Presentation to Rhode Island Board of Elections

2019-09-19

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Ray Lutz

- Master's degree in electronic and computer engineering
- Significant industry and standards experience in document processing equipment, including printer, scanners, facsimile, imaging, etc.
  - Involved in national and international standards development
  - Experience with test-strategy development for VLSI (very large scale integrated) circuits
  - Managed a quality assurance department in a manufacturing setting
- Involved in providing oversight to audits throughout CA, FL, MI, and other states.
- Founder and Executive Director of Citizens' Oversight, a 501(c)3 nonpartisan nonprofit charity organization.

Regarding this project

- Joined the SAWG, RI Audit and AuditWare groups last year.
- I observed a bias against Ballot Image Audits (BIAs)
  - My suggestion to include ballot image audits in this study was not embraced
  - Yet other districts, such as Maryland, included BIAs in their studies.
- The conclusions of the study were already decided when we discussed them.
- Thus, we agreed that I should present this dissenting opinion since my point of view was not included in the report

No disrespect to anyone

- Although I disagree, my remarks are presented with utmost courtesy and respect.
- I do not question the intentions of anyone concerned.
- The work performed on non-BIA options was done very well, these comments do not undercut that work.
- The group did adopt my suggestion to improve the collection of timings.
- Election audits are relatively new, and so such disagreements should be expected.
- Decision-makers should be aware of all options.
- It is my professional responsibility to speak up.

Recommendation for RI (preview)

- Batch Comparison Audit of the most consequential contests
  - Cover any contest with spending over $1 million per candidate.
  - No need to re-scan ballots
  - Logistics to pull samples simpler, easier to oversee
  - Traditional canvass report will suffice, but must be broken down by precinct.
  - Determine batch sample using
    - The most significant close contest
    - Assume max error per batch is 40%
    - Use weighed random sampling by max error based on reported results
  - This process also validates the ballot images
  - RI should reduce the size of precincts to less than 500 and more uniform.
- Use ballot image audits for local races.
  - Ballot image audits will resolve voter intent and processing errors of small local races.
  - Ballot images must be secured and (at least) hash codes posted on a secure server with trusted timestamps (Like Sharefile.com and other services).
  - Independent BIA services can be used for this process.

Key Testing Strategies

- Two key strategies for testing (and producing a reliable result):
  - **Divide and Conquer**
  - **Test Early and Test Often**
- These are testing strategies and go further than an audit.
- Elections departments should utilize additional testing procedures and not rely only on an audit.
- Thus, additional tests should be performed, and as often as possible.

What is RISK?

- “Probability Risk Assessment” (PRA) is the primary statistical methodology used by scientists and engineers
  - PRA has been used in nuclear reactors and NASA spacecraft designs esp. since the 1980s
  - Predates elections RLAs in terms of defining “Risk”
- **Risk = (Probability of Adverse Event) x (Consequence)**
- RLA advocates provide an incomplete analysis of the risk and ignore numerous hazards added by the RLA process itself.
- In RLA publications (Stark, Lindemann, Rivest, etc), “risk” is only the sampling error and not the comprehensive risk.

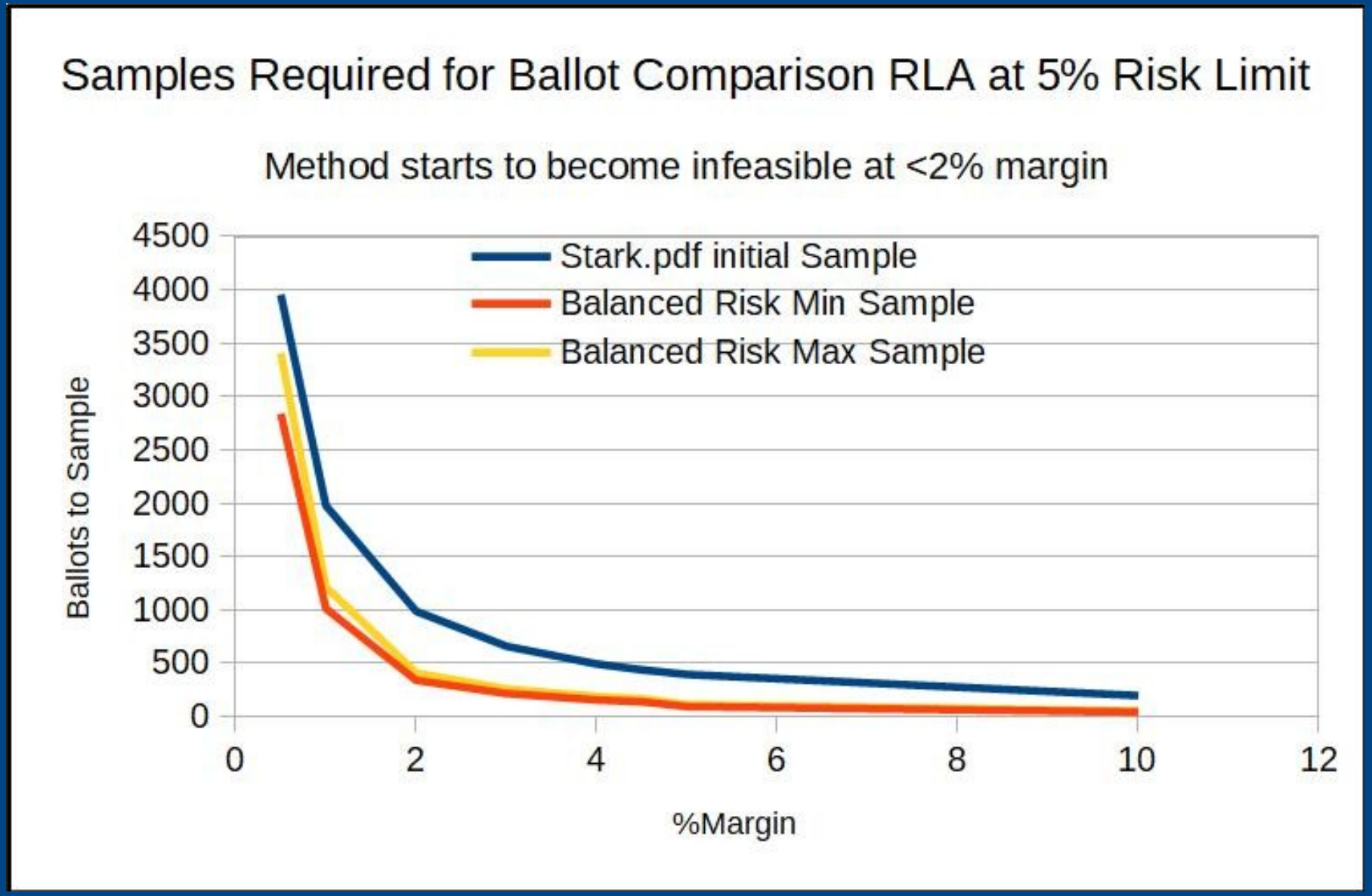
The Key Election Audit Hazard

- Election officials are auditing themselves.
- Election workers tend to seek a “clean audit”
  - Workers correct problems throughout the election process every hour of every day.
  - During the audit, they may innocently correct problems in the sampled cases rather than reporting them. We call this “innocent fix-up.”
  - But such corrections during the audit are not allowed and defeat the audit.
- Audits should be simple or mistakes and innocent fix-up can defeat them.

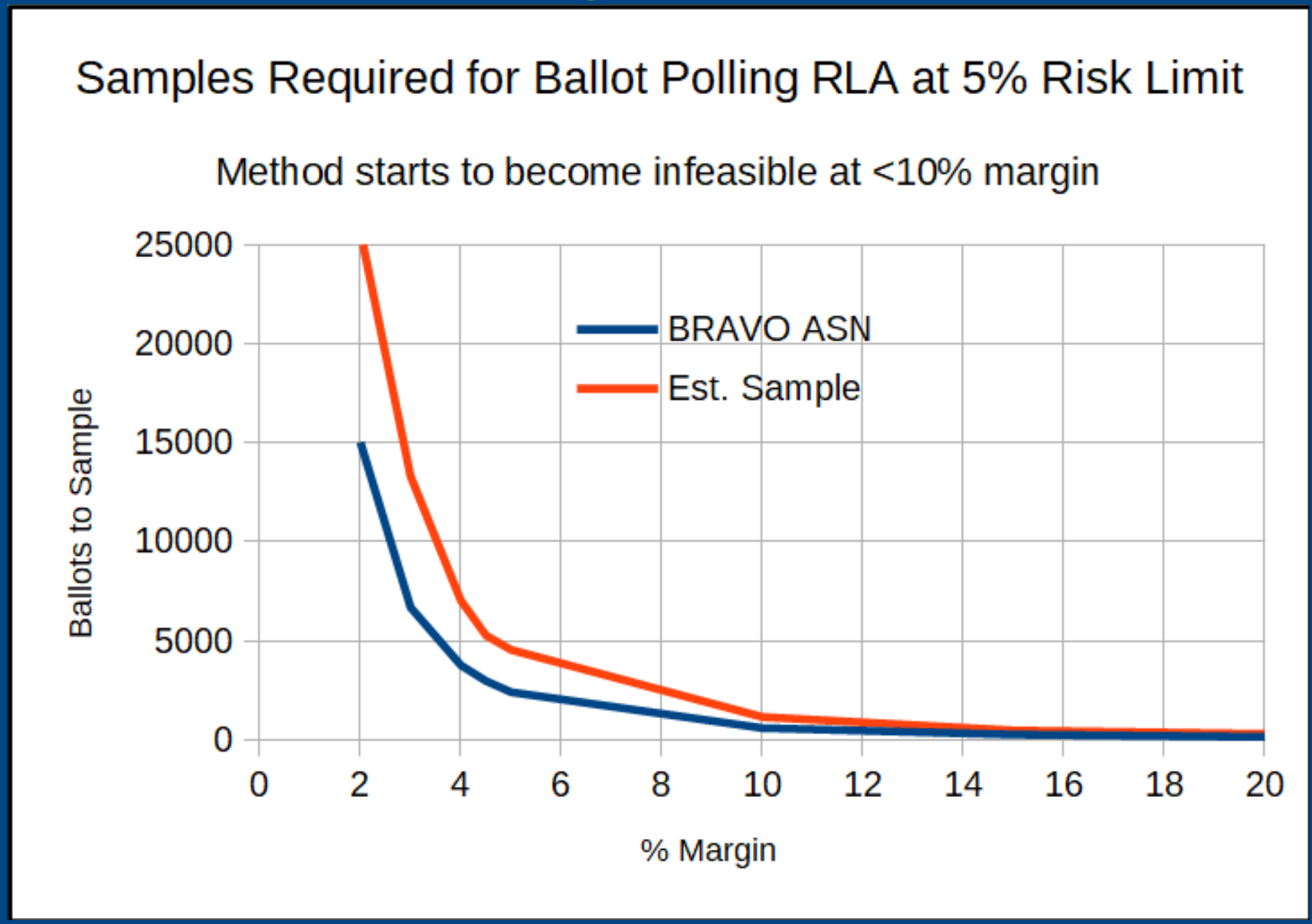
Statistical RLA Weaknesses (1)

- The process of doing the audit is complex, difficult to perform, observe, and understand.
- Pushes humans to the limit of their ability to organize paper.
- Many manual steps introduces “innocent fix-up hazard” at every turn.
- RLA “Risk” is actually only the error rate of sampling, and not the comprehensive risk
- Close contests quickly expand to a “full hand count” with no other option proposed.

RLA Sample sizes explode at close margins



Explosion even worse for Ballot Polling method



Statistical RLA Weaknesses (2)

- Typical implementation does not cover all contests of consequence.
  - But contests not explicitly audited are not “magically” audited
  - Adding coverage of local contests quickly becomes unwieldy.
    - The sample size is related to the MARGIN not the contest size.
    - Small contests require the same number of ballot samples as large contests, if a risk limit is to be respected.
    - Each contest in a set of non-overlapping districts must be adequately sampled.
- RLA procedures & publications do not help election officials choose contests to be audited.
  - If any set of contests are not all audited, then they should be randomly chosen weighted by consequence:
    - Close contests
    - Seats with highest power
    - Don’t waste time on advisory or unopposed contests.

Ballot Image Audits (1)

- A ballot image is a high-resolution image of a hand-marked paper ballot.
  - “Ballot image” is no longer used to refer to the memory image of a DRE machine.
  - Most modern equipment produces these images and they should be preserved.
- A Ballot Image Audit (BIA) exhaustively recomputes the result of the election by retabulating all ballot images usually by third party services.
- Compatible with crowd-sourced audits.
- If ballot images are validated (compared with paper ballots), a BIA is a risk limiting audit, with lower overall risk than any other method.

Ballot Image Audits (2)

- With validation, BIAs comply with Rhode Island RLA law.
- Can cover all contests, even small ones, down to the ballot for most hazards.
- Does not explode into costly hand counts.
- Can detect, even without ballot image validation:
  - All voter intent issues
  - Nearly all election processing errors
  - Nearly all malicious attacks
- Provides higher confidence to election officials who need to certify the election.
- Minimizes “innocent fix-up” errors.
- Compatible with third-party audit services
- Compatible with all next-generation voting equipment which do not keep ballots in order (and some actively scramble the images and CVR).

Ballot Image Validation

- Ballot image Validation is a review of paper ballots to validate that the images are a faithful representation of the paper.
- A limiting statistical RLA is sufficient.
  - A limited traditional RLA of consequential contests will also validate ballot images.
  - Ballot images need not be explicitly inspected.
  - Guards against malicious modification of ballot images prior to being secured.

The Only Malicious BIA Attack

- Malicious attack of BIA secured election would require modifying ballot images prior to being secured.
- Ballot images are used to generate the Cast Vote Record.
- Thus, the CVR is also modified and will not match the paper ballots.
- Such an attack would likely be for consequential races
- An RLA of consequential races therefore also validates ballot images against such a malicious attack.
  - All other contests can be included in the BIA with confidence down to the ballot.
  - The sampling RLAs were not including these contests to any viable level of confidence anyway.

Recommendation for RI

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