

However, if the EAC decides to adopt the TGDC's recommendation to use software independence as a category for voting systems, the EAC should provide voting system guidelines for both software dependent and software independent voting systems. Various techniques can be used to ensure that software dependent voting systems have sufficient security controls, including configuration management techniques, hash code testing of source code, placing source code in escrow, open-ended vulnerability testing, parallel testing, and post-election audits.

The Innovation Class

The TGDC recommended guidelines describe two methods for voting systems to satisfy the software independence requirement: through independent voter-verifiable records (such as a VVPAT) or through the innovation class. The spirit and intent of the innovation class is admirable and recognizes the importance of innovation to improving voting technology. Unfortunately, as currently drafted, the innovation class is inadequately defined and provides an unclear path to conformance.

The first problem with the innovation class is that these voting systems must still meet the definition of software independence. A true innovation class should not have any design standards applied to it, but rather only have the functional standards of a basic vote-capture device applied to it. Second, the innovation class does not define any objective standards by which voting system vendors can self-evaluate whether their proposed voting system will be accepted. Voting system researchers need criteria by which they can evaluate whether their system will be accepted for evaluation within the innovation class. Specifically, the EAC should work to define a clear threat model that will be used to evaluate all voting systems.

Conclusion

The purpose of the VVSG should not be to just define the standards to which existing voting systems must conform, but also to define the requirements for future voting systems. As such, the EAC should ensure that the next iteration of the VVSG promotes innovation so that voting systems can continue to improve by providing technology-neutral functional standards.

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1. See Daniel Castro, "Stop the Presses: How Paper Trails Fail To Secure E-Voting" (Washington, DC: The Information Technology and Innovation Foundation, 2007) <www.itif.org/files/e-voting.pdf>
2. The New Economy Task Force, "Rules of the Road: Governing Principles for the New Economy," Progressive Policy Institute, Washington, DC, 1999 <www.ppionline.org/ppi_ci.cfm?contentid=1268&knlgAreaID=128&subsecid=174>.
3. Rick Carback, Comments on "Seeking clarity on 'Software independence' in voting systems," accessed on December 4, 2007. <allaboutvoting.com/2007/09/11/seeking-clarity-on-software-independence-in-voting-systems/ >