Risk-Limiting Audits: Lessons Learned

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Committee on the Future of Voting

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- Consultant
- Free & Fair ColoradoRLA project team member
- Speaking for myself

- Working on election audits and integrity since 2003

    - Poll worker
    - Volunteer
    - IEEE P1622 Vice Chair
    - Board member
    - Software developer
    - Consultant

- Overview and History (updated):

    - The Colorado Risk-Limiting Audit Project (CORLA)

Overview

- Widespread, transpartisan consensus on need for both paper ballots and audits.

  - 2003 E.g. 4-party consensus in Boulder Colorado
  - 2017 EAC/NIST Voluntary Voting System Guidelines (VVSG) 2.0

- Huge steps forward, still much to do

- Why is it taking so long to adopt robust audits?

  - Elections are increasingly complicated
  - You can't easily audit the data you've got
  - You can't easily get the data you need
  - Critical *Common Data Standards* work by EAC / NIST

Re: Future of Voting - Statement of Task

Examine challenges arising out of the 2016 federal election;

2016 Presidential Recounts should have been audits

- Didn't get clear evidence that the paper ballots supported the election outcomes

  - Significant areas of all three states weren't recounted
  - Many were recounted by the same machines that did the original counts
  - Lack of randomness severely degraded the risk-limiting potential of the results

- Risk-Limiting Ballot Polling Audit would have been far easier

Evaluate advances in technology

- Future of RLAs (most of this presentation)

- End-to-End plus paper, in-person:

    - 2009, 2011 Scantegrity in Tacoma Park, MD
    - 202? STAR-Vote in Austin TX etc., just needs funding....

Data Format Standards: Critical!

- You can't easily audit the data you've got
  - Need to look thru all 200,000 ballots to find the ones you selected.
  - Different formats, often undocumented or "proprietary", from 4 different vendors in CO
- You can't easily get the data you need
  - Generate a full report for each batch, calculate batch totals from differences
  - Implemented in Boulder, starting in 2008 election
  - Big step forward with first open source code (ElectionAudits) and Hillary Hall and amazing Boulder County team who made it their own in following years (Excel etc)

Common Data Formats

- We need format standards! OASIS. IEEE. EAC/NIST

  - John Wack: Overview of VVSG-Interoperability Common Data Formats (two presentations)

- Election Results CDF V1 published as SP 1500-100.

  - Used in OH, NC, LA County, other states in progress.
- V2 synchronizes with Google/VIP 5.1, adds JSON.
- Election Log Export CDF soon published as SP 1500-101.
- Voter Records Interchange CDF slated for review by VR vendors and then published as SP 1500-102.
  - Initial use in OH and by OSET.
- Cast Vote Records CDF schema approved by WG, to be published as SP 1500-103.
- Continued development and documentation of election process business models and voting method descriptions.

Evidence presented and checked

- Detailed Public RLA Oversight Protocol, Stephanie Singer, Neal McBurnett 2017

- Elements:

  - 1 Chain of Custody
  - 2 Tabulation
  - 3 Manifest
  - 4 Commitment
  - 5 Random selection
  - 6 Ballot card retrieval
  - 7 Ballot Interpretation and data entry
  - 8 Ending the random selection and examination of ballots cards
  - 9 Hand Count
  - 10 Audit Conclusions Affect Outcomes

Convincing Officials of Election Outcomes

- ColoradoRLA includes `rla_export` tool to provide necessary data for Oversight Protocol in csv/json formats

- Open source `rla_report` demonstration code in progress to explain precisely how oversight steps.

- Verifiers should of course implement or vet their own processes, code, etc.

- Level 1: Election Adminstrators

  - Colorado 2017: The counties and state, based on *their* knowledge of the CVRs etc, dramatically limited the risk of an incorrect tabulation outcome in at least some contests

Far more than most states can say, very efficient!

Convincing Others of Election Outcomes

- Levels 2 and 3: Losers and the Public
  - Much more transparency than in the past
  - Still several crucial holes left in oversight protocol
  - Much summary data not available yet
  - Wrestling with anonymity issues => no CVRs
  - Can't check totals, interpretations, etc.
  - No complaints: amazing ongoing accomplishments by state and counties under very challenging circumstances!
  - More to come!

Targeted audits

- Anonymize CVRs and images up-front (redistricting, etc)
- Release CVRs before audit starts, including mark density data
  - (Note that VBM already undercuts most Australian Ballot protections)
- Also release ballot images online
- Encourage candidates, public to identify ballots to target interesting ballots for auditing
  - In addition to full random selection audit

Public engagement in verification

- Promote public participation in audit
- Print ballot tracking pages with QR codes
- App to photograph ballot + QR code
- Assist public tweets like "I verified this vote"

"I Verified My Vote"

- With E2E, facilitate "I verified My Vote"

Early Summary

- In audits of "driving" contests: 20 possible discrepancies out of 3015 audited ballot cards

- Of 4 investigated discrepancies, 3 seem like entry errors.

    - Note entry is blind, and no feedback is given at the time.
    - 4th was inconsequential: a vote that shouldn't be counted for sole candidate in contest

DIRECTOR DISTRICT 1
Four Year Term
(vote for one)

Brad Rupert

● Matt Van Gieson

DIRECTOR DISTRICT 2
Four Year Term
(vote for one)

Susan Harmon

● Erica Shields

DIRECTOR DISTRICT 5
Four Year Term
(vote for one)

✗ Ron Mitchell

Discrepancy Investigations

- Should probably inform Audit Board of each discrepancy right after entry, Would help investigation, quality control feedback, and trust in the process.

- Poorvi Vora and I have a document in progress on how to investigate discrepancies, preserving integrity, efficiency, flexibility

- More data would be invaluable in fine tuning the process

Remaining Challenges 1

- Since RLAs are defined as auditing against voter-verifiable paper ballots, should treat electronic-only UOCAVA ballots as non-voter-verifiable, and thus as votes for the losers.

- Foster collaboration between clerks and privacy experts around preserving anonymity, especially for complicated situation in Colorado

- Some systems (e.g. VR, signature verification, envelope sorters) are on the Internet or intranets. Continue to address / mitigate those, institute audits.

Remaining Challenges 2

- Extend to

    - Multi-county contests
    - Sampling from multiple overlapping districts
    - Combinations of comparison and ballot polling audits

- Handle In-Precinct/Vote center scanners, which randomize ballots and/or CVRs: complicate process of matching paper ballot with CVR

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- Free & Fair Team beyond the call of duty
- Galois support

Updated slides: http://bcn.boulder.co.us/~neal/elections/rla-nasem.pdf