NIST VOTING PROGRAM
MARY BRADY, PROGRAM MANAGER
Outline

- Motivation & Congressional Mandates
- Help America Vote Act
- Current Challenges
- Engage the Broader Community
- Summary
Motivation: 2000 Presidential Election

Confusion at Palm Beach County polls
Some Al Gore supporters may have mistakenly voted for Pat Buchanan because of the ballot's design.

Although the Democrats are listed second in the column on the left, they are the third hole on the ballot.

Punching the second hole casts a vote for the Reform party.

Sun-Sentinel graphic
Congressional Mandates

**HAVA 2002** (Public Law 107-252): The Help America Vote Act (HAVA) requires NIST/SSD to provide technical support for the development of Voluntary Voting Standard Guidelines (VVSG). Such technical work includes computer security, methods to detect and prevent fraud, protection of voter privacy, the role of human factors, including assistive technology for voters with disabilities, and remote access voting, including voting through the internet.

**MOVE 2009**: The Military and Overseas Voters Empowerment Act of 2009 (MOVE) directs NIST and EAC to provide ”best practices or standards in accordance with electronic absentee voting guidelines established”… to support the pilot program or programs developed by DOD as directed by the Uniformed and Overseas Citizens Absentee Voting Act (UOCAVA) of 1986 as amended.
Outline

- Motivation & Congressional Mandates
- Help America Vote Act
- Current Challenges
- NIST Response: A New Paradigm
- Summary
Help America Vote Act

- Standards Development
- Accreditation, Testing, and Certification
- Usage by States
VVSG Development

- EAC
- Standards Board
- Advisory Board
- TGDC NIST Director

Voting Guidelines
- VVSG 1.0 -- 2005
- VVSG 2.0 -- 2007
- VVSG 1.1 -- 2015
Lab Accreditation, Testing, Certification

**VSTL’s** – Voting System Test Laboratories are recommended for accreditation by NIST NVLAP Program. VSTL’s test voting systems and make recommendation to the EAC.

**Certification** - procedure by which a third party gives written assurance that a product, process or service conforms to specified requirements.

**EAC** – Reviews testing information provided by the VSTL’s and certifies a system. Also responsible for decertifying a system if necessary.

**EAC** – In consultation with NIST, may provide a request for interpretation.
VVSG: In use in 47/50 States
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Current Challenges

- Presidential Commission on Election Administration
- Jurisdictions: Large and Small
- Equipment Changes
- Increasing Use of Information Technology in Elections
In Recent Years...

- No EAC Commissioners from 2011 until January 2015
- TGDC has been on a hiatus
- Presidential Commission on Election Administration
- Voting Equipment is Changing
- Election officials looking to capitalize on advances in IT to gain efficiencies and lower cost
- Increasingly complex IT application
- Interconnected devices
- New paradigms for voting systems
- Voter Registration
- Ballot marking devices
- E-pollbooks
- Election Night Reporting
Presidential Commission on Election Administration (PCEA)

The Commission's key recommendations call for:

- Modernization of the registration process through continued expansion of online voter registration and expanded state collaboration in improving the accuracy of voter lists
- Measures to improve access to the polls through multiple opportunities to vote before the traditional Election Day and the selection of suitable, well-equipped polling place facilities, such as schools
- State-of-the-art techniques to assure efficient management of polling places, including tools the Commission is publicizing and recommending for the efficient allocation of polling place resources
- Reforms of the standard-setting and certification process for new voting technology to address soon-to-be antiquated voting machines and to encourage innovation and the adoption of widely available off-the-shelf technologies
Basic Election Administration Facts

Diversity is the underpinning of Elections.

50 States
3,140 Counties
1,620 NE Townships
5,312 Midwest Townships
10,072 Election Jurisdictions

Source: Kim Brace
Range of Election Jurisdictions

**LA County Warehouse**

- **4.8 million registered voters**
- **9 languages supported besides English (Spanish, Hindi, Japanese, Korean, Thai, Vietnamese, Chinese, Cambodian, Filipino)**
- **4,600 polling places**
- **22,200 pollworkers**

**Source:** Kim Brace
Voting Equipment is Changing

Type of Voting Equipment by County - 1980

Source: Kim Brace
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Future of Voting Systems Symposium

Purpose:
The Election Assistance Commission (EAC) and National Institute of Standards and Technology (NIST) are sponsoring a two and a half day symposium to explore emerging trends in voting system technology with the diverse election community at large. The sponsoring organizations seek to have lively discussion on the following topics:

- Why some jurisdictions are exploring building their own voting systems
- Trends in voting system technology acquisition and deployment plans
- How election officials, manufacturers and academics view the future of voting system technologies
- Alternative standard development processes for voting systems
- Alternative methods for voting system testing and certification at the Federal and State level

The symposium will provide an environment for interactive discussions among the attendees including election officials, voting system manufacturers, voting system test laboratories, standard developers, academics, and Federal, State, and local government officials. The symposium will encourage attendees participation through panel discussions with limited presentations to frame the topics to be explored. The first day of the symposium will explore voting system technology trends seen by election officials, voting system manufacturers, voting system test laboratories, and academia.

NIST/EAC Symposia

Explore Emerging Trends in Voting
## NIST Roadmap: The Voter Journey

<table>
<thead>
<tr>
<th>Preparing to vote</th>
<th>Choosing how to vote</th>
<th>Checking in/getting ballot</th>
<th>Marking the ballot</th>
<th>Casting the ballot</th>
<th>Verification &amp; results</th>
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<tbody>
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<td>Learn</td>
<td>People</td>
<td>Policy</td>
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<td>What is on the ballot?</td>
<td>Where do I go to vote</td>
<td>How do I get my ballot</td>
<td>How do I cast my ballot?</td>
<td>Who won?</td>
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<td>Am I/How do I register?</td>
<td>What are my choices?</td>
<td>How do I mark as I intend?</td>
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<td>Did my vote count?</td>
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<td>Register to vote</td>
<td>Request a VBM (or other)</td>
<td>Receive 'ballot'</td>
<td>Mark the ballot</td>
<td>Review the ballot</td>
<td>See election results</td>
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<tr>
<td>Registration Forms/OVR</td>
<td>Online VBM SYstem</td>
<td>Pollbook or Sign-in</td>
<td>Activate or open the ballot</td>
<td>Cast the ballot</td>
<td>Verify ballot was received</td>
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<tr>
<td>&quot;My Voter&quot; Portals</td>
<td>&quot;My Voter&quot; Portals</td>
<td>Ballot Delivery System</td>
<td>Ballot Marking System</td>
<td>VBM/Ballot Tracking</td>
<td>E2E Verification System</td>
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<td>Elections Web/Phone</td>
<td>Elections Web/Phone</td>
<td>Transportation to Polls</td>
<td>Ballot</td>
<td>Electronic Casting</td>
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<td>People</td>
<td>Policy</td>
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<td>Registrar</td>
<td>Voter Ed</td>
<td>Eligibility</td>
<td>Elections office</td>
<td>Poll workers</td>
<td>Mail Ballot Return</td>
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<td>Voting Options</td>
<td>Voting Options</td>
<td>Hours/Places</td>
<td>Poll workers</td>
<td>Poll workers</td>
<td>VBM/Ballot Tracking</td>
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<td>Voter ID</td>
<td>Sample Ballots</td>
<td>Provisional</td>
<td>Helper Rules</td>
<td>Helper Rules</td>
<td>E2E Verification System</td>
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<td>Helper Rules</td>
<td>Counting Rules</td>
<td>Provisional</td>
<td>Helper Rules</td>
<td>Canvass</td>
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<td>Canvass</td>
<td>Ballot Access</td>
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</table>
NIST Roadmap

• Partnered with Center for Civic Design
• Convened 2 Workshops
• Draft Report Available at:

• Identified Six Priority Areas:
  ➢ Support the design process
  ➢ Engage voters effectively
  ➢ Address the entire voter journey
  ➢ Support evolving technology
  ➢ Provide useful guidance and standards
  ➢ Improve testing in design and certification
NASED Subcommittee

**Principles**
- High-level
- Discussion points
- U&A: 2 pages

**VVSG**
- Additional Information
- U&A: 100 pages

**Test Assertions**
- Low-level details
- U&A: 65 pages

- Encapsulate knowledge from other disciplines:
  - U&A: >15 other standards activities
<table>
<thead>
<tr>
<th>Election Process Function(s)</th>
<th>Manual actions</th>
<th>Voter reg. sys.</th>
<th>EMS</th>
<th>Poll books</th>
<th>EPB</th>
<th>postal mail deliv</th>
<th>Online ballot deliv (PDF) sys</th>
<th>ballot delivery</th>
<th>mark + count</th>
<th>markers</th>
<th>verify</th>
<th>Acc-VS</th>
<th>paper ballot</th>
<th>touch-screen ballot UI</th>
<th>audio ballot UI</th>
<th>physical controls UI</th>
<th>Sip’n Puff UI</th>
<th>Acc-Switch UI</th>
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<td>voter cancels/spoils ballot</td>
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<td>transfer information (physically, electronically)</td>
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</table>
IEEE Voting System Standards

VSSC
John Wack, Chair

1622.2
Election Results Reporting
Sarah Whitt

1622.3
Event Logging
John Wack

1622.4
Election Data Modeling
Kenneth Bennett

1622.6
Voting Methods Mathematical Models
Lauren Massa-Lochridge

1622.7
Electronic Pollbooks
Jay Bagga

“IEEE effort is most significant work going on in Voting”
Matt Masterson
EAC Commissioner
Trustworthy Elections

- Legislatures, Election Officials
  - Cybersecurity Education
  - Risk-Based Security

- Manufacturers, Test Labs, EAC
  - Software Assurance
  - Test Assertions
Test Assertions: Low-level details

NIST Team > EAC/VSTL’s > Manufacturers

Draft from VVSG

In-Depth Review

Feedback

Harmonized Assertions

Usability/Accessibility (U/A) assertions
- Covered 19 sections: 3.1.1-3.2.8, 7.9.5-7.9.7
- 546 TAs = (204 usability, 287 acc., 55 VVPAT

Security assertions
- Covered Chapter 8, 9
- 404 TAs
**Principle:** No interference

**VVSG 1.0 Requirement 3.2.2.2c-iii:** No voting equipment shall cause electromagnetic interference with assistive hearing devices that would substantially degrade the performance of those devices. The voting equipment, considered as a wireless device, shall achieve at least a category T4 rating as defined by American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids, ANSI C63.19.

- **TA3222ciii-1:** Voting equipment, when used with assistive hearing devices, SHALL achieve at least a category T4 rating as defined by American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids, ANSI C63.19.
- **TA3222ciii-1-1:** Voting equipment, when used with cochlear implants, SHALL achieve at least a category T4 rating as defined by American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids, ANSI C63.19.
- **TA3222ciii-1-2:** Voting equipment, when used with hearing aids, SHALL achieve at least a category T4 rating as defined by American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids, ANSI C63.19.
# Voting Security Studies

<table>
<thead>
<tr>
<th>Report</th>
<th>Year</th>
<th>Voting System Report Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>[14]</td>
<td>2010</td>
<td>Security Analysis of India’s Electronic Voting Machines</td>
</tr>
<tr>
<td>[15]</td>
<td>2010</td>
<td>Exploiting the Client Vulnerabilities in Internet E-voting Systems: Hacking Helios 2.0 as an Example</td>
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<tr>
<td>[16]</td>
<td>2010</td>
<td>Maryland State Board of Elections Online Voter Services Penetration Testing Report</td>
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<tr>
<td>[18]</td>
<td>2012</td>
<td>Security Analysis of the Estonian Internet Voting System</td>
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<tr>
<td>[19]</td>
<td>2012</td>
<td>Review of Scytl’s system by Finland (Audit report on pilot electronic voting in municipal elections)</td>
</tr>
</tbody>
</table>
CWE Mapping

- Over 250 Vulnerabilities
- Top 15 Voting CWE’s

- CWE-306 - Missing Authentication for Critical Function
- CWE-120 - Classic Buffer Overflow
- CWE-522 - Insufficiently Protected Credentials
- CWE-345 - Insufficient Verification of Data Authenticity
- CWE-311 - Missing Encryption of Sensitive Data
- CWE-134 - Uncontrolled Format String
- CWE-310 - Cryptographic Issues
- CWE-330 - Use of Insufficiently Random Values
- CWE-190 - Integer Overflow or Wraparound
- CWE-20 - Improper Input Validation
- CWE-321 - Use of Hard-coded Cryptographic Key
- CWE-327 - Use of a Broken or Risky Cryptographic Algorithm
- CWE-269 - Improper Privilege Management
- CWE-303 - Incorrect Implementation of Authentication Algorithm
Outline

- Motivation & Congressional Mandates
- Help America Vote Act
- Current Challenges
- Engage the Broader Community
- Summary
Summary

- Elections are complex and the elections community is very diverse
- Wider engagement of state and local election officials, manufacturers, test laboratories, academics, and a number of advocacy groups
- Working with the broader elections community on laying the foundation for the next version of the VVSG
- Restarting the TGDC with recently appointed Commissioners
- Let’s get to work!