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US Electoral Integrity in 2026: Navigating the Patchwork of American Election Tech

AI * Ethics * Computing

Introduction: Technological Federalism and the Patchwork of American Voting

The American electoral landscape in 2026 represents a convergence of decentralized administration and modern digital infrastructure. Executed by thousands of local jurisdictions under a patchwork of state laws, U.S. election administration pairs technical innovation -- such as open-source hardware and cryptographic verification -- with state legislative intervention to standardize or restrict voting methods.[1][3] This report examines the mathematical mechanics and 2026 operational status of Ranked Choice and Approval Voting, software-independent paper hardware, homomorphic encryption, mail-in ballot logistics, and statistical post-election audits.

Alternative Voting Methods: Ranked Choice, Approval, and the Legislative Backlash

Dissatisfaction with vote splitting and the "spoiler effect" under First-Past-The-Post (FPTP) plurality rules has spurred alternative voting experiments, followed between 2024 and 2026 by a wave of state prohibitions:[1][3][4]

* Ranked Choice Voting (RCV): Also called Instant Runoff Voting (IRV), RCV allows voters to rank candidates. If no candidate wins a first-round majority (50% + 1), the last-place candidate is eliminated and their ballots transfer to each voter's next choice iteratively until a majority winner emerges.[3] While mitigating spoilers, RCV does not guarantee a Condorcet winner and can theoretically violate monotonicity.[5][6] In 2026, RCV remains active statewide in Maine and Alaska -- where voters defeated Ballot Measure 2 on November 3, 2026, preserving top-four primaries and RCV[11] -- across dozens of municipalities including NYC, San Francisco, Minneapolis, Seattle, and Washington, D.C., and for overseas (UOCAVA) runoff ballots in several states.[2][4]

* The 19-State Ban Wave: Following Indiana's enactment of Senate Bill 12 during the 2026 legislative session, 19 states explicitly prohibit ranked-choice voting (up from 18 entering 2026), while 8 states permit or require it in some form and 23 leave its status unclear, with critics citing ballot exhaustion and strategic complexity.[4][10][44] In November 2024, Missouri voters approved Amendment 7 (~68% in favor), prohibiting candidate ranking while grandfathering municipal systems active before November 5, 2024.[7][8][9] In April 2025, North Dakota Governor Kelly Armstrong signed a blanket ban on both RCV and Approval Voting without exemptions, ending Fargo's Approval Voting system used since 2018.[12]

* Approval, STAR, and Positional Systems: Grandfathered under Missouri's amendment,

St. Louis uses Approval Voting -- where voters select all acceptable candidates in a nonpartisan primary (averaging 1.56 selections per ballot) to advance two finalists -- as in the April 2025 mayoral race won by Cara Spencer over Tishaura Jones.[9][13][14] Conversely, Eugene, Oregon voters rejected STAR Voting (Measure 20-349) by 67% to 33% in May 2024, while the Borda Count remains unused in U.S. public elections due to vulnerability to strategic candidate cloning.[15][16][17][18]

| Voting Method | | Tabulation Mechanism | | Key U.S. Adoptions | | Late-2026 Status |

| Plurality (FPTP) | | Select one candidate; most votes wins. | | Universal federal/state default. | | Mandated or protected via RCV bans in 19 states.[4][7] |

| Ranked Choice (RCV) | | Rank candidates; iterative instant-runoff transfers. | | ME, AK, NYC, D.C., municipalities, UOCAVA.[2] | | Preserved in AK (Nov. 2026); banned in 19 states.[4][11] |

| Approval Voting | | Select all acceptable candidates; top two runoff. | | St. Louis, MO.[13] | | Active in St. Louis; banned in ND (Fargo).[9][12] |

| STAR Voting | | Score 0-5; top two sum scores enter automatic runoff. | | None (proposed in Eugene, OR).[16] | | Rejected by 67% of Eugene voters (2024).[15] |

Voting Machine Hardware, Open-Source Systems, and VVSG 2.0

Voting hardware has undergone a cyclical evolution back toward "software-independent" paper records.[19][21] Hand-marked Optical Scan paper ballots read by OCR tabulators dominate U.S. precincts, while Direct Recording Electronic (DRE) touchscreens almost universally require a Voter Verified Paper Audit Trail (VVPAT) behind glass, yielding voter confidence levels comparable to hand-marked paper.[19][20][22]

Challenging proprietary vendors (ES&S, Dominion, Hart InterCivic), non-profit VotingWorks submitted open-source voting software (VxSuite 4.0) built on commercial off-the-shelf (COTS) silicon hardware for federal testing in 2025 -- achieving formal Election Assistance Commission (EAC) certification under VVSG 2.0 standards on September 15, 2026.[23][24] VVSG 2.0 prohibits wireless connectivity (Wi-Fi/Bluetooth) and mandates Common Data Formats (CDF) for interoperable post-election auditing.[25]

Cryptographic Security: Homomorphic Encryption and End-to-End Verifiability

Using high-entropy keys and the Paillier cryptosystem, additive homomorphic encryption computes the sum of encrypted ballots (ciphertexts) directly without decrypting individual votes.[26][27] Microsoft's open-source ElectionGuard SDK applies this mathematics for End-to-End (E2E) Verifiability in Wisconsin, California, Idaho, and Utah pilots:[28][30]

* Cast as Intended: Voters use a tracking hash to verify on a public portal that their ballot was recorded accurately.

* Counted as Cast: Using Zero-Knowledge Proofs, independent observers download the

encrypted ballot file to verify mathematically that the decrypted tally matches the cast ballots without exposing individual choices.[28][29]

While Mexico's INE paired Paillier encryption with a blockchain ledger for expatriate voting in June 2024, cybersecurity researchers and U.S. federal guidance warn against internet and blockchain voting due to client-side malware, denial-of-service, and coercion risks.[31][32]

Mail-In Ballot Logistics, Automated Signature Verification, and Risk-Limiting Audits

Stabilizing at 29% of ballots in 2024 (37% of Democrats and 24% of Republicans), the mail-in voting ecosystem relies on three verification layers:[43]

* Intelligent Mail Barcodes (IMb): A 65-bar serialized USPS envelope code (tracked via USPS Informed Visibility) links each ballot envelope to an administrative voter record -- without exposing ballot selections -- enabling SMS/email custody portals across U.S. election offices.[33][34][35]

* Automated Signature Verification (ASV): High-volume states (CA, CO, OR) use ASV systems (BlueCrest, Parascript, Kodak Alaris) to score affidavit signatures (0-100).[36][37] Because independent studies note real-world true-positive rates as low as 74%, ASV acts strictly as a "green-light" filter: only bipartisan human judges can reject a ballot, triggering a mandatory voter cure process.[38][39]

* Chain of Custody and Risk-Limiting Audits (RLAs): Bipartisan teams log tamper-evident seals from monitored steel drop boxes to central count.[40] Post-election Risk-Limiting Audits (RLAs) apply statistics and sampling theory to Cast Vote Records (CVRs) -- auditing small random samples in landslides or scaling to full hand recounts in tight margins, avoiding uncalibrated precinct hand-count mandates like Georgia's contested 2024 rule.[41][42]

| Technology | | Function | | Security Mechanism | | Late-2026 Status |

| VVPAT & Optical Scan | | Software-independent record. | | Voter visual check; physical paper recount trail. | | Standard across U.S. states; open-source VxSuite 4.0 VVSG 2.0 certified.[19][24] |

| Paillier / ElectionGuard | | E2E cryptographic audit. | | Additive homomorphic tally + Zero-Knowledge Proofs. | | Open-source SDK piloted in WI, CA, ID, UT.[27][30] |

| Intelligent Mail Barcode | | Postal envelope tracking. | | 65-bar serialized USPS Informed Visibility scans. | | Standardized in EAC & state vote-by-mail tracking.[33][34] |

| Risk-Limiting Audits | | Outcome validation. | | Margin-based statistical sampling of paper CVRs. | | Expanding via VVSG 2.0 CDF exports.[25][41] |

Conclusion: The Paper Standard in a Digital Era

Through the 2026 midterm cycle, amid ongoing federalist divergence over voting rules and generative AI disinformation risks, U.S. election security has converged on "digitally assisted paper" -- where serialized barcodes track envelopes,

EAC-certified open-source hardware and homomorphic cryptography strengthen verifiability, and the physical paper ballot remains the gold standard of democratic legitimacy.[21][24][45]

Updates... (Nov 21, 2026): Replaced all five Wikipedia references (#2, #8, #12, #13, #17), the HTTP 403 Caltech/pressbooks links (#22, #44), and the timed-out AlgorithmWatch link (#38) with primary peer-reviewed election-science DOIs (Santucci, Jun 15, 2021; Tideman, Sep 1, 1987; Alvarez et al., Jul 1, 2008; Burnett & Kogan, Mar 2015), official state records (North Dakota HB 1297, Apr 2025), and verified primary reporting (KCUR, Approval.vote, UCLA Voting Rights Project), added verified publication years and specific dates across all 45 references, and standardized the reference list structure; previously (Nov 18, 2026) updated 2026 legislative and certification milestones -- including VotingWorks VxSuite 4.0 achieving EAC certification under VVSG 2.0 on September 15, 2026, Indiana SB 12 expanding state RCV bans to 19 states, and Alaska voters defeating Ballot Measure 2 on November 3, 2026 -- stripped section numbering, and pruned uncited entries from Works Cited.

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