Software Recommendations for 2018 Colorado Elections

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We first want to thank Colorado's county Clerks, Secretary of State, Elections Division, and especially Dwight Shellman for their leadership in making Colorado the first state in our nation to embrace risk-limiting audits as a key part of securing elections and thereby helping increase public confidence in election outcomes. We particularly commend Colorado's Department of State for providing funding in 2017 to underwrite part of the development costs for the first open-source software in the world that helps support statewide risk-limiting audits across multiple election administration jurisdictions (e.g., counties).

Because the timeline and budget for software development were severely constrained for last year's 2017 consolidated elections, the Secretary of State's office and software contractor Free and Fair had to defer implementing a number of important features that will be needed for this year's 2018 general election. Several of those required features for 2018 are described as follows in the Request for Information (RFI) that issued on December 29, 2017:

1. User interface enhancements, including:

    a. Browser compatibility improvements and usability/readability updates

    b. Review screens and warnings for critical county and state activities

    c. Additional instruction text to provide more feedback for county audit boards including clearer instructions for completing the audit paperwork

2. Functional enhancements, including:

    a. Ability for counties to have multiple audit teams logged in and conducting simultaneous auditing

    b. Changes to county reports to provide clearer and additional information

    c. Ability to correct a county status before launching audit

    d. Ability to import CVR data exported by additional voting systems (other than Dominion), particularly Clear Ballot's newly certified ClearVote system, version 1.4.1.

    e. Ability for the tool to import the ballot manifest and summary reports exported from various voting systems (including Clear Ballot and legacy ballot-polling systems).

We agree that the several enhancements noted above and in the RFI are necessary for auditing the 2018 general election, and we want to add a some other necessary capabilities that need to be added to the current RLATool, including the following:

1. The software has to be modified to have the notion of multi-county contests -- i.e., contests in districts that cross county lines (especially state-wide contests, Congressional contests, and state legislative contests. This is absolutely necessary. The amount of auditing depends on the diluted margin in the contest as a whole, not in each county part of a district separately. So the RLATool needs to be restructured to have contests (not votes within counties) be a first class entity.

2. The RLATool has to have the notion of **sampling from contests**, and computing risk for contests, not just sampling from parts of contest districts within each county.

3. The RLATool will also have to aggregate contest CVRs to get contest totals, then check that those contest totals agree with the sums of the subtotals reported separately by counties.

4. Get information from SCORE on the number of returned/voted ballots that contain each contest. The RLATool has to be modified to have a UI to ingest those data from SCORE; ideally, SCORE would export things in a machine-readable format that the RLATool can read.

5. The RLATool has to know what CVRs contain what contests; that can be inferred from the nonnull fields in the CVRs.

6. The RLATool has to be able to do sanity checks that there aren't more CVRs with any given contest than there "should" be, according to SCORE. (And we need to think about what to do if there are more CVRs than there should be.)

7. The RLATool needs to be able to sample from CVRs that are supposed contain a contest (across counties), augmented by "zombie" CVRs if the number of CVRs is less than SCORE says should be there. Note that sampling in a nonuniform manner increases the complexity of calculating risk levels, so care should be taken in interpreting the evidence for other contests. Risk calculations in RLATool should automatically substitute overstatements or the appropriate equivalent whenever a zombie is selected.

8. Prevention and graceful recovery from problem situations that arose in 2017, including
    a. mistakes choosing contests to audit;
    b. issues with CVR and ballot manifest files after launch of audit;
    c. discrepancies due to wrong ballot-pulling process in one or more counties;

Experience with auditing the November 2017 consolidated elections in Colorado also revealed the need for the Secretary of State's Elections Division to issue additional rules and regulations in order to make it possible for statewide risk-limiting audits to succeed in 2018, including the following:

1. The Elections Division needs to establish, and counties must use **uniform names and naming conventions** for contest and candidate names associated with all election data across all counties in the state so the RLATool can be used to audit any contest that spans more than one county.

2. The Elections Division also needs to prohibit any county from using procedures that make it possible to track a ballot or cast vote record back to the individual envelope from which it came. Some counties have been under the mistaken impression that that they need to be able to do such tracking if errors are found on ballots, but that is not correct, and if ballots are not completely anonymous by the time they are counted and audited, that not only compromises voter privacy, it also severely compromises the state's ability to make cast vote records available to the general public for checking prior to and during a risk-limiting audit.

3. The Elections Division should probably specify a standard format for ballot manifests in order to facilitate easy uploading into the RLATool.

4. Specify minimum set of tables necessary for export from county to public Audit Center (see details on GitHub)

5. Hashes uploaded with the CVRs should be checked against the hashes local election officials think they transmitted, or the hashes don't add any integrity: the CVRs could have been altered in flight.

Finally, we want to emphasize that adequate time and money for enhancement of the RLATool software are absolutely essential for success of statewide risk-limiting audits in 2018. Staff from both the Elections Division and Free and Fair worked well beyond the call of duty and paid project time in order to create RLATool software for Election Division and county staff to use in carrying out risk-limiting audits in 2017. But they cannot be expected to do that again. There needs to be an RFP issued as soon as possible, and sufficient funding needs to be provided in order to cover actual costs for necessary software enhancements in time for use in the November, 2018, general election.