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## **Letter of Comment on Discussion of Audit Requirement in Senate Bill 0406**

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**Luther Weeks**  
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Dear Chair Kaiser, Subcommittee Chair Washington, and Members of the Election Law Subcommittee,

We are a group of election integrity experts who have collectively been involved in dozens of election audits in dozens of jurisdictions. We are writing to provide expert perspective on some of the issues brought up during the discussion on 30 March 2017 regarding the automated software audit of ballot images proposed in Senate Bill 0406.

**The ability of humans to count:** The fact that humans make errors while counting was presented in support of automated audits. While humans do make errors, these errors tend to be small and to cancel. That is, they do not, in general, build up systematically for or against any particular candidate. On the other hand, machine count errors can be very systematic. For example, a machine may not recognize all marks of a certain darkness level or on a particular part of the page. Or, as noticed in Maryland in 2016, the scanner may insert marks in the image, then interpret them as votes for multiple candidates, and ignore the original vote because the ballot is interpreted as an over voted ballot.

Systematic errors—whether due to uncalibrated or faulty technology, or with specific intent to change an election outcome—can result in changing a large number of votes. These changes can be biased against or towards a specific candidate, if, for example, they are focused in a particular precinct. A best approach—to harness the ability of machines to count accurately, while checking them to ensure the absence of systematic errors—is to have an automated count with a manual audit by humans. Note that a well-designed audit typically examines only a small number of ballots unless the margin is close or the election outcome is incorrect; it is misleading to compare the burden of an audit to the burden of a complete hand count.

**Pre-election hand-to-eye tests:** Such tests can provide information on the tested scanners and their calibration and may help improve their performance. They cannot, however, provide reliable information on the fidelity of the ballot images before the ballots are voted or scanned.

**The voting system software checks itself:** In response to a question about how one would know that the ballot images represented the paper ballots, it was said that the software checks that the ballot images match the paper copy. This statement is difficult to understand.

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The software cannot “see” the paper ballots, except through the same scanner lens (and software) that takes the ballot images. So, does the scanner take a second image? We are not aware of code in op-scan voting systems that compares two such images. Further, if there were a problem in the scanner lens or image capture technology, how would the software see the ballot except through this faulty mechanism? Further, what does it mean for a system to audit itself? The proposed automated software audit falls far short of basic safeguards and best practice as recommended by, for example, the Presidential Commission on Election Administration<sup>1</sup> and the League of Women Voters<sup>2</sup>.

Because the audit has as its basis unverified images provided by the system that is itself to be audited, it is not independent, even if conducted by a third party. Because the audit cannot detect manipulation, passing such an audit does not necessarily mean the results are correct. Because it is a software audit, it is not at all transparent.

Given that there is much to consider before determining how to carry out a robust audit, the strong opposition to the proposed audit among experts<sup>3</sup>, and the importance of independent, public, and transparent audits to trustworthy and fair elections, we repeat our strong recommendation that the Maryland Legislature hold full hearings and perform a complete analysis on the risks, costs, and alternatives before passing audit legislation that is inadequate to ensure election integrity.

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<sup>1</sup>[https://law.stanford.edu/sites/default/files/publication/466754/doc/sls\\_public/Amer%20Voting%20Exper-final%20draft%2001-04-14-1.pdf](https://law.stanford.edu/sites/default/files/publication/466754/doc/sls_public/Amer%20Voting%20Exper-final%20draft%2001-04-14-1.pdf)

<sup>2</sup>[http://lww.org/files/Report\\_ElectionAudits.pdf](http://lww.org/files/Report_ElectionAudits.pdf)

<sup>3</sup><http://www2.seas.gwu.edu/~poorvi/MarylandAudits/>

## Biographies

**Mark Lindeman** is a political scientist whose research includes public opinion, political behavior, and election verification issues. His work with post-election vote tabulation audits includes writing several co-authored methods papers; serving as executive editor of the 2012 white paper "Risk-Limiting Audits: Why and How" on behalf of a multidisciplinary working group; and advising officials and advocates in several states about audit implementation. He is co-author of *Public Opinion* (third edition: Perseus Westview, 2015). Lindeman has a Phd from Columbia University.

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**Neal McBurnett** is an independent consultant in election integrity and security. He has worked for Bell Labs, Internet2 and Databricks. He has worked to improve election integrity since 2002 by pioneering post-election audits, working with election administrators, legislators and secretaries of state. He did the first risk-limiting audit in Colorado, and collaborated on Colorado's Risk Limiting Audit project and ballot-level risk-limiting audits that reached new levels of efficiency and scale. He also audited the innovative Scantegrity end-to-end-verifiable election in Takoma Park MD in 2011, and is a member of the STAR-Vote design team.

McBurnett has also worked on data format standards for elections via the IEEE and the US Election Assistance Commission (EAC), and is active with the Election Verification Network. McBurnett has a BS in computer science from Brown University and an MS in computer science from University of California, Berkeley.

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**Ronald L. Rivest** is the Institute Professor of Computer Science in MIT's Dept. of Electrical Engineering and Computer Science. He is a member of MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL), a member of the lab's Theory of Computation Group and is a leader of its Cryptography and Information Security Group. He is a founder of RSA Data Security and an inventor of the RSA public-key cryptosystem, and a co-founder of Verisign and of Peppercoin. Professor Rivest has research interests in cryptography, computer and network security, voting systems, and algorithms. He is a member of the National Academy of Engineering, the National Academy of Sciences, and is a Fellow of the Association for Computing Machinery, the International Association for Cryptographic Research, and the American Academy of Arts and Sciences. He is also on the EPIC Advisory Board.

Together with Adi Shamir and Len Adleman, Rivest was awarded the 2000 IEEE Koji Kobayashi Computers and Communications Award and the Secure Computing Lifetime Achievement Award. He also received, together with Shamir and Adleman, the 2002 ACM Turing Award and the 2009 NEC C&C Prize. He received an honorary degree from the University of Rome. He is a Fellow of the World Technology Network and a Finalist for the 2002 World Technology Award for Communications Technology. In 2005, he received the MITX Lifetime Achievement Award; in 2007,

he received both the Computers, Freedom and Privacy Conference “Distinguished Innovator” award and the Marconi Prize. In 2008, he received an honorary doctorate from the Louvain School of Engineering at the Universite Catholique de Louvain (UCL). In 2010, he was awarded MIT’s Kilian Faculty Achievement Award. He has extensive experience in cryptographic design and cryptanalysis, and served as a Director of the International Association for Cryptologic Research, the organizing body for the Eurocrypt and Crypto conferences, and as a Director of the Financial Cryptography Association.

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**Philip B. Stark** is Professor of Statistics Associate Dean of the Division of Mathematical and Physical Sciences, and Director of the Statistical Computing Facility at the University of California, Berkeley. Stark serves on the Board of Advisors of the US Election Assistance Commission. He developed the notion of “risk-limiting audits,” which are now required by the state of Colorado (C.R.S. 1-7-515) and are part of audit-related legislation in California: California AB2023, SB360, AB44. He served on [California Secretary of State Bowen’s Post Election Audit Standards Working Group](#). Stark has published more than one hundred fifty articles and books, served on the editorial board of several scientific journals, and lectured at universities and professional societies in more than twenty-five countries. He has consulted for the U.S. Department of Justice, the Federal Trade Commission, the U.S. Department of Agriculture, the U.S. Census Bureau, the U.S. Department of Housing and Urban Development, the U.S. Department of Veterans Affairs, the California Attorney General, the California Highway Patrol, and the Illinois State Attorney. He has testified to the U.S. House of Representatives Subcommittee on the Census; the State of California Senate Committee on Elections, Reapportionment and Constitutional Amendments; the State of California Assembly Committee on Elections and Redistricting; and the State of California Senate Committee on Natural Resources. Stark received the University of California Chancellor’s Award for Public Service for Research in the Public Interest and the Leamer-Rosenthal Prize for Transparency in Social Science.

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**Paul Stokes** spent most of his career at Sandia National Laboratories conducting research, development and analysis of technologies for arms control compliance verification and intelligence, and later at the International Atomic Energy Agency in Vienna, Austria, conducting nuclear inspections in Iraq, and at the Comprehensive Nuclear Test Ban Treaty Organization, also in Vienna, developing on-site inspection techniques.

Stokes has been engaged in election integrity activities since the 2004 election, when he worked with national organizations to pursue a recount, followed by support for legal action to investigate the accuracy of voting machines. Since that time, as coordinator for United Voters of New Mexico, Stokes has continued to work with state election officials and the Legislature to bring the uniform use of paper ballots throughout the state, and post-election audits to verify with high confidence the accuracy of voting machines. He continues to work on Election Integrity by

advocating methods to improve voter access to the polls. Stokes has B.S. and M.S. degrees in Electrical Engineering from North Dakota State University and the University of New Mexico respectively.

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**Poorvi L. Vora** is Professor of Computer Science at The George Washington University. Her research focus has been on end-to-end independently verifiable (E2E) voting systems which enable voters and observers to audit election outcomes without requiring them to rely on the trustworthiness of election technology or unobserved election processes. Vora was a member of the team that deployed polling-place, paper-ballot-based, E2E voting system Scantegrity II in the Takoma Park elections of 2009 and 2011, and of the team that developed remote voting E2E system Remotegrity and accessible voting variant Audiotegrity, used in 2011. She has worked with the National Institute of Standards and Technology (NIST) on definitions of desired properties of E2E systems, and on information-theoretic models and measures of voting system security properties. Her research is funded by the National Science Foundation and the Maryland Procurement Office. Vora has a Ph.D from North Carolina State University.

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**Luther Weeks** is Executive Director of CT Voters Count. He is a retired software engineer, and a computer scientist who has been active for several years in voting integrity issues and citizen-lobbying the Connecticut Legislature and the U.S. Congress.

Weeks' efforts in Connecticut contributed to the passage of the paper record law in 2005 and the selection of optical-scan over DRE (touch screen) voting equipment in 2006. In 2007, he organized a coalition of citizens to observe Connecticut's post-election audits resulting in public legislative hearings across the state. He is also Executive Director of the [Connecticut Citizen Election Audit](#) and a Director of TrueVoteCT.

Spanning thirty-five years, Weeks led the initial implementations of database, personal computer, and artificial intelligence technologies for The Travelers, where he also led the evaluation and acquisition of commercial software. In the 1990's, for nine years, he was a field engineer and product manager for two data communications software start-ups. Weeks has a B.S. in Mathematics with distinction from Clarkson University and an M.S. Computer Science from Rensselaer Polytechnic Institute. He is Master Fellow of the Life (insurance) Management Institute.

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