

## **Testimony**

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I wish to thank the Election Assistance Commission for this opportunity to speak about how to improve the usability and accessibility of voting products and systems and the role of the National Institute of Standards and Technology (NIST) in this endeavor.

NIST has been asked, in the Help America Vote Act (HAVA), to assess the research, standards, and guidelines in the areas of human factors, usability and accessibility in terms of their applicability to voting products and systems. As a result of this investigation, we have compiled a set of recommendations that, if followed, should measurably improve the usability and accessibility of voting systems.

In the usability field, the definition of a “system” encompasses the users and all the elements required to accomplish some goal. A specific system is viewed as one (or more) users, attempting to accomplish some activities towards a goal or set of goals, within a specific environment. The human factors and usability for voting systems focus on the process of the voter casting a ballot as intended and the interaction of the poll worker with the voting system. This primarily involves the “user interface” the voter is presented by the product, such as a Direct Recording Electronic terminal, also known as a “DRE”, and the environment and related equipment at the polling place. In this context, we have NOT examined issues such as the accuracy of the product counting the votes, the quality of hardware and software, or the underlying security of voting systems as these, in general, do not involve user interaction.

From a usability perspective, the voting system is defined by:

- The voters themselves,
- The physical environment in which they vote (such as a polling station or home for Internet-based voting),
- The psychological environment associated with voting (for example, stress induced by long lines at polling stations, or social pressure, or time pressure associated with personal deadlines),
- The equipment, both hardware and software, used for voting (such as paper ballots, optical scanning, and DREs),
- The ballot itself, and
- The quality of support provided (if required by the voter) by poll workers, and
- Any documentation and training provided to the voter, poll workers or other election administrators).

Usability is a measure of the effectiveness, efficiency, and satisfaction achieved by a specified set of users performing specified tasks with a given product. Effectiveness includes accuracy and completeness, such as number of errors;

efficiency includes resources such as time expended by the voter, and satisfaction includes the subjective comfort and acceptability of the results to the voter. Accessibility is defined as the degree to which a system is available to and usable by voters with disabilities. These are standard definitions that have been formulated to provide the means for explicit measurements for usability and they are certainly applicable to voting systems. This means that we can measure usability of voting products such as DREs. Currently, we are unsure of what, if any usability problems exist, because for the most part, voting products and systems have not been tested for usability. To give a simple example, for touch screen ballots, if a voter selects a candidate by mistake and wants to deselect that choice, we do not know whether any of the current implementations causes voter confusion and errors or not.

It is possible to create standards which address usability and accessibility. However, in order for an Independent Testing Authority to qualify a system as conforming to such a standard, that is, that a voting product has achieved a specified level of usability and accessibility, tests must be designed to measure these levels. Conformance tests for requirements that do not involve human interactions can often be automated, since only the intrinsic structure or behavior is being tested. When a requirement does involve human interaction, the way in which it is to be tested depends on the type of requirement: for example, a design requirement could be tested by inspection, but a performance benchmark needs to be tested with actual users. This implies that the standards have to be written with such testing in mind. These standards should also be relatively independent of specific implementations. In addition, aspects of the voting system beyond the user interface itself such as the ballot design, documentation, etc, also need to be examined with usability and accessibility in mind.

The NIST recommendations are:

1. Develop voting system standards for usability that are performance-based, high-level (that is, relatively independent of the technology), and specific (that is, precise).
2. Specify the complete set of user-related functional requirements for voting products in the voting system standards.
3. Avoid low-level and general product design specifications for usability. Only those product design requirements that have been validated as necessary to ensure usability should be included as “shall” statements in standards.
4. Build a foundation of applied research for voting systems and products to support the development of usability and accessibility standards.
5. To address the removal of barriers to accessibility, the requirements developed by the Access Board, the current Voting System Standards or VSS, and the draft Institute of Electrical and Electronics Engineers standards should be reviewed, tested, and tailored to voting systems then considered for adoption as updated VSS standards. The feasibility of

expansion to include both self-contained, closed products and open architecture products should also be considered.

6. Develop ballot design guidelines based on the most recent research and experience of the visual design communities, specifically for use by election officials and in ballot design software.
7. Develop a set of guidelines for facility and equipment layout; develop a set of design and usability testing guidelines for vendor- and state-supplied documentation and training materials.
8. Encourage vendors to incorporate a user-centered design approach into their product design and development cycle including formative (diagnostic) usability testing as part of product development.
9. Develop a uniform set of procedures for testing the conformance of voting products against the applicable accessibility requirements.
10. Develop a valid, reliable, repeatable, and reproducible process for usability testing of voting products against agreed-upon usability pass/fail requirements.

In general, the **single most critical need** NIST has identified is a set of usability standards for voting systems that are performance-based and support objective measures and associated conformance test procedures that can be used for the qualification and certification of voting products.

We also recommend that, in the short term, states perform their own usability testing before procurement as well as after procurement with their own ballots to mitigate any potential usability problems that might occur.

We expect that these recommendations will be taken into consideration by the Technical Guidelines Development Committee when it becomes operational under the Election Assistance Commission as described in the HAVA.

Thank you.