

# Voting System Requirements for Ballot-Level Comparison Auditing

It is important for new voting equipment to support ballot-level comparison auditing, as discussed by others in these VVSG Working Group use cases:

- <http://collaborate.nist.gov/voting/bin/view/Voting/AuditingSecurity>
- <http://collaborate.nist.gov/voting/bin/view/Voting/AuditingUseCase>

For reference, see:

- <https://www.verifiedvoting.org/voting-system-principles/>

## Voter-Verifiable Paper Ballots

- Support for risk-limiting audits requires Voter-Verifiable Paper Ballots.
- If a duplicated ballot is selected for audit, the system (and/or procedures) should support retrieving and auditing the original voter-verifiable paper ballot.
- Ballots for which VVPBs are not available such as for reasons of voter privacy are generally treated during an audit as votes for the loser, and must thus be minimized.

## Support for determining quantity of ballots to be randomly selected

- Tabulated results for each contest that includes vote totals for each candidate as well as undervotes, overvotes, and any other invalid votes, such that the total number of ballots for each contest in each batch can be determined (ballot manifest)
- These results should be available for the entire contest as well as by precinct, batch, and jurisdiction.

## Comprehensive Cast Vote Record (CVR) with complete information on how each contest was adjudicated and a standard format for export.

- CVR identifier (The numbering of CVRs of multi-sheet ballots still needs to be resolved.)
- Ballot Style for the paper ballot or side or sheet comprising a paper ballot corresponding to each CVR.
- Report presence of ambiguous marks with an optional associated vendor-defined figure of merit, such as mark density. Marks that seem marginal, e.g. either light but interpreted as a vote, or significant but interpreted as a non-vote, or light and causing an overvote, or simply unusual, compared with other marks on the same ballot, can be used to select ballots for targeted auditing.
- Vote interpretation by machine, subsequently in some cases by human adjudication.
- Preserve vote anonymity: it should not be possible to link any voter to selections preserved on a ballot, when the system is used appropriately.
- Provide contest meta-information necessary for tally: number of winners, distinguish different winner categories if necessary (e.g. top 3 winners get a 4 year term, 4th place gets a 2 year term) since each category needs to be audited.

## Support for finding the physical ballot(s) that match a given CVR (or visa-versa):

### FOR MACHINES USED IN CENTRAL COUNT

- Batch ID number - identifies the batch/box/room in which the paper ballot corresponding to the CVR is located.
- Ballot Position - Identifies the position of any ballot sheet corresponding to the CVR within the batch.

- Imprinted ID (optional) . If the scanner model supports imprinting a unique character string on the ballot during the scanning process. (It still needs to be worked out how this numbering works for multi-sheet docs and instances where the ballot is scanned more than once.)
- Ability to maintain paper ballots in order of scan

#### FOR MACHINES USED IN POLLING PLACE

- Imprinted ID (It still needs to be worked out how this numbering maintains privacy and works for multiple scan passes and multi-sheet docs.)
- Ability to physically separate ballots into small batches (optional for ballot-level audit, but required for efficient small batch audit).

### Support for analyzing errors

- CVR may include Device ID which identifies the scanning device by model, serial number, and/or scanning station identifier. But this may in some circumstances allow linking voters to ballots, in which case it should be omitted.
- CVR includes history of any changes to a contest's adjudication including what is the change, who made and when it was made
- CVR documents vote interpretations in a way that can be compared in detail with an independent interpretation of the same ballots or ballot images, allowing for a wide variety of evaluations of system quality.

### Support for poll book accounting, ballot reconciliation

- Comprehensive event logs on the entire voting system in an interoperable format. Standard event types should be defined and used for important events like "ballot cast", so that generic tools can be used to examine and analyze the event logs and compare counts of cast ballots with poll book information or mail-in ballot handling and signature verification counts by batch.