

# Illustrative Risks to the Public in the Use of Computer Systems and Related Technology

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EXCERPT: Election Problem cases as of August 18, 2008

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This list summarizes items that have appeared in the Internet Risks Forum Digest (RISKS) – which I moderate (comp.risks newsgroup) – and/or published ACM SIGSOFT *Software Engineering Notes* (SEN). In this collection of mostly one-liner summaries, (R i j) denotes RISKS volume i issue j; (S vol no:page) denotes an issue of SEN, where there has been one volume per year, with vol 33 being the year 2008; page numbers are given regularly from 1993 on; (SAC vol no) indicates an item in the quarterly SIGSAC Security and Control Review, where vol 16 is 1998, which was the final volume. The RISKS-relevant SEN material prior to 1995 is summarized in my Computer-Related Risks, Addison-Wesley, 1995. SEN material is now being brought on-line by Will Tracz: <http://www.acm.org/sigsoft>

The complete Illustrative Risks document is on-line: [illustrative.html](http://illustrative.html); ([illustrative.pdf](http://illustrative.pdf); [illustrative.ps](http://illustrative.ps)). It includes

## Descriptor Symbols

The following descriptor symbols characterize each entry.

! = Loss of life/lives; \* = Potentially life-critical or safety problem

V = Overall system or subsystem surViVability problems (with respect to diVerse adVersities, including attacks *and* malfunctions).

\$ = Loss of resources, primarily financial

S = Security/integrity/misuse problem; P = Privacy/rights abuse or concern

H = Intentional Human misuse (e.g., user-administrator-operator-penetrator)

h = Accidental Human misuse or other inadvertence

I = Insider; O = Outsider; A = Inadequate Authentication, Access control, or Accountability

d = System Development problems

e = Improper Evolution/maintenance/upgrade. (H,h,i,f,d,e involve human foibles.)

r = Problems with Requirements for system or operation (including the overall system concept)

f = Flaws (or Features in design, or hardware/software implementation)

i = MisInterpretation/confusion/human errors at a man-system Interface; documentation problems

m = Hardware Malfunction attributable to system deficiencies, the physical environment, acts of God, etc.

## 1 Election Problems

We have reported election problems in *Software Engineering Notes* and RISKS for many years. Many of these problems are summarized below. More recently, in the 2000 election, particularly in Florida, the chickens of neglect have come home to roost, exemplifying everything we have been saying all these many years – and more. Similar to the 1988 fiasco where a 210,000-ballot undervote occurred in the Senate Race in four counties run by BCR/Cronus, 19,000 votes were disqualified for the presidential race in Palm Beach County, and many more in Broward County – perhaps because of the confusion raised by the butterfly ballots. There are also some reports of the left-hand and right-hand pages being improperly aligned, so that a vote for one candidate actually counted for another candidate.

Dimpled chad became important – perhaps resulting in part from blocked and never-cleaned chad trays (and there was a lot of extra chad resulting the invalidated multiple votes!). There were many irregularities involving improper voter disenfranchisement, with at least 91,000 voters being unable to vote because of a largely erroneous list of supposed convicted felons – including one election commissioner who found herself incorrectly on the list, and was apparently the only one to block use of the list in her region.

Also, see the CACM Inside Risks articles from November 1990 (PGN), 1992, 1993, 2000 (Rebecca Mercuri), January 2002 (Mercuri), as well as November 2003, 2005, 2006, and 2007 (various authors). (<http://www.csl.sri.com/neumann/insiderisks.html>). Numerous problems are noted in the on-line RISKS, along with various commentaries (R 21 10-14). We note that punched-card systems are inherently flaky (!), and that even optical scanning is problematic, but that direct-recording electronic systems tend to be subject to serious potentials for fraud and manipulation. Internet voting is a disaster waiting to happen in light of the inadequate security of the Internet, personal computer systems, and subvertible servers. For example, the SERVE system appears to be seriously flawed. Proposals to vote from automated teller machines (R 21 15-16) are also problematic, and basically undesirable. Election 2000 demonstrated once again that we need to reexamine the entire election process objectively, and devise less-easily subvertible checks and balances that can provide much greater assurance. Election 2002 still had vastly too many problems, many of which have not been eliminated for Election 2004.

Integrity throughout the election process is essential. And yet we repeatedly hear about unexplained anomalies (enumerated below, including the 1985 articles by David Burnham noted below) and various suspicions of fraud – some with convictions. For example, Ransom Shoup II (purveyor of the ShoupTronic election machines) was convicted of two felony counts – election fraud and conspiracy to commit election fraud. In 1996, Senator Chuck Hagel was CEO of the election company (now a part of ES&S) used by most of Nebraska in his first-term election (e.g., see Thom Hartmann, If you want to win an election, just control the voting machines, *The Hill*, 31 Jan 2003 – R 22 55); this may not have affected the outcome, but the early denial of the association is certainly ethically curious. In 1999, 22 people were indicted in Louisiana and 9 admitted guilt in a huge bribery/kickback election scam involving the acquisition of Sequoia voting systems.

Numerous Web sites are springing up with timely information in addition to mine and Rebecca's. For example, see David Dill's Voter Verification Newsletter and subscribe: [www.VerifiedVoting.org](http://www.VerifiedVoting.org) Also, see Lynn Landes's Web site [www.ecotalk.org/VotingSecurity.htm](http://www.ecotalk.org/VotingSecurity.htm) and particularly [www.ecotalk.org/VotingMachineErrors.htm](http://www.ecotalk.org/VotingMachineErrors.htm) for considerable detail on election fraud and irregularities. Another useful site is <http://www.epic.org/privacy/voting/>.

If you are seriously interested in what might be needed for a high-integrity election process, and a further study of the inherent risks, see the outstanding University of Pennsylvania PhD thesis <http://www.notablessoftware.com/evote.html> of Rebecca Mercuri

(mercuri@acm.org), *Electronic Vote Tabulation Checks and Balances*, 2000. What we are calling the Mercuri Method involves voter-verified paper ballot-images that become part of the official records. Useful URLs for various other relevant organizations are included at the end of that Web site. See also "Explanation of Voter-Verified Ballot Systems" (Rebecca Mercuri, S 27 6:15-16, R 22 17). See also my later comments (S 28 2:16-17) based on R 22 36 and R 22 38.

If the risks of voting concern you, including potential conflicts of interest among owners, you might find some provocative information at <http://www.ecotalk.org/VotingSecurity.htm>, clicking on Ownership – privatizing, monopolizing, and politicizing the voting process. You can report voting irregularities you see for posting at <http://www.VoteWatch.us/>.

S Role of standards (Roy Saltman)(S 18 1:17); see also (R 14 08-11) [Roy has retired from NBS/NIST, and was evidently the government person most knowledgeable about punched-card systems. He is still active.] See "Accuracy, Integrity, and Security in Computerized Vote-Tallying, Roy G. Saltman, National Bureau of Standards (now NIST) special publication, 1988, for a definitive report.

+/-? US Federal Election Commission Voting Systems Standards update: draft available (R 21 51); the final version is on the FEC Web site at <http://www.fec.gov>. It still fails to address some of the most important integrity issues.

..... **U.S. election events, 1984 and before:**

1982: Elkhart, Indiana, program failed in midstream, programmer rebooted or patched the system on the fly during the election process. (S 10 3:8); more in (S 10 4)

SH 1984: Series of articles by David Burnham in *The New York Times*, (29Jul, 30Jul, 4Aug, 21Aug, 23Sep, 24Sep, 18Dec 1985) documents vulnerabilities to tampering in Computer Election Systems (then the dominant electronic vendor); elections with their machines challenged in Indiana, WVirginia, and Maryland, with rigging suspected in the 1984 election in the first two states; Federal Election Commission standards inadequate; Texas also investigated numerous discrepancies, involving Business Records Corporation (which subsequently was involved in the Florida fiasco of 1988) – formerly known as Computer Election Systems; NSA asked to investigate if CES systems were open to fraud; California and Florida also investigated; Michael Shamos quoted – CES systems equipment "is a security nightmare open to tampering in a multitude of ways." The Burnham articles are a startling warning shot that was almost completely ignored. [Most lawsuits later thrown out: not guilty or lack of evidence, particularly in the absence of audit trails!].

1984: McCloskey McIntyre Congressional election in Illinois long questioned, with only a few votes making the difference depending on which were thrown out in which recount. Other problems in Dade County in 1984, West Virginia, St. Louis (S 10 3:8)

S[H?] Election frauds, lawsuits, spaghetti code, same memory locations used for multiple races simultaneously, undocumented GOTOs, COBOL ALTER verb allowing self-modifying code, calls to undocumented/unknown subroutines, bypassable audit trails (S 11 3); Report from the Computerized Voting Symposium, August 1986 (S 11 5)

h Clerical error blamed for election computer program mishap (S 11 5)

SHrf System designs, bad software engineering, standards (Eva Waskell, S 11 3)

S[H?] Alabama, Georgia election irregularities (S 12 1)

Sh Texas beefs up security of computerized voting (S 12 1)

..... **1988 U.S. election events:**

SH Computers in Elections (see the excellent article by Ronnie Dugger, *The New Yorker*, 7 Nov 1988, and several cited reports); 1988 problems in Florida – 210,000 votes fewer for Senate race (Connie Mack vs. Buddy Mackay) than for President in 4 counties administered by Business Records Corporation, part of Cronus Industries of Dallas, Texas (*The New York Times*, 12 Nov 1988, S 14 1:20, R 7 78); jammed chad slots? post-election multiply punched ballots? at least one disappearing ballot box reported? other possible scenarios?

..... **1992 U.S. election events:**

m Misaligned Votomatic in Berkeley caused mispunched cards (S 18 1:15)

S? Sandia helps NM develop "uncrackable" phone voting system (S 18 1:15)

hf Oregon computer error reversed election results (S 18 1:16)

hf Programming error reverses DistAtty election landslide in Oregon (S 18 1:16)

h Ventura Cty CA votes reversed on 13 state propositions (S 18 1:16)

h/H? Another voting machine misaligned, biased toward Bush (S 18 1:16)

..... **1996 U.S. election events:**

+ Hanging chad removal in punch-card ballots overturns Massachusetts primary election (S 22 1:21)

? Louisiana results questioned because of evidence of misrecorded votes

Ethics? Senator Hagel of Nebraska was CEO of the company whose voting machines got him elected, and had denied the connection (R 22 55)

..... **1998 U.S. election events:**

h ABC News accidentally posted test election results before the election (they were correct in 61 out of 70 Senate and Governor races!); Fox TV did a similar thing for a Yankee-Padre World Series game (R 20 05)

..... **2000 U.S. election events:**

hifm(H?) U.S. and Florida Presidential race complexities discussed (S 26 2:7-9), relating to RISKS items and others (R 21.09-15) [noted at the beginning of the section]. Sanity in the Election Process (Lauren Weinstein and PGN, R 21 12). Statement by Don Dillman on Palm Beach ballot layout (R 21 12). The early recount process showed many irregularities (R 21 12). Perspective from PGN (R 21 13) reminds us of many earlier warnings from 1985 (David Burnham) and 1988 (Ronnie Dugger, who quoted Willis Ware: "There is probably a Chernobyl or a Three Mile Island waiting to happen in some election, just as a Richter 8 earthquake is waiting to happen in California.") (R 21 13). Discussions on Internet and electronic voting by PGN, Rebecca Mercuri, and Lauren Weinstein (R 21 14), and others (R 21 13-14). Criteria for voting systems (Rebecca Mercuri's PhD thesis, <http://www.notablessoftware.com>), also Fred Cohen (R 21 15-16). Testimony of Doug Jones before U.S. Civil Rights Commission (R 21 20). DUMvoting 1.0, Gene N. Haldeman's parody on Dell/Unisys/Microsoft consortium (R 21 20). Later study by Doug Jones shows certain specific slots were more likely to jam and result in pregnant chad in Votomatic machines used in Florida (S 27 1:17, R 21 70-71), which could be relevant to the 1988 Florida Senate race as well. (See Mack/Mackay election, noted above.) Discussion of the Caltech/MIT report and what Los Angeles County is doing about it in attempting to upgrade to all-electronic systems (S 27 1:17, R 21 70)

h Exit polls blamed for misleading results in disputed Florida counties, although those polls seemingly correctly reflected the intent of voters whose ballots were invalid! (R 21 11, S 26 1:17)

f(h or H?) Florida election erroneous disenfranchisement of thousands of voters also traced to bogus Choicepoint data; Choicepoint blames its data aggregator, DBT (R 21 42)

fmmH 4 to 6 million votes uncounted in 2000 U.S. election (S 26 6:15, R 21 51)

Sfh Broward County FL officials consider letting students hack election systems, but later overruled (S 26 6:15, R 21 61)

fe New voting protocol and new ballot tally system in Cochise County AZ special election resulted in miscounting (R 21 07; S 26 1:21)

S Vote auction Web site moves overseas after being outlawed (R 21 11, S 26 1:18)

..... **Other year 2000 items:**

fS? Contribution from Douglas W. Jones, Chair of Iowa State Board of Examiners for Voting Machines and Electronic Voting Systems (S

26 1:15-16, R 21 10). This updates his earlier report on risks in electronic voting in Iowa (R 18 15).  
dfeSPHh NSF workshop on feasibility of e-voting, commentary by Avi Rubin and others (S 26 1:16-17, R 21 10-11)  
Sf House Science Committee hearings on electronic and other voting systems, 22 May 2001: testimony by Stephen Ansolabehere, Rebecca Mercuri, Roy Saltman, Douglas Jones (R 21 44)  
SP Risks of receipts for voting machines (R 21 23); potential risks in “open” development of voter data standards (R 21 33)  
fHh Discussion of the use of ATMs for voting (R 21 15-16)  
f\$ Also in 2000, Pennsylvania county wins \$1M for faulty MicroVote computer voting machines (R 21 10)  
SHA Minnesota election fraud accused in e-mail sent by Christine Gunhus (using a Hotmail alias) disparaging her husband Senator Rod Gram’s opponent; identity revealed by X-Originating-IP: header sent from a campaign computer, and by GUIDs included in Word documents! (But Gram lost.) (R 21 50)  
Shmf New Mexico: at least 678 votes lost in 2000 early voting, greater than the presidential margin (R 23 50, correction R 23 51);  
..... **2001 U.S. election events:**  
f Programming error scrambles San Bernadino election results (S 27 1:15, R 21 74)  
VSm Implications of power outage during Nov 2001 Pennsylvania election (R 21 80)  
m Mercer County NJ voting problems 2001 due to Anthrax scare delaying Internet voting info (S 27 1:16, R 21 74)  
h Election problems before the election in Virginia result from 2000 census redistricting; electronic rolls lost 18,000 voters (S 27 1:17, R 21 74)  
@hP Erroneous law-enforcement data from Choicepoint: Privacy Foundation’s Richard Smith discovered he had been dead since 1976, and had aliases with Texas convicts; Chicago woman misidentified as shoplifter and drug dealer, and fired. (Florida election erroneous disenfranchisement of thousands of voters also traced to bogus Choicepoint data; Choicepoint blames its data aggregator, DBT.) (R 21 42)  
..... **2002 U.S. election events:**  
h Compton California Mayoral election screwup from lack of randomization of candidate ordering (S 27 3:16, R 21 91)  
SP Miami-Dade OKs touchscreen voting for Nov 2002 (S 27 3:16-17, R 21 90,92,93)  
SAf Palm Beach’s new electronic voting machines have problems (S 27 6:15, R 22 16) and more on lack of accountability (S 27 6:16, R 22 17)  
fmiSP(HI?) Florida Primary 2002 problems: touchscreen machines not working, showing the wrong candidate, or nonworking authorization cards; some huge voter delays, Governor authorized two-hour extensions although some already shut-down machines could not be restarted; lame testing; purchase contract makes it a felony violation if any devices provided for internal examination; serious reliability problems reported in Georgia and Maryland; comments from the Georgia Secretary of State (R 22 25); comments from Mercuri on MIT/Caltech press release (R 22 26);  
fmiSP(HI?) U.S. general election 2002: Glitches widely reported in FL, TX, AL, NV, GA, CA, SC, NE, NJ; Voter News Service outage (R 22 38); iVotronic machines lose 294 votes in Wake County NC (R 22 33); 2-3 hour waits in Florida early voting result from voter anticipation of election day problems! (R 22 34); factual errors reported in CNN article, particularly regarding use of old FEC standards, not new, and still voluntary; other errors (R 22 36); in FL Palm Beach and Broward counties and Georgia, voters found touch-screen machines that showed votes for untouched candidates; Broward programming error omitted 34,000 votes; 70,000 absentee and Spanish-language ballots missing from turnout but (supposedly) included in counts; Houston voters in 5 precincts had straight-party votes rejected; half of the Pulaski County AK had not been assigned precincts after redistricting, were not allowed to vote; NE long-shot candidate was given a premarked ballot for his opponent (R 22 36); more on exit polls (R 22 35,37); Broward County vote total short by 104,000 votes (R 22 36-37); 67 memory cards misplaced in Georgia, representing 2,180 ballots (R 22 37); “The right to have the vote counted is infringed, and we have lost the integrity of our voting system, when the ease with which ballots can be manipulated is greater than the ease with which the manipulation can be detected.” (Kevin Craig, 2000) www.electionguardians.org (R 22 37); chip glitch hands victory to wrong candidate in Nebraska (R 22 38); Voters can report election irregularities at VoteWatch.us (R 22 38); problem in White Plains NY with sticking lever machine (R 22 44); vote only by mail in Oregon (R 22 35)  
Sm?f?H? 2002 unofficial election results in Alabama reversed, cause still unexplained: electronic results wrong, hardcopy results correct (R 22 60-61, S 28 3:10)  
fiSP(HI?) Columns by Lynn Landes on questionable ownership of voting machine companies (felons, etc.), also citing VoteScam, 1992 book by James and Kenneth Collier; interactive modems capable of controlling voting machines in real-time (R 22 25,37-38); ideal voting systems? (R 22 34); further discussion of the Mercuri Method, alternatives, and butterfly ballots again, and other discussions (R 22 27-31,38)  
SHPfi Boston gets Diebold AccuVote marked-paper reader systems, seemingly lacking in assurance of correct tabulation (but at least recounts by independent systems are possible – if requested) (R 22 39)  
SH? Diebold AccuVote system integrity questioned in Georgia because of the use of an unprotected FTP site for storing election software, election results files, upgrade files, etc. (for example, see *The Register*, 8 Feb 2003; surprising Max Cleland defeat linked?)  
SPH Powervote electronic vote machines open to tampering: bogus ballot face (R 22 44)  
\*m Explosion of nickel-cadmium batteries used in electronic voting (R 22 28)  
Sf Panel reports DoD SERVE System fatally flawed; bureaucrats in denial (R 23 14-15)  
SHf How to Hack an Election; Maryland (R 23 17); Physical security of voting machines (R 23 20); blank page anomaly (R 23 24)  
SH Online poll rigging (R 23 13)  
S+/- Avi Rubin’s experiences as an election judge: <http://www.avirubin.com/judge.html> (R 23 25)  
S(Denial of Service!) Many new e-voting machines won’t boot in San Diego County (California) primary election (R 23 25)  
fh Lost e-votes could flip Napa County race: Sequoia Optech optical scanner failed to record votes, detected by random 1% recount (R 23 27)  
m Many California voters turned away in Alameda and San Diego Counties in 2004 primary; Diebold DRE authorization machines failed, supply of paper ballots ran out; 200 calls for help from poll workers (R 23 27)  
..... **2003 U.S. election events:**  
SH Chief of Diebold voting machine company writes Republicans in fund-raiser he is “committed to helping Ohio deliver its electoral votes to the President next year.” (R 22 89, S 28 6:11)  
SH “According to election industry officials, electronic voting systems are absolutely secure, because they are protected by passwords and tamperproof audit logs. But the passwords can easily be bypassed, and in fact the audit logs can be altered. Worse, the votes can be changed without anyone knowing, even the County Election Supervisor who runs the election system.” (R 22 83)  
fS(H?) Avi Rubin et al. analyze serious flaws in Diebold electronic voting systems (R 22 82)  
mh Voting tech problems galore in Mississippi: locked precincts, machine malfunctions, erroneous ballots, voters given wrong ballots (R 22 83)  
f?m?SH? (who knows?) NYCity: Blank ovals sensed as votes, legitimate votes disqualified as overvotes (R 22 75)  
H? UC Riverside student arrested for allegedly derailing student election, casting 800 votes for a fabricated candidate (R 22 78)  
f?m?SH? Boone County Indiana’s MicroVote election software returned about 144,000 votes with only 19,000 registered voters; final review counted 5,352 votes (R 23 03)

f More voting snafus in Palm Beach and Broward Counties: Florida House District 91, 6Jan2004, winner Ellyn Bogdanoff by only 12 votes over Oliver Parker, out of 10,844 cast ballots, with 137 supposedly blank ballots in the only item in a special election; no mandated recount possible with ES&S touch-screen voting (R 23 12)

m?f? Report of Diebold voting machines in Volusia County FL registering -16,022 votes! (R 22 93,94)

Sie Data transfer Excel-COBOL loses voter data in 2003 Greenville Mississippi election (R 22 95)

hi\$ Grant Parish, Louisiana, election results reversed by doubled absentee counts; new election to be held (R 23 02)

SH Hackers break in to VoteHere (which claims "best-of-breed security") (R 23 12)

ei Pleasanton CA school board election displays instructions for the previous election (R 23 01)

SHfe At least eight Fairfax County VA WinVote machines failed, seals were broken, and machines fixed (!) for reuse (R 23 01,02); more problems in Fairfax CO: WinVote machines subtract one in each hundred votes for a particular candidate (R 23 02)

S(m/f/H) Analysis of California recall data confirms doubts about voting systems (R 22 94-96)

Se California halts e-vote certification of Diebold machines after uncertified software installed in Alameda County CA (R 23 01,03); also, outsiders could make changes to vote-counting software (R 23 03); Diebold machines in 17 California counties had not been state-certified, three had not been Federally certified; changes after certification commonplace! (R 23 07); At least FIVE convicted felons among Diebold voting subsidiary employees (R 23 07)

SHhfme California Secretary of State requires voter-verified paper audit trail by 2006 (R 22 04)

Smf\$ Broward County FL considers dumping \$17 million in touch voting machines or retrofitting voter-verified audit trails, after serious errors (R 22 93)

SHfm Avante Vote-Trakker voter-verified ballot printout mechanisms disabled by registrar when discrepancy occurred (R 23 03); What if DRE and paper trail disagree? DISABLE the system immediately (R 23 06)

SHfm Congressional Research Service report raises more questions about electronic voting machines (R 23 03)

\$ Nevada to apply slot-machine security to e-voting hardware? (R 23 06)

SH(I/O) Another case of electronic vote-tampering? IEEE standards process broken (R 22 92); insecure wireless communications would satisfy draft IEEE standards (R 23 02)

SP Sensitive voter information publicly up for grabs (R 23 07,09,10)

Hm Mechanical voting machines also risky (R 23 03); Why not just mark a piece of paper? Much of the rest of the world does. (R 23 06-08,10-12)

SHf VoteHere reports computer break-in (R 23 10)

+/- Essay on social aspects of electronic voting (R 23 10)

..... **2004 U.S. election events:**

\$f California bans Diebold e-vote machines (R 23 35)

\$fh Republicans walk out on Federal civil rights hearing on voting machines (R 23 32)

SPhie Florida's list of felons ineligible to vote in 2004 is still full of eligible voters (R 23 44)

Sfd eVoting standards and testing (R 23 40)

Sfi Washington State primary irregularities (R 23 53)

SHVmie Some thoughts on the November 2004 U.S. election process: almost everything in the election process was a potential weak link. (S 30 1:15-17) Numerous anomalies were reported: Palm Beach County logged 88,000 more votes than voters; A Franklin County Ohio machine error gave Bush 3,893 extra votes; Broward County FL balloting for Amendment 4, software counted backwards after reaching 2<sup>15</sup> - 1, in signed 16-bit field, in tabulating absentee ballots; numerous reports of screens "jumping" votes from Kerry to Bush; many cases of long lines and long waits only in certain politically skewed precincts, legitimate voters who were disenfranchised, special optical scan pens that were not capable of being tallied, and so on. Many other problems include weak standards and secret system evaluations, partisan oversight, inadequate funding for NIST and Election Assistance Commission, poor training, dirty tricks (S 30 1, elaborating on R 23 58,59); Better standards needed for elections (R 23 59; S 30 1; more in R 23 61)

rfmhiSHPV etc. More on election standards, voting anomalies, and the electoral process (R 23 61,62)

f Preferential voting software breaks down in San Francisco (R 23 58-59; S 30 1:17)

SHPhi Perils of database matching on voter purges (R 23 45; S 30 1:17-18)

SPHmf, etc. Rebecca Mercuri's challenge at Black Hat Convention (R 23 47); The Mr Micawber Syndrome relating to incidents (R 23 47); Al Kolwicz evicted for submitting real accuracy/logic tests in Boulder County (R 23 48); Obion County Tennessee vote counting problems, failing to count early votes (R 23 49); Sequoia's new paper audit-trail system demo failed to record test votes cast by California State Senators (R 23 50); that Sequoia system used in Nevada in 2004 (R 23 52,53); Maryland rules against opponents of e-voting machines (R 23 53); Robert Heinlein scenario in "The Moon is a Harsh Mistress" (1966): computerized voting with no audit trail or ability to recount (R 23 53) Touchscreen voting spawns glitches (R 23 58)

SHA Ohio: Columbus Ohio voters report fake elections board calls as election 2004 neared (R 23 57); Thieves steal campaign computers with sensitive information in Toledo (R 23 57);

SHf Diebold GEMS central tabulator contains a stunning security hole: two-digit code alters results; this is a real doozer (R 23 52)

SPfff (you-gotta-be-kidding department) Missouri military absentees in 2004 could have absentee ballots scanned, sent by unencrypted e-mail to Omega Technologies (partisan "trusted third party"), which then faxes the printed version to the appropriate precinct! Signed waivers of your privacy rights required. (R 23 52)

S+ California Secretary of State Kevin Shelley (who mandated voter-verified paper trail by 2006) established more stringent requirements for touch-screen machines (R 23 45); Gov. Schwarzenegger signs California paper trail bill into law (R 23 55)

SHhmf etc. Lost records of 2002 Florida vote raise 2004 concern (R 23 46); Alabama 2003, ES&S machines reversed the governor's race, not detected until long afterward! Bev Harris records 51 cases in which voting machines recorded the wrong outcomes, including Wayne County NC (reversed in time); 100% error in Orange County in 1998 bond issue (yes/no reversed) (R 23 51; more on Bev Harris's crusade, R 23 45 [her predictions were fairly prescient])

SHf Multiple security vulnerabilities in Diebold Optical Scan 1.94w used to tally 25M votes in 2004 (R 23 94-95; S 30 4:27-28)

..... **2005 U.S. election events:**

SH Ballots "enhanced" by L.A. City Clerk (R 23 79; S 30 3:37)

mfhH? Seven voting machines under scrutiny in Wayne County PA; 211 votes counted with 163 cast (R 23 90; S 30 4:27)

f,m,h Legal docs expose various risks in routine Diebold maintenance in North Carolina (R 24 06; S 30 6:25)

fmhi Voting glitches from the 7 Nov 2005 election (Joe Hall, R 24 10): San Joaquin County, CA: misplaced memory cartridge; Cumberland County, PA: software error forces recount; Harwinton, CT: Voting machine snafu may lead to challenge; Pasquotank Co., NC: 14-vote gap questioned Lucas Co., OH: State plans to investigate voting chaos; Wichita County, TX: Human errors hamper voting; Montgomery County, OH: 'Human error' creates doubt about phantom votes

..... **2006 U.S. election events:**

Shi EFF sues North Carolina over electronic voting-machine certification (R 24 12)

fmhi? Texas voting recount halted; discrepancies of 20% between count and report (R 24 21)

fm Computer problems with voting system invalidated U. Wisconsin-Madison student council election; then, failed again due to software errors (R 24 23,24)

f Brennan Center study finds many flaws in three vendors' systems (R 24 38)

f Princeton analysis of Diebold Accuvote-TS security (R 24 42); another report (R 24 39)

f More on voting in Ohio (R 24 40); Cuyahoga County report (R 24 43)

SP Avi Rubin's experience as an election official (R 24 42-43); another experience (R 24 44)

Sf Florida's voting system certification inadequate (Rebecca Mercuri, R 24 50, S 32 1)

SPfhi, etc. Bo Lipari's weblog on election problems: an excerpt (R 24 47, S 32 1)

\$\$fhiV etc. Five U.S. House election results unresolved after 2 weeks: Mexico 1st Congressional district, with a .5% difference; North Carolina 8th Congressional district, with a .025% difference; North Carolina Court of Appeals, with a .24% difference; Williamson County, Texas, the votes each recorded 3 times. (R 24 47, S 32 1) Report blames Denver election woes on flawed software (R 24 52, S 32 1)

Bo Lipari's weblog on election problems: an excerpt (R 24 47); Rebecca Mercuri's analysis of Florida's voting system certification (R 24 50); Report blames Denver election woes on flawed software (R 24 52); Audit finds many faults in Cleveland's 2006 Voting (R 24 65)

\$\$fhi etc. Analysis of computerized voting machines in Florida (Arthur J. Byrnes, with PGN comment on Noel Runyan's report Improving Access to Voting (R 24 63); Florida trying to sell off new DREs (R 24 86)

..... **2007 U.S. election events:**

SPfmi Major summer study produced ten public reports on Sequoia, Hart, and Diebold election systems: California Secretary of State Debra Bowen's Top-To-Bottom Review [http://www.sos.ca.gov/elections/elections\\_vsr.htm](http://www.sos.ca.gov/elections/elections_vsr.htm) (S 32 6:26, November 2007) A one-page summary by Matt Bishop and David Wagner is in the November 2007 Inside Risks column in the *Communications of the ACM*, <http://www.csl.sri.com/neumann/insiderisks07.html#209>

See also an excellent analysis by Bruce Schneier (R 24 79); Indications of Sanity? California Secretary of State Debra Bowen likes *paper* ballots (R 25 25)

fShi Alameda County judge invalidates e-voting results in close ballot measure because Diebold machines were unauditible (R 24 84)

f Ohio's Hamilton Township election result reversed; blamed on ES&S programming error (R 24 91)

SH Netcraft shows Ohio Secretary of State Web site redirecting apparently illegally (R 24 65)

+ Overreliance on voting technology? Paper and other low-tech alternatives (R 24 80); Also, see also Ron Rivest's three ThreeVotingProtocols: <http://people.csail.mit.edu/rivest/publications.html>

SPf E-voting predicament: Not-so-secret ballots; time-stamps permit votes to be tracked (R 24 81)

..... **2008 U.S. election events:**

Vfm Florida "total network failure" halts early voting in Palm Beach County primary; voter registration database inaccessible (R 25 03)

MV Ohio vote tampering opportunity? Use PDA and a magnet. (R 24 93)

f Colorado decertifies voting machines (R 24 93)

SHP Election commission laptops stolen in Tennessee (R 25 01)

+ Voting machine usability testing (MIT *Technology Review*) (R 25 04)

SHf Nasty undetectable scanner attack on Diebold AccuVote Optical Scan: AccuBasic malware (R 25 08)

SHf One way not to conduct Internet voting: Democratic Party's Global Primary (R 25 06)

f Arkansas ES&S voting machines flipped race results, cast votes in wrong race (R 25 18)

SPhi NC State voter site exposes voter addresses (R 25 24)

SP Rogue code could skew election system integrity (R 25 21)

fhi Strange Yahoo! Annual Meeting vote count: corrected changes exactly 100 or 200 million votes! (R 25 27)

V Obama's widespread Democratic fundraising overwhelms Federal Election Commission computers (R 25 17)

fhi Risks in Instant Runoff/Approval Voting (R 25 18,19,20-24)

..... **Other election items in the U.S.:**

- Drunks have full disclosure for breath-measuring software; voters do not (R 24 13,14); subsequent court ruling denies disclosure

Sfde Voting machine engineer sues, alleges machine design flaws (Bev Harris via Susan Marie Weber, R 22 59, S 28 3:10)

S(H?) Senator Frist's on-line poll on Iraq removed, claiming tampering (R 22 62, S 28 3:10-11)

Sfm Electronic voting: computer reliability aspects (R 23 11)

h Missouri legal decision questions automatic ballot counting (S 13 2)

m Computer miscounts votes on a May 1988 StarWars (Strategic Defense Initiative) Dellums-Boxer amendment in the House of Representatives to kill SDI funding (358 ayes for the amendment, & 237 nays, which added up to much more than 435!!! A manual recount showed the amendment was actually *defeated*, 299 to 118.) (S 13 3:4)

Electronic voting on CAFTA in the U.S. House: decisive pledged *no* vote not recorded because Congressman's "*electronic voting card failed*." (R 23 96; S 30 4:28)

\*h Computer data-entry error in vote tallying (2828, not 28) (S 13 4)

f/h? 8 Durham NC precincts had correct totals counted twice (S 15 1)

f/h? Virginia governor's race also had totals counted twice (S 15 1)

h Undeleted leftover test data reverses Yonkers NY election results (S 15 1:12)

rf Manual districts required live fudging of Michigan election system (S 15 1)

f Another experience with voting machines in Fairfax County VA (S 15 1)

SHAO Absentee ballot fraud detected in Colorado since 1984 (S 18 1:18); 11 indicted in Costella Cty CO; 2536 voters with pop. 2278 (R 15 41)

fh Other risks in unaccountable computerized elections (S 19 1:6)

m CMU elections suspended because roster database system was down (S 19 2:8)

SH Cat registered as voter to show risks (no pawtograph required) (S 20 1:16)

m Static electricity affects ballot counting (S 22 1:18)

VSH San Jose State voting computer crashes, "fixed". (S 18 1:18)

\$f NY City electronic voting machines still unaccepted after spending \$20M (R 19 06) (Note: 1940s lever machines still in use in 2000 election!)

+? A little humor: use of "*fixed*" vs "*repaired*" (S 18 1:18)

m Computer disk crash gives ballots with 2 candidates omitted (S 20 1:17)

hfm 1995 San Francisco elections (S 21 2:19)

mfi Problems in Montgomery County election, 7 Nov 1995: anti-moisture spray effects, delays, bad operator initialization, phantom votes (R 17 50,56)

h Risks of global editing in voting context: name 'Pollack' changed to 'Turnoutack' (S 14 5)

Sm A. Appel and S. Govindavajhala, "Using Memory Errors to Attack a Virtual Machine, it IEEE Symposium on Security and Privacy, 2003. (R 23 48) [Not specific to voting systems, but relevant!]

SHf Washington voting for state quarter design hijacked by computer mischief (R 24 24)

..... **Internet and remote voting:**

Internet voting systems are potentially even riskier than electronic voting systems, especially if you (and everyone else) can vote from anywhere in the world on a PC with inadequate security using code that you have downloaded from some supposedly trustworthy site on the Internet. The California Commission studying Internet voting suggested that the risks were too high for such a balloting method to be used, although it considered using such a scheme under carefully controlled physical surroundings. See <http://www.pfir.org/statements/2000-02> for a discussion by Lauren Weinstein of risks in Internet voting, and later by PGN, Rebecca Mercuri, and Lauren Weinstein (S 26 2:, R 21 14), and others (R 21 13-14).

SPf More on risks in Internet voting: NSF report (R 21 28-30,32,34)

rSH Garciaparricide in 1999 All-Star balloting? 25,259 on-line votes cast by a Perl devotee; 22-vote max detected: same e-mail address; needed IP spoofing (R 20 47-48)

SAOf Vote early, vote often for your favorite California quarter design – via the Internet (R 22 49)

SP 2000 Arizona Democratic primary allows Internet voting (R 20 83) and more people voted that way than all votes in the 1996 election. Needs for privacy and anonymity difficult to meet (R 20 84); crypto for voting (R 20 85);

fSH Problems with Australian ABC TV show online voting scores (R 21 06; S 26 1:33)

f? College election.com online voting glitch (R 21 28)

SH Large-scale fraud in Dutch election choosing new name for merged towns of Leidschendam and Voorburg (S 27 1:16, R 21 70)

SPH E-voting and international law (S 27 2:11-12, R 21 81)

SH 1998 People Magazine Most Beautiful People poll winner Hank the Angry Drunken Dwarf! 1998 Kesmai employees instructed to vote early vote often for Kesmai game award (S 27 3:18, R 21 90)

SH Microsoft "astroturf" campaign stuffing an e-ballot box (S 27 2:12, R 21 87)

SH Vivendi suspects electronic vote fraud (S 27 3:18, R 22 05)

SP UK tries remote voting in Liverpool and Sheffield in May 2002, using SMS (R 21 90, R 22 03,05); Web voting in Wybunbury and Maw Green (R 22 04)

Sf Internet voting: in the Netherlands (R 23 48,55); in Canada (R 23 53); in Switzerland (R 23 55); Internet voting contrasted with voter-verified paper audit trails (R 23 55); "Internet voting should not be considered secure until the electoral authorities are confident enough to give immunity from prosecution to anyone hacking the election, and to offer a substantial prize for anyone who can produce evidence that they have attacked it successfully." Martyn Thomas (R 23 56; comments 58,59)

fm, etc. National Academies/CSTB report on Electronic Voting, 2005 (R 24 04)

..... **Other Election Problems:**

f Quebec election prediction bug: wrong pick [1981] (S 10 2 pp 25-26, 11 2)

Sf Calgary Online student election; software flaws mix up voters, block some from voting (R 23 29)

S+/- Electronic voting in Canada: intelligent report on Access, Integrity, and Participation (R 23 53)

\$\$fhim Electronic voting blamed for 2006 Quebec municipal election 'disaster' (R 24 46, S 32 1)

fh Votes and candidates misaligned in Calgary 2001 election through misalphabetization of d'Arras as Arras (S 27 1:16, R 21 70)

\$f Votes lost in Toronto (S 14 1, 14 5); Toronto district finally abandons computerized voting; year-old race still unresolved (S 15 2)

SHm SQL Slammer DDos attack disrupted the 25 Jan 2003 NDP leadership convention voting in Toronto (election.com) (R 22 59)

hfi Alberta vote-by-phone fiasco (S 20 2:8)

- Canadian law disenfranchises one million people who do not have street names and numbers; later rectified (R 24 88,90)

\$\$SHPfhi NEDAP, the Dutch voting machine reprogrammed to play chess! (R 24 61,62); Yet another risk of voting computers: shoulder-surfing in the Netherlands (R 24 60); Dutch government suspends computer voting (R 24 84); E-Voting banned by Dutch government (R 25 17)

\$\$SPfhi Opposition to e-voting grows in France (R 24 62); French elections bring down foreign Web sites (R 24 65)

SH Election fraud in the UK? (R 21 50,51)

SP(+/-) UK publishes security requirements for e-voting (Cuddy and Mercuri response, R 22 40)

SH BBC Website article on risks with e-voting: Yet every time we get to look inside a piece of software or a security system that has been developed in secret, and built on the top of a compromise between acceptable levels of risk and the cost of doing it properly, we find holes and errors. (R 22 83)

SP+ The shape of elections to come in England: paper ballots continue, electronic voting considered (R 22 95)

f UK Elections: Web and text vote trials dropped (R 24 03; S 30 6:25)

SPf E-vote 'threat' to UK democracy (R 24 71,84)

+? Church of England has certified software for its elections (S 17 1)

SP Electronic voting in Ireland in spring 2002 (S 27 3:16, R 21 93)

Sf Irish Labour Party urges suspension of e-voting until flaws addressed (R 23 01)

Sf Ireland scraps electronic voting plans (R 23 35) and The Netherlands accepts the same technology despite secret evaluation (R 23 39)

SHfm Future of e-voting in doubt in Japan: reliability, credibility, other concerns (R 25 05)

mH? Philippines election power failure affected only the area of the computer center; on reboot, the computer immediately declared the underdog to be the winner (S 10 3:8, *The Washington Post* 10 Jun 1985)

\$\$SPfhi Philippine Internet voting system challenged (R 24 64)

fSAP New Zealand electoral Web site for registering and updating; authentication consists of full name and date of birth! (R 21 41,44)

SAfe Electronic voting systems: more on system integrity and accountability (R 22 66); New South Wales forced to hand-count poll result after inadequately tested computer upgrade (R 22 69); crash of Will County, Illinois, Web site for tallying and publishing election results after being deluged with bogus requests (R 22 69)

h 6000 moved Australian voters lost from computer election rolls (S 14 6)

fm DB and WWW on one machine mess up 2001 Australian Capital Territory election (S 27 1:15, R 21 71-72); see earlier anticipation (R 21 67)

fh Risks with automated counting of preferential ballots in 2001 Australian Senate elections (S 27 1:15-16, R 21 77)

f/h/H? Computer error in Cape Town election affects results (R 18 17)

h Read-ahead synchronization glitch and/or eager operator causes large data entry error, giving wrong winner in Rome Italy city election (S 15 1)

f German parliament election: program rounds up Greens' 4.97%, but 5% needed to count; corrected error gives Social Democrats one-seat majority (S 17 3)

h Wrong result in German Bundestag elections due to FAX of double-sided results pages (R 20 04)

f Swedish election results delayed by computer errors, 140% returns (S 17 1)

\$h Mis-set parameter invalidates Oslo parliamentary election (S 19 1:5)  
 S? Tampering blamed for lost Peruvian candidacy signatures (S 20 1:18)  
 SH Electronic ballots eschewed in India due to rigging fears (S 16 3)  
 Sfi Bulgarian parliament e-voting authentication based on member's weight (S 27 2:12, R 21 88-89)  
 S Injured technician's inability to provide the password delays vote count in Mali (S 27 3:18, R 22 05)  
 SHf Olympics' ice skating judging rigging leads to strange proposal for nonaudited electronic randomized voting scheme! (S 27 3:18, S 21 92)  
 m Mice chew up paper ballots in Bangkok election (S 27 3:18, R 21 98)  
 h How to rig an election by clever redistricting (R 22 05)  
 hi Brazilian computer blocked twins, like-named siblings from voting (S 12 1) (This problem may still have existed in 1994, unless new report was old.) (R 16 45)  
 fe Voting machine inflexibility causes postponement of Brazil's standard time cutover from daylight time because law requires 8 to 5 voting (R 22 33); Brazil modified 3% of their machines to use the Mercuri Method (R 22 24) – see article in November 2002 IEEE Spectrum.  
 SP Nigerians to use fingerprint scanning technology in elections; lower-level officials hoard registration forms (R 22 30)  
 SHf Phantom voting in Israeli Knesset; no security (R 22 76,79)  
 SHPhfi Secret-ballot e-voting in Tel Aviv University (R 23 11)  
 SM Cosmic ray blamed for failure of 2003 Belgian voting system adding extra 4,100 votes! (R 23 46, with discussion R 23 47)  
 S+ Voter-verified e-voting in Venezuelan election deemed sound (R 23 52)  
 SH Election candidates' Web pages hacked during Finnish election (R 23 58)  
 SP Voting machines in Ireland and The Netherlands (R 24 36, S 31 6:33-34)  
 .... **Related technology problems**  
 @+? Use of 'unpredictable auditable random numbers' in casino/gaming systems, possibly relevant in elections? (R 22 57)  
 @S? New cell phones well suited to wireless gambling (resembling the voting machine situation?)! (R 22 55)  
 h? Counting error on SMS poll evicts wrong contestant from 'Big Brother'; caught in audit! (R 23 46)  
 SP+ Ron Rivest's ThreeBallot paper approach, eschews cryptography, hinders vote selling (R 24 44); Rivest-Smith three approaches to reducing electoral fraud (R 25 02) <http://people.csail.mit.edu/rivest/publications.html>