

**Testimony  
Public Hearing of the  
Election Assistance Commission**

**Pre-election Testing**

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**Introduction**

My name is Merle King. I am the Executive Director of the Center for Election Systems at Kennesaw State University in Kennesaw, Georgia. I have been the Executive Director since the formation of the Center in July of 2002. The Center serves as the technical support arm of the Elections Division of the Office of the Secretary of State of Georgia. The Center provides various services including a call center, ballot building, precinct-level implementation of the voter registration list, training and various kinds of testing of voting systems.

My testimony today will address the testing that our Center performs, prior to an election.

The testing of voting systems faces numerous constraints, including the need for well-reasoned and validated testing goals; metrics for measuring attainment of those goals, methods for applying the metrics, and the availability of resources: personnel (expertise), equipment and time. Finally, there must be an operational environment capable of integrating the outcomes of the testing into an action plan. I would like to preface my description of the Center's testing activities with comments on some of the aforementioned constraints.

**Testing Constraints**

Prior to designing a testing protocol for a voting system or a voting system component, testing goals must be established. Are we testing for conformance to a standard? Compliance with a statute or rule? Compatibility with other components or prior versions? The presence or absence of a condition? Error and exception handling? Can the test be a simulation of a real-world condition? This fact gathering, prior to construction of the testing protocol can be both time consuming and unstructured, requiring multiple iterations.

The metrics used to measure compliance will be quantitative or qualitative – or perhaps a combination of both. The identification of the metrics will assist in the definition of the methods by which the metrics will be measured.

The resources needed for testing voting systems can be deceptively complex. The expertise required is both broad and deep. Designers of testing protocols must have a working knowledge of the voting system at the hardware, application software and systems software level; they must know the statutes, rules and regulations that govern the jurisdiction's voting system; they must know the operational environment in which the system is to be deployed. I would also add an additional, desirable requirement of the testers: independence from the vendor.

The testing of voting systems requires full and complete access to the voting system's components. This requirement ranges from a single configuration to implement proof-of-concept testing, to all units in the jurisdiction for acceptance testing. Acquiring or scheduling access to this resource can be a significant component of the testing protocol.

The final constraint I mentioned is time. The testing of voting systems has to be interleaved with their availability to hold elections. Election code in Georgia requires the units be held for L&A testing, up to 45 days before an election and 30 days following an election. In 2008, Georgia has, or will hold elections on February 5, July 15, August 5, August 26, September 16, November 4 and December 2. This does not count special elections called to filled vacant seats.

Before I begin to describe the testing that we do in Georgia, I would like to point out that quality cannot be tested into a system. Testing can reveal the presence or absence of features and functionality, but it cannot make a bad system good, or a broken system fixed.

## **Testing**

The pre-election testing we do in Georgia is spread over a variety of products used in an election. Rather than describe the testing by product, I will describe it chronologically.

### **State Certification Testing**

The State of Georgia requires the use of federally certified voting systems. In order for a voting system to be state certified, it must also be federally certified – but the testing of the systems is not sequential. State Certification testing precedes the purchase of a new system or the acceptance of a modification to an existing system.

Georgia uses a uniform statewide voting system, with a single vendor, Premier Election Systems. The model of state certification we now utilize, initiates state certification testing before federal testing. This model addresses the reality of the length of time that it takes to move a candidate system through federal testing. We want to avoid the prospect of discovering a deficiency in a federally qualified system that would first

require its modification to conform to Georgia's requirements, then sending it back through the federal certification process. We now view state certification as a two-pass process – one preceding or concurrent with federal testing and a second pass after the completion of federal testing. An important outcome of the state certification test is the development of the acceptance test protocol.

### **Acceptance Testing**

Once a voting system has been deployed or a repaired unit returned to a county, the Center performs an acceptance test on the unit. The acceptance test assesses the physical and mechanical condition of the unit, the software version, calibration, battery status, and a number of other pass/fail criteria to determine if the unit is capable of holding and election in Georgia. The acceptance test includes testing the functionality of the software installed on each unit. Georgia code requires that every unit used in an election must be acceptance tested.

There are several incidental benefits from acceptance testing equipment. First, we can inspect the physical storage of the equipment at the county level, including an assessment of the physical security. Second, we develop a master list of equipment in the state. This list is used to assist counties if their records are lost or contains errors.

We also apply acceptance testing to moved servers. If a county has to relocate their election server, we acceptance test it after it has been moved. The acceptance test on the server includes a hash compare of approximately two hundred files that are involved in processing an election. County officials can also request that equipment be acceptance tested if they have any reason to believe that the security of the storage facility has been compromised or if a voter raises concerns about a specific piece of equipment.

Currently Georgia has 26,000 TS units, 6500 ExpressPoll units, 600 optical scan units and 165 servers – all of which have been acceptance tested at least once.

### **Ballot Testing**

The Center builds the ballots for 126 of Georgia's 159 counties and tests the ballots of all 159 for content, layout and logical correctness. A ballot is considered correct if it contains all of the races, candidates and questions, properly spelled and displayed with supporting audio files for each ballot style associated with a vote center. Ballots go through multiple layers of proofing at the Center including an assessment of their logical correctness – the ability of the system to aggregate votes cast on a particular ballot style and to match voters to ballot styles. Ballots are evaluated against a checklist of 85 items, including the audio. When testing ballots we use the audio to reinforce visual checking. No builder can proof their own ballots. When the ballot proofs leave the center, they are proofed by the county at least once prior to final signoff.

## **Pollbook File Testing**

The Center prepares the master data file and compact flash cards for electronic pollbooks used in counties to check in voters at the precinct and issue them voter access cards. An important aspect of the preparation of the data file used build the cards, is mapping all 5.4 million voters in the voter registration system to one of approximately 3000 ballot styles used in a statewide election. This process enables us to determine if there are any voters not assigned to a valid ballot style. County registrars are notified of any unmatched voters and will attempt to resolve the issue before the election. In the February 5<sup>th</sup> Presidential Preference Primary, we were able to reduce the number of unmatched voters to 28 – a remarkable accomplishment.

## **Logic and Accuracy Testing**

Georgia code requires that all equipment used in an election be submitted to a Logic and Accuracy test in the week(s) preceding the election. The purpose of L&A is to demonstrate the correctness of the ballot and the operational functionality of the voting system equipment.

L&A is a critical time to assess failures and pending failures of election equipment, especially the servers running the EMS. We encourage counties to turn their servers on days in advance of L&A and in advance of the election and leave them on through the event. Servers have a tendency to fail at startup. The more rigorous and thorough L&A testing, the less likely defective ballot styles or defective equipment will be used in the election. L&A is the last, best chance to repair and replace equipment prior to an election.

In many jurisdictions, including some in Georgia, vendors are used to conduct L&A. It is my preference that this task not be delegated to the vendor. At a minimum, the supervisor of elections and staff should be engaged in a supervisory role. Vendors may be incented to minimize problems found in L&A, knowing they can implement election night workarounds for ballot and equipment issues.

## **Parallel Monitoring**

Parallel Monitoring is a test designed to detect election-day anomalies in voting equipment. Prior to a general or primary election, we select six precincts at random from around the state. We prepare memory cards from the same election database that was prepared for the county. Scripts are prepared that vote every position in the ballot a known number of times. On the morning of the election, at about 10 am, we open a simulated precinct with one machine. We vote the script by having one employee read the script, a second vote the choices on a touchscreen and a third video taping the voting.

At the conclusion of the script we close the election and tally the votes, comparing the machine generated totals to those hand tabulated from the scripts. In the four years that we have performed parallel monitoring we have encountered two anomalies – both

explained when we reviewed the video tape. The “voter” made a choice not matching the script.

Three other precincts are selected on Election Day and their databases and paper tapes from the precinct are reviewed, post election.

### **Special Case Testing**

The Center also designs and implements one-off tests for special cases. Recently our vendor issued a product advisory notice for a version of the ballot station software that is not used in Georgia. We thought the symptoms of the problem were sufficiently similar to phenomena that we had observed in our touchscreen systems, that we initiated a test to determine if the election archive management of our system mirrored the behavior of the reported system. This testing has led to the development of a protocol for removing archived elections from touchscreen units used to upload cast ballots to the server.

We also use our testing lab to duplicate the tests performed by the vendor, VSTLs, activists and others engaged in voting system testing. This permits us to independently verify the results of other organizations.

### **Utilizing Test Results**

Testing for the sake of testing would be a waste of resources. The results of testing must be reviewed, verified, and then incorporated into the appropriate follow on activity. Results of certification testing are folded back into the specifications for the voting system and the development of acceptance testing protocols. Results of acceptance testing are folded back into quality assurance requirements, maintenance and warranty decisions, and physical security assessment. Results of ballot testing are folded back into the training of ballot builders. Results of testing of pollbook files are folded back into the voter registration maintenance process. Results of special case testing are used to improve products and technical support. Ultimately, the net effect of the testing is to improve the performance and the public’s confidence in the performance of our voting system.