

# Risk-Limiting Audits (RLA)



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# Overview

- Colorado is a leader in election integrity
- Achieved via multi-partisan collaboration!
- Elections are increasingly complicated
- Need for Evidence-Based Elections
- Risk-Limiting Audits
- How RLA Works in CO – The Basics
- Web Resources

# Evidence-Based Elections

- We shouldn't blindly trust computer-based voting systems, e.g. relying just on certification
- We should audit and certify each contest in each election => **Evidence-Based Elections**
- **Risk-Limiting Audits (RLAs)** check the **tabulation** of a set of voter-verifiable paper ballots
- RLAs should be used in conjunction with other audits (**ballot reconciliation, signature verification, chain-of-custody**, etc.) to support Evidence-Based Elections

# Why Audits are Important

- Machine interpretations of ballots are recorded in a Cast Vote Record, but machines can fail, and also might misinterpret ballots marked by humans.
- Routine audit in Palm Beach County, FL in 2012 revealed two city council contests were certified with the wrong outcomes. See also RI, etc.
- We want **statistical evidence** of correct election **outcomes**, or ability to **correct** errors.

# Risk-Limiting Audits are Efficient

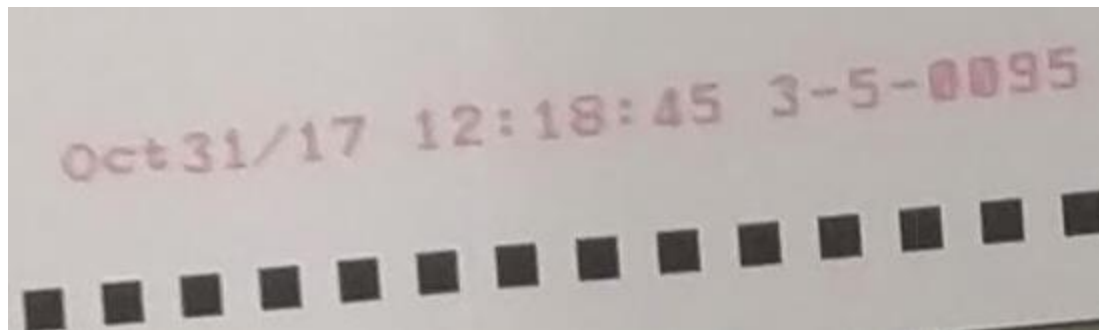
- Traditional tabulation audits usually either
  - require more work than necessary to confirm an outcome, or
  - yield too little information to be conclusive.
  - An RLA uses statistics to check voted ballots until it has strong evidence that election outcome is correct according to the evidence provided to them. Then the audit can stop. Efficient!





# Ballot Identification

**Imprinted ID** showing a ballot was scanned on October 31<sup>st</sup> at 12:18:45 and positively identified as ballot card “**3-5-0095**”:  
scanner 3, batch 5, 95<sup>th</sup> card



# Status of RLA in CO:

## Successes

- Efficiently-auditable tabulation
- All contests subject to audit (but not reviewed)
- Open Source Software developed for ballot-level RLAs
- Publicly verifiable random selection
- Officials could check risk measurements



# Status of RLA in CO:

## Remaining work

- Publish data to be audited before rolling dice.
- End SOS (especially as a candidate) from responsibility to choose audited contests
- Target the most interesting, closest contests, to a larger risk limit if necessary, and target all remaining contests with a reasonable estimated workload
- Share results for opportunistic audits. Allow public RLA oversight (publish CVRs, `rla_export` data, images)
  - Requires addressing anonymity issues better
- Handle non-voter-verifiable ballots properly (e.g., received by email)

# RLAs in Other States

- Auditing more challenging in most states: in-person scanners require randomization of CVRs => can't match with paper ballots
- Require **Batch Comparison** or **Ballot-Polling audits**
- New **Arlo** software, in Python
- ***Minerva*** math for more efficient Ballot-Polling audits from Professor Poorvi Vora and team (my day job....)

# RLA Laws, Pilots Spreading

- RLAs now required by law in CO, RI, GA, NM, NV, CA (for some equipment)
- Pilots done in IN, VA, MI, NJ, RI, VA, PA, OH, GA and more

# Website Resources (1 of 2 pages)

- CO Risk-Limiting Audit Project (CORLA):

<http://bcn.boulder.co.us/~neal/elections/corla/>

- CO Secretary of State Audit Center:

<http://www.sos.state.co.us/pubs/elections/auditCenter.html>

- Public RLA Oversight Protocol:*

<http://bcn.boulder.co.us/~neal/elections/PublicRLAOversightProtocol.pdf>

- A Gentle Introduction to Risk-Limiting Audits*

<https://www.stat.berkeley.edu/~stark/Preprints/gentle12.pdf>

# Website Resources (2 of 2 pages)

- Principles and Best Practices for Post Election Tabulation Audits

- <https://verifiedvoting.org/publication/principles-and-best-practices-for-post-election-tabulation-audits/>

- Harvie Branscomb's Election Quality website: <http://electionquality.com/>

- This presentation:

- <http://bcn.boulder.co.us/~neal/talks/neal-mcburnett-legislative-audit-committee-testimony.pdf>