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COMMITTEE/BOARD OF SUPERVISORS

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Completed by: ___Alisa Somera_____ Date _November 26, 2014_
Completed by: _____ Date _____

1 [Supporting the Creation of Open Source Voting Systems - Studying New Models of Voting
2 System Development]

3 **Resolution committing the City and County of San Francisco to work with the**

4 **California Association of Voting Officials and other jurisdictions and organizations to**

5 **create new voting systems using open source software; and to study the feasibility of**

6 **the City and County of San Francisco developing and using a new voting system,**

7 **either whole or in part, through a collaborative model like the Los Angeles County**

8 **Voting Systems Assessment Project.**

9
10   WHEREAS, The City and County of San Francisco holds it in the interest of its citizens

11 to conduct efficient and accurate elections in a manner which promotes public trust in the

12 integrity of every aspect of the elections process; and

13   WHEREAS, Transparency in the recording, collection, transmission, aggregation and

14 tally of votes promotes public confidence in the integrity of elections; and

15   WHEREAS, A growing number of government leaders, good government groups,

16 citizens, and media reports have questioned the value and integrity of the existing, limited

17 choices of voting systems certified for use in conducting elections; and

18   WHEREAS, A limited number of vendors dominate the voting systems marketplace,

19 reducing incentives to innovate, and their refusal to make public their voting system software

20 and hardware designs conflicts with the goal of election transparency; and

21   WHEREAS, In order to address these issues, the San Francisco Board of Supervisors

22 on November 18, 2008, adopted Ordinance No. 268-08, File No. 081227, amending the

23 Administrative Code by adding Sections 5.400-410 to establish a Voting Systems Task Force

24 comprised of individuals with backgrounds in good government, computer science or the

25 computer industry, election administration, and accommodations of persons with disabilities,

1 to make recommendations to the Board of Supervisors about voting system standards, design

2 and development; and

3   WHEREAS, Pursuant to Ordinance No. 268-08, the San Francisco Voting Systems

4 Task Force was created to provide the City with recommendations on: standards and

5 guidelines for development and acquisition of voting systems; methods for acquiring voting

6 systems in conformity with federal, state and municipal laws; models for the development of a

7 voting system; business models, including the City and County of San Francisco acting as its

8 own vendor, which promote transparency; and any other issues related to voting systems

9 which will engender public trust in the elections processes of the City and County of San

10 Francisco; and

11   WHEREAS, In June 2011, "Recommendations on Voting Systems for the City and

12 County of San Francisco – A Report by the San Francisco Voting Systems Task Force

13 (VSTF)" was completed, in which the VSTF recommended that San Francisco advocate with

14 the California Secretary of State and the State legislature for a new, comprehensive state

15 certification process to replace the existing requirement for federal certification; and

16   WHEREAS, California Governor Jerry Brown on October 5, 2013, approved California

17 Senate Bill No. 360 amending the California Elections Code to create a comprehensive state

18 certification process and adding a new Section 19006 to the Elections Code stating the intent

19 of the Legislature that:

20   (a) All voting systems be certified or conditionally approved by the Secretary of State,

21   independent of voluntary federal qualification or certification, before they are used in

22   future elections to ensure that the voting systems have the ability to meet accuracy,

23   accessibility, and security standards.

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(b) The Secretary of State adopt and publish testing standards that meet or exceed federal voluntary standards set by the United States Election Assistance Commission or its successor agency.

(c) The Secretary of State study and encourage the development of voting systems that use nonproprietary source code and that are easy to audit.

(d) A local jurisdiction may use available public funds to purchase and maintain any certified or conditionally approved voting system or part of a voting system.

(e) California receives the benefits of the publicly funded development of a nonproprietary voting system in the state.

(f) A local jurisdiction may use available public funds to research and develop a nonproprietary voting system that uses disclosed source codes, including the manufacture of a limited number of voting system units, for use in a pilot program or for submission to the Secretary of State for certification; and

WHEREAS, The VSTF in its June 2011 report also recommended that:

(a) the San Francisco Department of Elections give strong preference to a voting system licensing structure that gives San Francisco all of the rights provided by a license approved by the Open Source Initiative, a global non-profit that supports and promotes the open source movement ("OSI-approved license"), even if the system is maintained by an external party.

(b) San Francisco work with other jurisdictions and organizations, if an open source model is used, to develop and manage the code-base in order to leverage additional resources and expertise, and participate during the requirements gathering stage of development so that its unique requirements can be incorporated into the system design and implementation.

(c) San Francisco be an active participant in the movement toward more open and

transparent voting systems, acknowledging the complexity of moving from the existing

marketplace toward more innovative voting systems; urging San Francisco to move

steadily toward the goal of transparency—even if it must do so in incremental steps;

encouraging the City to be a strong advocate in the private sector marketplace for more

transparent systems and to be open as well to new collaborative development models;

and

WHEREAS, The Los Angeles County Voting Systems Assessment Project (VSAP) is a

collaborative project to design and implement a new voting system that was launched by the

Los Angeles County Registrar-Recorder/County Clerk and is a project that San Francisco

officials can learn from; and

WHEREAS, The California Association of Voting Officials (CAVO) is a California

nonprofit non-stock mutual benefit corporation designed to create new voting systems utilizing

free open source software and inexpensive commodity components, with a mission to develop

and make available open source voting systems for use in public elections, as well as to

provide training, education and management practices to election officials for the effective

employment of technologies; and

WHEREAS, CAVO's mission is to create certified and freely shareable voting

technology that will be based on free and open source software working with common off-the-

shelf modern hardware, including but not limited to tablets, battery-powered printers,

computers, and scanners, thus enhancing quality, security, and availability of voting systems

available to counties; and

WHEREAS, The City and County of San Francisco recognizes that development and

certification of these systems will entail substantial investment, but by pooling resources from

other jurisdictions and organizations, the cost to each participant can be reduced; now,

therefore be it

1 RESOLVED, That the City and County of San Francisco, in order to further these

2 goals, pledges to support the California Association of Voting Officials (CAVO) and other

3 jurisdictions and organizations working to implement open source voting programs ; and, be it

4 FURTHER RESOLVED, That the City and County of San Francisco supports the

5 movement toward more open and transparent voting systems and the creation of new voting

6 systems using open source software and inexpensive commodity components; and, be it

7 FURTHER RESOLVED, That the Board of Supervisors requests that the Local Agency

8 Formation Commission conduct a study of the feasibility and cost-effectiveness of the City

9 and County of San Francisco leading an effort to develop and use a new voting system, either

10 whole or in part, through a collaborative model, and which includes researching and

11 presenting options for structuring such a development project, as well as reviewing the work

12 of the Los Angeles Voting Systems Assessment Project (VSAP) and its process of voting

13 system design and acting as its own vendor, as a model for San Francisco in its pursuit of

14 transparent, secure and fair elections.

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**VOTING SYSTEMS
TASK FORCE**

Edwin M. Lee, Mayor

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4   RECOMMENDATIONS ON VOTING SYSTEMS FOR
5   THE CITY AND COUNTY OF SAN FRANCISCO

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7   A Report by the San Francisco Voting Systems Task Force (VSTF)

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17   **June 2011**

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1 TABLE OF CONTENTS

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Section 1:
Introduction and Background

1.1 Mission and Context of the Voting Systems Task Force (VSTF)

In September 2008 the City and County of San Francisco[1] Board of Supervisors established the Voting Systems Task Force to make recommendations to that body about voting systems standards, design, and development.[2] We define our work as follows:

Mission: Our mission is to advise San Francisco on the development and/or acquisition of voting systems that ensure fair and accurate elections, achieve voter intent, and provide for transparency and public auditability of voting systems components and election data.

Scope and Objective: Activities encompass voting systems and related elections issues that affect or are affected by voting systems and voting system acquisition in San Francisco. A "voting system" for this report is defined to be a system of hardware, software, and processes that prepares a ballot and records, collects, transmits, counts, and reports on votes and election results as cast by voters. Included in this definition are the associated reports and audit logs that provide information about management of election data in the system and system use, integrity, administrative access, configuration and configuration changes as well as documentation for support, use and training on use of the system.

Our report contains recommendations, coupled with supporting rationale, for each of the five areas identified by Section 5.405(b) of the Administrative Code:[3]

1. Standards and guidelines to gauge the adequacy, accuracy and trustworthiness of any voting system to be developed or acquired and the adequacy of any vendor or other entity that might develop and deliver such a system;
2. Methods for generating or acquiring designs for a voting system that meets applicable Federal, State, County and City laws, regulations and other requirements and all other goals for the voting system while minimizing system life-cycle costs;
3. Models for development of a voting system including proprietary, disclosed and open source software and hardware approaches and which address aforementioned voting systems requirements and assure a cost effective, highly reliable, maintainable system;

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[1] Unless specified individually as "the City" or "the County," San Francisco" will be used to refer to the City and County of San Francisco throughout the remainder of this report.
[2] San Francisco, Calif., Ordinance 268-08 (2008); www.sfbos.org/ftp/uploadedfiles/bdsupvrs/ordinances08/o0268-08.pdf.
[3] San Francisco, Calif., Ordinance 268-08 (2008), page 3, line 4; www.sfbos.org/ftp/uploadedfiles/bdsupvrs/ordinances08/o0268-08.pdf.

1   4. Business models, including the City and County of San Francisco acting as its own
2   vendor, which promote the transparency of all aspects of design, development,
3   production and the business relationship of all parties associated with production,
4   delivery, implementation and use of the voting system;

5   5. Any other considerations related to voting systems that will promote public trust in the
6   conduct and results of elections.

7   Recommendations are presented in five topic areas: election records and post-election audit
8   procedures; balloting systems and services; security; Ranked-Choice Voting; and acquisition
9   strategies.

10   This report is not intended to be a complete statement of requirements or technical specifications,
11   and it is not an exhaustive study of all topics related to voting systems. Rather, it provides a
12   framework that will guide San Francisco as it seeks its next voting system. A coordinated effort
13   will be needed to establish a policy direction for San Francisco and to support its Department of
14   Elections through a robust and forward-thinking process. We recognize that the City may wish to
15   initiate further investigation of certain topic areas as it considers a direction for San Francisco's
16   next voting system. We recommend that the San Francisco Board of Supervisors establish a body
17   or process to implement the recommendations contained in this report and to maintain steady
18   focus on this issue over coming months and years.

19   **Time Frame for Recommendations:** San Francisco is currently under contract with Sequoia
20   Voting Systems (which was acquired by Dominion Voting Systems Corporation in 2010),[4] and
21   has the option to extend that contract through elections in 2013. We have identified several
22   opportunities for improving public confidence in the City's use of Sequoia Voting Systems.
23   However, this report primarily offers guidance regarding San Francisco's next voting system.
24   Our recommendations can be found in Section 2 of this report.

25   **Audiences:** Our recommendations are intended to provide guidance to a variety of audiences
26   including the following:

27   • the San Francisco Board of Supervisors
28   • the San Francisco Department of Elections
29   • the San Francisco Elections Commission
30   • San Francisco voters

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[4]Dominion Voting Systems Corporation website (2010), "Dominion Voting Systems Corporation
Acquires Assets of Sequoia Voting Systems," (news release);
http://www.dominionvoting.com/images/pdfs/DominionAcquiresSequoiaFinal.pdf.

1.2 Background on San Francisco's Current Voting System

On March 31, 2005, the San Francisco Department of Elections (DOE) initiated a Request for Proposals (RFP) process seeking bids for a new voting system (including equipment and services) to collect, count, tabulate, and report votes.[5] In December 2007, the San Francisco Board of Supervisors approved a contract with Sequoia Voting Systems for voting systems/services.[6] Sequoia replaced Elections Systems and Software (ES&S) with which the City had been under contract through the 2007 election cycles.

The Sequoia system was implemented beginning with the February 2008 election. The contract runs through December 2011. The contract with Sequoia Voting Systems for a voting system and associated services is valued at $12,650,233.35 (per Resolution 654-07).[7] The DOE has the option to renew the contract two times, each time for one year and has indicated that it anticipates extending the Sequoia contract through the end of 2013. Were it to do so, the DOE estimates that annual maintenance would be approximately $400,000, and services per election would be approximately $500,000. With three elections scheduled in 2012, the projected cost would be approximately $1.9 million. With one election scheduled in 2013, the projected cost would be approximately $900,000 (two year total: $2.8 million).[8]

Sequoia Voting Systems was acquired by Dominion Voting Systems in June 2010. Subsequently, the City accepted the assignment of the contract from Sequoia to Dominion. In this report, San Francisco's voting system is referred to as the "Sequoia Voting System."

San Franciscan voters use an optical scan voting machine to cast their ballots at the polling place. This machine is a paper-based voting system that optically scans the marks that voters make on a paper ballot and counts the votes electronically when the ballot is inserted. Additionally, each polling place has one Sequoia AVC Edge accessible touchscreen voting machine.[9]

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[5]City and County of San Francisco, DOE (6 February 2007),"Contract for New Voting System" (memo from DOE Director John Arntz to Merrick Pascual, Budget Analyst, Board of Supervisors); http://www.sfgov2.org/ftp/uploadedfiles/elections/Announcements/MR2007/20070206.pdf.
[6]City and County of San Francisco government website, "City and Country of San Francisco—NFAMIS Blanket Purchase Order Writing"; http://www.sfgov2.org/Modules/ShowDocument.aspx?documentid=152.
[7]San Francisco Board of Supervisors website, "Resolution No. 65-08," http://www.sfbos.org/ftp/uploadedfiles/bdsupvrs/resolutions08/r0065-08.pdf
[8]San Francisco Department of Elections, e-mail message to Jody Sanford, April 14, 2010.
[9]Nataliya Kuzina, Deputy Director, San Francisco Department of Elections, e-mail message to Jody Sanford, April 19, 2011.

1   The technical specifications of San Francisco's current voting system are as follows:[10]

2   Optech Insight Plus
3   APX Firmware K2.16.080626.1320
4   HPX Firmware K1.44.080501.1500
5
6   Optech 400-C Hardware version 3.00P
7   WinETP Software version 1.16.6
8
9   AVC Edge Model II
10   Firmware version 5.0.24
11
12   WinEDS versions 3.1.012 and 4.0.116B
13   WinEDS Extended Services 1.0.47
14   WinEDS Election Reporting Software 4.0.44
15
16   Card Activator version 5.0.21
17
18   MemoryPack Receiver (MPR) Hardware version D
19   Firmware version 3.01.080422.0522

20   1.3 Opportunities Presented by "Next Generation"
21   Voting Systems

22   John Arntz has been the director of the San Francisco Department of Elections (DOE) since
23   2002. Under his capable leadership, DOE has conducted well-run elections. Yet, the VSTF
24   believes that there is room to improve the underlying voting system and the procedures that
25   accompany the elections process. We have identified opportunities for improvement in several
26   areas:

27   • intent of voter and accessibility
28   • audit and verification procedures
29   • security
30   • transparency

31   These issues exist across the entire election systems landscape. In order to address them, there is
32   a need for innovation in the voting systems marketplace. Yet there are many barriers that limit
33   advancement and prevent new players from entering the market: the regulatory environment at
34   the state and federal level is shifting and cumbersome; developing, testing, and certifying new
35   systems are costly endeavors and time-consuming; the voting systems market is fragmented with
36   multiple jurisdictions and differing systems requirements; and many jurisdictions lack adequate

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[10]Nataliya Kuzina, Deputy Director, San Francisco Department of Elections, e-mail message to Jody
Sanford, April 19, 2011.

1   funding to invest in a new system. (The regulatory environment and acquisition marketplace is
2   discussed in detail in Section 2.5: Acquisition Strategies.)

3   Given these challenges, San Francisco would be prudent (a) to begin immediately considering
4   the characteristics of the voting system it would like to implement after the contract for its
5   current voting system terminates, and (b) to consider the acquisition model it will use to obtain a
6   new system. In fact, the City would be on par with other jurisdictions. Across the nation,
7   jurisdictions are grappling with how to provide elections that are accurate, fair, secure,
8   transparent, and accessible, and with how to evaluate the merits of various systems and
9   acquisition models.

10   The conversation about next generation voting systems is generating opportunities for
11   collaboration and information sharing. An effort to study future voting systems has been
12   undertaken by at least two other jurisdictions, including the following:

13   1. County of Los Angeles (California) Voting Systems Assessment Project (VSAP)
14   http://www.lavote.net/voter/VSAP
15   2. Travis County (Texas) Elections Study Group 2009
16   http://www.co.travis.tx.us/county_clerk/election/study_group_2009

17   We acknowledge that the obstacles to progress are significant and that jurisdictions must balance
18   aspiration with pragmatism. However, we believe that San Francisco should be an active
19   participant in the movement toward modernized voting systems, and it should consider a broad
20   range of possibilities regarding the business and partnership model it will pursue to
21   acquire/develop its next voting system.

22   While a flawless voting system is not attainable, the VSTF members hope that this strategic
23   guidance will help San Francisco implement a voting system that earns the highest level of
24   public confidence.

25

Section 2: Recommendations

2.1. Election Records and Post-Election Audit Procedures

2.1.1 Introduction

This section concerns the records generated in the course of an election and the procedures for checking records to verify that the election was conducted properly. Comprehensive records and audit procedures are essential for ensuring a correct outcome, deterring fraud, building public confidence in elections, and understanding how to improve the election system. Though there are many types of audits, this section deals only with post-election verification of the results.

2.1.2 Concepts and Definitions

Election records include paper or electronic records at all stages of an election, such as the following:

- **Voter registrations:** lists of the registered voters
- **Election definitions:** lists of the contests and candidates in the election and which groups of voters are eligible to vote in which contest
- **Ballot definitions:** descriptions of the contents and layout of each type of blank ballot
- **Cast vote records (CVRs):** electronic records of the choices that a voter made
- **Audit logs, event logs, and error reports:** timed records of events that took place during the election (e.g. accessing of sensitive information, opening or closing of polls, casting of ballots, granting or revocation of access, actions by election workers)
- **Canvass records:** all records used to reconcile vote totals during the post-election canvass period (period between election night and the date an election is certified), including ballot reconciliation sheets, records establishing chain of custody, and other precinct records
- **Vote counts:** counts of the votes (usually within an election district)
- **Election outcome:** the winning candidate in a contest, or the winning side of a referendum, as determined by the vote counts from all districts
- **Election results:** the final report of overall vote counts and outcomes, including the number of ballots cast, voter registration and turnout percentages, and other election statistics

A **post-election manual tally** (sometimes called a post-election audit) is a procedure conducted after an election to check the vote counts. It is usually performed by dividing the cast ballots into

1 groups called **audit units**, selecting some fraction of the audit units for a manual count, and
2 checking that the manual counts for each unit match the vote tallies from the election. The
3 California Elections Code, Section 15360,[11] currently requires a manual tally of the ballots from
4 1% of the precincts.

5 A **risk-limiting audit** is an audit that ensures a high, pre-specified chance of detecting and
6 correcting an incorrect election outcome. Any auditing procedure that can provide such a
7 guarantee qualifies as a risk-limiting audit. For the purpose of this definition, the correct outcome
8 is the outcome that a full hand count of all the ballots would have produced. Audits can be made
9 risk-limiting by establishing specific criteria under which a full hand count must occur. Typically
10 a risk-limiting audit involves hand-counting a randomly selected sample of the ballots (where the
11 number of ballots to count depends on how close the contest was), comparing the hand-verified
12 results to the vote tallies, and escalating to a full hand count if the error is sufficiently large. For
13 example, to limit the risk of an incorrect outcome to 1%, the sampling procedure and escalation
14 criteria must be chosen such that there is at least a 99% chance of escalating to a full hand count
15 when the outcome is incorrect.

16 **Ranked-Choice Voting** (RCV) is an election method in which each voter ranks the candidates
17 and the votes are counted through a multiple-round elimination process. This method is also
18 known as Instant-Runoff Voting or the Alternative Vote. As currently implemented in San
19 Francisco, each voter indicates a first choice, an optional second choice, and an optional third
20 choice for an elected office. In the first round of counting, all ballots are assigned to their first
21 choices. If one candidate now has a majority of the ballots, that candidate wins. If not, the
22 candidate with the least ballots is eliminated; ballots with that candidate as their first choice are
23 then reallocated to their second choice, or set aside as exhausted ballots if there is no second
24 choice. Rounds of counting and elimination repeat—always assigning each ballot to its highest-
25 ranked non-eliminated candidate—until one candidate has a majority of the non-exhausted
26 ballots.

27 **Election Markup Language** (EML) is a suite of XML-based data formats for election records,
28 defined by the Organization for Advancement of Structured Information Standards (OASIS). The
29 current version is EML 5.0 and work on EML 6.0 is under way. EML defines several different
30 data formats for different kinds of records; each format is identified by a number.

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[11]California Legislative Counsel government website, "Election Code Section 15360";
http://www.leginfo.ca.gov/cgi-bin/displaycode?section=elec&group=15001-16000&file=15360.

1 2.1.3 Findings

2 2.1.3.1 Voting System Vulnerabilities

3 Numerous independent investigations have discovered serious security weaknesses and design
4 errors in widely used electronic voting equipment. Some examples are cited as follows:

5   - In 2004, four computer security experts examined the source code of a DRE voting
6   machine[12] and found it to be "far below even the most minimal security standards
7   applicable in other contexts."

8   - In 2006, investigators at Princeton University demonstrated that it is possible to construct
9   a software virus that spreads from voting machine to voting machine—even when the
10   machines are not connected to a network—while altering votes in an undetectable
11   fashion.[13]

12 - In 2007, a team of reviewers appointed by the California Secretary of State found major
13   security flaws in three of the major brands of voting systems used in California, [14, 15, 16, 17]
14   including vulnerability to infection by a software virus in some cases.

15 - In 2008, the election system in Humboldt County erroneously deleted 197 ballots.[18]

16 Voting machines are still perceived as untrustworthy in the public consciousness. The
17 investigations mentioned above were widely publicized, and there continues to be a steady flow
18 of news headlines raising concerns about flaws and reliability problems with voting machines.

19   **Finding 1:** It is not safe to rely solely on electronic voting equipment for accurate results.

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[12]Kohno, Tadayoshi, Adam Stubblefield, Aviel D. Rubin, and Dan S. Wallach (2004). Analysis of an Electronic Voting System. In *Proceedings of the 2004 IEEE Symposium on Security and Privacy*, pp. 27-40. IEEE Computer Society Press.

[13]Feldman, Ariel J., J. Alex Halderman, Edward W. Felten (2007). "Security Analysis of the Diebold AccuVote-TS Voting Machine." In *Proc. 2007 USENIX/ACCURATE Electronic Voting Technology Workshop (EVT/WOTE '07)*; http://citp.princeton.edu/pub/ts06EVT.pdf.

[14]California Secretary of State Debra Bowen government website, "California Top-to-Bottom Review of Voting Systems" (TTBR); http://www.sos.ca.gov/voting-systems/oversight/top-to-bottom-review.htm.

[15]Calandrino, Joseph A., Ariel J. Feldman, J. Alex Halderman, David Wagner, Harlan Yu, and William P. Zeller (2007a). "Source Code Review of the Diebold Voting System." (report, University of California, Berkeley under contract to the California Secretary of State's TTBR); http://www.sos.ca.gov/voting-systems/oversight/ttbr/diebold-source-public-jul29.pdf.

[16]Inguva, Srinivas, Eric Rescorla, Hovav Shacham, and Dan S. Wallach (2007). "Source Code Review of the Hart InterCivic Voting System." (report, University of California, Berkeley under contract to the California Secretary of State's TTBR); http://www.sos.ca.gov/voting-systems/oversight/ttbr/Hart-source-public.pdf.

[17]Blaze, Matt, Arel Cordero, Sophie Engle, Chris Karlof, Naveen Sastry, Micah Sherr, Till Stegers, and Ka-Ping Yee (2007). "Source Code Review of the Sequoia Voting System." (report, University of California, Berkeley under contract to the California Secretary of State's TTBR); http://www.sos.ca.gov/voting-systems/oversight/ttbr/sequoia-source-public-jul26.pdf.

[18]California Secretary of State Debra Bowen government website, "Report to the Election Assistance Commission Concerning Errors and Deficiencies in Diebold/Premier GEMS Version 1.18.19," (2009). https://www.sos.ca.gov/voting-systems/vendors/premier/sos-humboldt-report-to-eac-03-02-09.pdf.

Finding 2: Public confidence in electronic voting has been diminished by the discoveries of serious flaws in electronic voting systems.

2.1.3.2 Current Auditing Procedures

San Francisco's post-election audit is known as the "1% Manual Tally," in which the ballots from a random selection of precincts are manually counted.[19] The manual counts are checked against machine reports at the precinct level. For speed and accuracy, the contests are counted one at a time; that is, each counting team counts a single contest for an entire precinct, then counts the next contest for the entire precinct, and so on.

We inquired as to the procedure taken when the audit appears to be at variance with the reported election results. When there is a discrepancy of even one vote, the ballots are counted again, with particular attention to counting the ballots as a machine would count them, not as a human would interpret the voter's intent. That is, the audit seeks a way to interpret the ballots that confirms the machine result. If a discrepancy remains after a second count, the audit team fills out a Manual Tally Incident Report, which is reviewed by supervisors in charge of the canvass. There is no formal written procedure for escalating the audit or challenging the election results based on such a discrepancy.

Finding 3: The current post-election audit procedure does not establish a known limit on the risk of an incorrect outcome.

2.1.3.2.1 Auditing Procedures for Non-RCV Contests

For a regular contest, the manual count produces a tally of the number of votes for each candidate. These numbers are then compared directly to the vote counts on the machine report for the precinct. The counting process is quite fast, because the ballots are first sorted into piles (one pile for each candidate), and then each pile is counted. We watched a video of the manual tally for a ballot measure; a member of the team counted the "Yes" pile, speaking "Yes, yes, yes, yes, yes..." at a rate of about two ballots per second.

If this manual tally process were carried out for every precinct, it would give assurance that the counts are correct in every precinct, and thus the totals are correct for the entire election, and thus the outcomes (winners) are also correct. Performing this process for a randomly selected fraction of the precincts therefore verifies the outcome with a known level of confidence. This level of confidence can be calculated, and it depends on how many precincts are checked, the number of ballots, and the margin of victory. A 10% tally provides higher confidence than a 1% tally, and a 100% tally provides complete confidence.

2.1.3.2.2 Auditing Procedures for RCV Contests

For an RCV contest, the team manually counts the first choices, second choices, and third choices separately, as if they were three independent contests, resulting in three counts for each candidate. These are compared directly to the machine report, which also provides vote counts of

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[19]San Francisco Department of Elections, SF RCV BDProcedures2009-Final.xls, electronic file.

1 each RCV contest as though it were three independent contests. Next, the team carries out the
2 RCV elimination process *at the precinct level*. That is, if no candidate has a simple majority of
3 the first-choice votes *in the precinct*, then the candidate with the lowest number of first-choice
4 votes in the precinct is eliminated; those ballots are transferred to piles for their second-choice
5 candidates, and so on.

6 Since the actual election outcome is determined by elimination based on totals for the entire
7 election, the sequence of candidates eliminated during the manual precinct tally bears no
8 relationship to the actual elimination sequence. Also, checking the three independent totals does
9 not verify the outcome because the outcome depends on which first-choice votes are cast with
10 which second-choice votes—not just how many of each there are. Thus the RCV manual tally
11 process does not verify the outcome of the election (see Appendix A for a detailed example).

12 **Finding 4:** The manual tally procedure for RCV contests is significantly more complex
13 than the procedure for non-RCV contests.

14 **Finding 5:** The manual tally procedure does not verify the outcome of RCV contests.

2.1.3.3 Alternative Auditing Procedures

2.1.3.3.1 Independent Verification

17 The deletion of 197 ballots in Humboldt County led to the certification of incorrect results in the
18 November 4, 2008, General Election. The discrepancy went undetected until it was discovered
19 by an audit conducted by the Humboldt County Election Transparency Project.[20] The ballots
20 were scanned with a general-purpose, high-speed office scanner. A pre-imprinter attached to the
21 scanner printed a unique serial number on each ballot before scanning. The resulting scanned
22 images were then counted by an image analysis program called TEVS,[21] written by Mitch
23 Trachtenberg. TEVS is freely available under an open source license and has been developed
24 further since 2008.

25 **Finding 6:** An independent verification of an election has been successfully conducted
26 by scanning and counting ballots using ordinary office equipment and free software, and
27 such procedures can be effective at detecting errors in election results.

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[20]Humboldt Election Transparency Project, last accessed on June 23, 2011; http://humtp.com/.
[21]Trachtenberg Election Verification System, last accessed on June 23, 2011;
http://code.google.com/p/tevs/.

2.1.3.3.2 Risk-limiting Audits

In 2008, Joseph Hall et al. conducted risk-limiting audits of four contests from elections that took place in California's Marin, Yolo, and Santa Cruz counties. The authors reported that "[t]he cost and the time required were modest....There remains room for big gains in efficiency—that is, for reducing the number of ballots that must be counted to confirm an election outcome that is, in fact, correct."[22]

In 2009, risk-limiting audits were performed for two contests in Yolo County, as reported by Philip Stark.[23] In one case, the audit units were batches of between 200 and 600 ballots, and the risk-limiting audit required hand-counting 1,437 ballots—a little more than 11% of the ballots cast. In the other case, the audit units were individual ballots, and the risk-limiting audit required hand-counting only 32 ballots.

> **Finding 7:** Risk-limiting audits have been carried out successfully in California.

We note that several risk-limiting audit methods have been proposed and published in peer-reviewed literature. One notable example is the method proposed in "Super-Simple Simultaneous Single-Ballot Risk-Limiting Audits,"[24] which audits all the contests on the ballot at once, requires just one parameter to be calculated by a formula (which needs to be calculated only once before the audit begins), and has a simple method for determining how many ballots to check. However, all the proposed methods so far assume a non-RCV contest: there appear to be no peer-reviewed, published methods for risk-limiting audits of RCV contests.

> **Finding 8:** There is at least one peer-reviewed risk-limiting audit method for non-RCV contests that is practical and straightforward to carry out.

> **Finding 9:** There do not appear to be any peer-reviewed risk-limiting audit methods for RCV contests that have yet been published.

2.1.3.3.3 Ballot-level Auditing

In addition to Stark, other researchers also report that auditing at the individual ballot level dramatically reduces the number of ballots that need to be hand-counted in order to achieve a high degree of confidence. Calandrino et al. (2007b)[25] have proposed a method of ballot-level auditing that uses a machine to mark each ballot with a unique number, so that randomly selected

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[22]Hall, Joseph Lorenzo, Luke W. Miratrix, Philip B. Stark, Melvin Briones, Elaine Ginnold, Freddie Oakley, Martin Peaden, Gail Pellerin, Tom Stanionis, Tricia Webber (2009). "Implementing Risk-Limiting Post-Election Audits in California"; http://www.usenix.org/event/evtwote09/tech/full_papers/hall.pdf.

[23]Stark, P.B. (2009). "Efficient Post-Election Audits Of Multiple Contests: 2009 California Tests." (Refereed paper presented at the 2009 Conference on Empirical Legal Studies.); http://ssrn.com/abstract=1443314.

[24]Stark, P.B. (2010). "Super-Simple Simultaneous Single-Ballot Risk-Limiting Audits," in the 2010 Electronic Voting Technology Workshop/Workshop on Trustworthy Elections (EVT/WOTE '10); http://www.usenix.org/events/evtwote10/tech/full_papers/Stark.pdf.

[25]Calandrino, Joseph A., J. Alex Halderman, and Edward W. Felten (2007b). "Machine-Assisted Election Auditing"; http://www.usenix.org/events/evt07/tech/full_papers/calandrino/calandrino.pdf.

1   ballots can be individually retrieved and checked against their corresponding cast vote records.
2   Even without such markings, keeping the ballots stacked in the same order that they were
3   scanned is sufficient to make ballot-level auditing possible.[26] The number of ballots to check
4   depends on the margin of victory; closer contests require more manual checking. Calandrino
5   et al. (2007b) analyzed the statewide contests in the Virginia elections in November 2006 and
6   found that in order to achieve a 99% confidence level of detecting an incorrect outcome, a ballot-
7   level audit would require hand-counting 40 times fewer ballots than a precinct-level audit.

8   **Finding 10:** Performing a risk-limiting audit with large audit units (e.g. randomly
9   selecting entire precincts for manual counting) is likely to be more expensive than a 1%
10   manual tally.

11   **Finding 11:** Performing a risk-limiting audit at the ballot level (i.e. randomly selecting
12   individual ballots for manual counting) is likely to be considerably cheaper than a 1%
13   manual tally, while providing stronger assurance that the outcome is correct.

14   **2.1.3.3.4 Assembly Bill 2023**

15   We note that California Assembly Bill 2023[27] (AB 2023) authorizes the establishment of a
16   groundbreaking pilot program to conduct risk-limiting audits in "5 or more voluntarily
17   participating counties" during 2011. The program will yield a report to the California
18   Legislature evaluating the effectiveness and efficiency of the audits. We find that the definition
19   of "risk-limiting audit" given in AB 2023 matches the meaning intended in this report.

20   **Finding 12:** The AB 2023 pilot program provides a valuable opportunity to conduct
21   officially recognized risk-limiting audits, advance the state of the art in post-election
22   auditing procedures, and achieve higher confidence in election outcomes.

23   **2.1.3.3.5 File Formats**

24   Those who have conducted the aforementioned audits also reported that "[a] great deal of
25   scripting and hand editing was required to make the exported data [from Election Management
26   Systems] useful....Election auditing requires better 'data plumbing' than EMS vendors currently
27   provide....One suitable format is the OASIS Election Markup Language (EML)...."[28]

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[26]Note: In order to preserve voter anonymity, it is important not to order the ballots in a way that can be correlated with the order in which public records show the voters as having cast their votes.
[27]Official California Legislative Information, "Assembly Bill 2023"; http://www.leginfo.ca.gov/pub/09-10/bill/asm/ab_2001-2050/ab_2023_bill_20100719_chaptered.pdf.
[28]Hall, Joseph Lorenzo, Luke W. Miratrix, Philip B. Stark, Melvin Briones, Elaine Ginnold, Freddie Oakley, Martin Peaden, Gail Pellerin, Tom Stanionis, Tricia Webber (2009). "Implementing Risk-Limiting Post-Election Audits in California"; http://www.usenix.org/event/evtwote09/tech/full_papers/hall.pdf.

1   Neal McBurnett worked with the Boulder County Elections Division to conduct an audit for the
2   2008 General Election in Boulder County, Colorado,[29] and reported the following:

3   •   Most of the reports produced by the Hart tally system were poorly specified or hard to
4   parse for auditing.
5   •   The Hart tally system produced an XML report that was usable for auditing, though it
6   still lacked some important information and did not adhere to the EML standard.
7   •   Effective audits are easier and require less hand counting to achieve a similar level of
8   confidence if results are reported in smaller audit units.

9   Both of these reports point to non-proprietary reporting formats, specifically EML. We are also
10   aware of IEEE P-1622, which is another voting data standard under development with more of a
11   focus on elections in the United States. We have not reviewed the specification for P-1622, as the
12   IEEE P-1622 Working Group's working documents are not freely available on its website. If and
13   when P-1622 is a fully developed, freely available open standard with comparable
14   expressiveness to EML, it may also be a suitable option.

15   **Finding 13:** The use of proprietary, vendor-specific data formats increases the difficulty
16   of conducting an audit or forensic investigation.

17   **Finding 14:** Election Markup Language is a suitable structured data format for enabling
18   efficient post-election audits.

19   **2.1.3.3.6 End-to-end Verification**

20   Another way to establish confidence in an election is to provide the voters with a way to verify
21   that their own votes were correctly recorded and included in the tally. Voting systems that make
22   this possible are said to offer **end-to-end verification**. At the same time, however, it is important
23   to avoid enabling voters to prove how they voted in such a way that they can sell their votes, and
24   also to avoid enabling voters to fraudulently claim that their votes were misrecorded. Although
25   this is a tricky set of requirements to satisfy all at once, there is a substantial body of research
26   and invention in voting systems that actually do have all of these properties. To cite one
27   example, a system called Scantegrity II[30] allows voters to note confirmation codes for their
28   choices and check those codes against a published list of the codes for all the cast ballots, but it
29   does not allow them to prove to others which candidates those codes represented. The City of
30   Takoma Park, Maryland, used Scantegrity II for its November 2009 election.

31   **Finding 15:** There is at least one voting system offering paper-based end-to-end
32   verification that has been used to conduct a real election.

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[29]McBurnett, Neal (2008). "Obtaining Batch Reports for Audits from Election Management Systems:
Election Audits and the Boulder 2008 Election" National Institute of Standards and Technology;
http://www.nist.gov/itl/vote/upload/neal-mcburnett-boulder-paper.pdf.
[30]Scantegrity, last accessed on June 23, 2011; http://www.scantegrity.org/.

2.1.4 Recommendations

Based on the findings above, the VSTF makes the following recommendations.
Recommendations 1 through 7 can begin implementation now. Recommendations 8 through 12
concern longer-term or more speculative changes, such as the criteria for San Francisco's next
voting system. Below, the phrase "EML or an equivalent open standard" refers to a publicly
available, freely licensed format of equivalent expressiveness to EML, established by a vendor-
independent national or international technical standards body.

2.1.4.1 Near-term Recommendations

1. Publish all election records on the city's website, redacting records only as necessary to
   protect the anonymity of each voter's votes and the privacy of each voter's personally
   identifying information. Give public notice when records are published. Whenever
   feasible, use EML or an equivalent open standard format for the published records. The
   VSTF recommends prioritizing these four types of records first:

   a. *Tallies of the vote counts, under-votes, and over-votes from each precinct:*
      Publish (using EML section 500 or equivalent formats) as soon as possible after
      each precinct closes its polls. For RCV contests, publish the tallies of each
      preference level, to the extent that these tallies can be compared against totals
      published at the polling place in order to verify the correct transfer of ballots to
      the central election office.

   b. *Text files of cast vote records, which are currently called "ballot image files":*
      For precinct-scanned ballots, publish as soon as the memory packs are loaded; for
      centrally scanned ballots, publish as soon as the ballots are centrally scanned.
      These must be published before any precincts are randomly selected for audits.

   c. *Election definitions:* Publish (using EML section 200 and 600 or equivalent
      formats) as soon as the Qualified Candidate List and Official Measures List are
      complete.

   d. *Ballot definition files:* Publish (in the current proprietary format) as soon as ballot
      layouts are complete. When EML or an equivalent open standard format is used
      (see Recommendation 7), publish in that format.

2. Correct the audit procedure for RCV contests in such a way that a 100% tally would
   actually ascertain the outcome. In particular, as recommended by the California Secretary
   of State, use entire-election totals—not precinct vote totals—to determine which
   candidates to eliminate.[31]

3. Pursue participation in the post-canvass risk-limiting audit pilot program authorized by
   California AB 2023.

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[31]California Secretary of State Debra Bowen government website. Debra Bowen (2010) "Instant Runoff
Voting in Charter Counties and Charter Cities"; http://www.sos.ca.gov/voting-
systems/oversight/directives/irv-guidelines.pdf.

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4   4. Define, pilot, and use a ballot-level risk-limiting audit procedure for all non-RCV
        contests, taking guidance from Hall et al.'s "Implementing Risk-Limiting Post-Election
        Audits in California"[32] and considering as one option Stark's "Super-Simple
        Simultaneous Single-Ballot Risk-Limiting Audits." [33]

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7   5. At such time as a peer-reviewed method for risk-limiting audits of RCV contests has been
        published, define, pilot, and use a ballot-level risk-limiting audit procedure for all RCV
        contests.

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12   6. Permit academic organizations[34] to publicly request and obtain timely access to all the
        paper ballots (without any information linking ballots to voter identities) for the sole
        purpose of digitally scanning the ballots and analyzing the scanned images to
        independently verify election results,[35] and to publish their findings from such
        verification.

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14
15   7. Permit academic organizations to publicly request, obtain, and study machine audit logs
        from which any information identifying individual voters has been removed, and to
        publish their findings from such study.

16   ## 2.1.4.2 Longer-term Recommendations

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20   8. Consider broadening the audience with access in Recommendations 6 and 7 to include
        other organizations that serve the public interest, or all members of the public, under
        conditions that limit conflicts of interest, provide full transparency, protect voter privacy,
        and discourage vote-selling.

[32]Hall, Joseph Lorenzo, Luke W. Miratrix, Philip B. Stark, Melvin Briones, Elaine Ginnold, Freddie
Oakley, Martin Peaden, Gail Pellerin, Tom Stanionis, Tricia Webber (2009). "Implementing Risk-
Limiting Post-Election Audits in California";
http://www.usenix.org/event/evtwote09/tech/full_papers/hall.pdf.
[33]Stark, P.B. (2010). "Super-Simple Simultaneous Single-Ballot Risk-Limiting Audits," in 2010
Electronic Voting Technology Workshop/Workshop on Trustworthy Elections (EVT/WOTE '10); URL:
http://www.usenix.org/events/evtwote10/tech/full_papers/Stark.pdf.
[34]Note: Due to the precedent set by the Humboldt County Election Transparency Project, the
VSTF finds great potential value in enabling independent parties to scan and analyze the ballots.
However, we also recognize that making all ballots available to the public creates concerns about
voter privacy and may enable large-scale vote-selling. Because we believe that independent
verification is a powerful way to establish voter confidence, we prefer to see short-term action
rather than have such action delayed, perhaps indefinitely, by the controversy that the public
distribution of ballots would raise. Thus, we propose the compromise of making the ballots
available for scanning to academic organizations, under the assumption that such organizations
have sufficient reputations and oversight to be trusted not to engage in large-scale vote-selling
schemes. We do not intend this recommendation to prohibit members of the public from
collaborating with academic organizations to participate in the verification process. In fact, we
encourage a publicly transparent process.
[35]By way of example, two such systems are or will become available from TEVSystems
(http://www.TEVSystems.com, http://code.google.com/p/tevs/) and the Clear Ballot Group
(http://www.ClearBallot.com).

1   9. Use EML or an equivalent open standard format internally within the Department of
2   Elections as the primary data format for election definitions and results.

3   10. Announce an acquisition preference for voting systems that facilitate auditing of
4   individual randomly selected ballots, for example, by exporting digital cast vote records,
5   by exporting scanned images of ballots, and/or by printing a unique identifier on each
6   ballot at the time the ballot is scanned in order to associate each physical ballot with its
7   digital cast vote record.

8   11. Announce support for EML or an equivalent open standard format as a procurement
9   requirement for new voting systems—specifically, as the format for election definitions,
10   results, outcomes, and any reports necessary to support the risk-limiting audit procedure
11   in use.

12   12. Announce an acquisition preference for voting systems that allow individual voters to
13   verify their cast votes after the election and independently check the vote tally, without
14   enabling voters to sell their votes or fraudulently claim that their votes were miscounted.

15

2.2 Balloting Systems & Services

2.2.1 Introduction

3   This section addresses selected issues and opportunities for balloting systems and services,
4   which the VSTF believes are the most important to consider in any next-generation elections
5   administration and voting systems platform. Where possible, this section makes tactical
6   recommendations that can be applied to the current system(s) in place. The majority of this
7   material, however, focuses on recommendations to guide the defining of requirements and
8   specifications for any future voting system acquisition to enhance, extend, or replace what
9   San Francisco currently has deployed.

10   "Balloting systems and services" as used in this Report refers to those technologies employed
11   for the following uses of secret ballots in a public election: (1) producing ballots prior to an
12   election or on-demand during an election; (2) delivering a ballot to a voter, either in person or
13   remotely for absentee voters; (3) marking a ballot, whether manually marking a paper ballot,
14   digitally marking an electronic ballot, or using digital means to indicate ballot choices that are
15   then represented on a printed ballot; (4) presenting a ballot to be counted, whether remotely or
16   in-person, or presented physically or digitally; and (5) the actual counting of ballots.

17   The "secret ballot" is used here in recognition that it has been traditionally a term of art within
18   the elections administration community. However, it is important to balance the access to and
19   verifiability of election records (including ballots) with the need to maintain voter privacy. The
20   principal quality of the U.S. election system that guarantees this privacy is perhaps best
21   described more constructively as "ballot anonymity" rather than "ballot secrecy." Ballot
22   anonymity means that voters cannot provably be associated with their vote data. It does not mean
23   that ballots should be kept secret after casting. Incidental recognition of a ballot image or a vote
24   pattern by the voter is probably unavoidable without closing off access in an irrevocable manner.
25   Even so, there are means available to reduce the likelihood that personal identities will be
26   associated with otherwise anonymous records.

27   Ballot anonymity should be recognized as an essential part of any existing or future voting
28   system. There is concern that coercion and vote buying/selling might occur when specific ballots
29   can be linked to specific voters. (See recent cases of vote buying and selling in Kentucky for an
30   example.)[36] This danger, however, should not be over interpreted in a way that leads to the loss
31   of necessary transparency in the counting of ballots or the verification of counts. At the same
32   time, it is important to consider dangers inherent in selective access to election records (e.g. for
33   officials only).

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[36]See http://www.kentucky.com/2010/11/03/1506063/voting-going-smoothly-across-kentucky.html.

2.2.2 Concepts and Definitions

- **Direct-Record Election device (DRE):** a computer-based device that presents a ballot as a series of ballot items; accepts voter selection(s) for each ballot item; provides navigation, help, confirmation and other UI functions; records an electronic ballot that comprises all of a voter's ballot item selections. Some DREs include a voter-verified paper audit trail (VVPAT).

- **Remote Digital Voting:** is a voting method in which marked ballot data is digitally transmitted from voter to election officials, either with or without a paper trail.

- **Uniformed and Overseas Civilian Absentee Voter Act (UOCAVA):**[37] an act of the U.S. Congress that places requirements on states' conduct of elections to include measures to enhance access by (a) military or civilian voters not residing in the U.S. or (b) military voters on service away from their locality of voter registration.

- **Vote By Mail (VBM):** a voting method by which a blank ballot and voter affidavit are sent via postal service to an absentee voter, who is expected to complete both documents and return them via postal or express service, packaged in such a way that the affidavit can be viewed without viewing the marked ballot. Jurisdictions employ a wide variety of methods for packaging, for information required on affidavits, and for validation (if any) of the affidavit sometimes including a signature.

- **Voter-Verified Paper Audit Trail (VVPAT):** a paper-based component of a DRE. Some DREs print a VVPAT for a voter to view and independently verify before casting an electronic ballot. Such VVPATs are removed from view after casts; in some jurisdictions, VVPATs are used for hand-count audits of DRE counts.

A **Ballot Marking Device (BMD)** presents a ballot as a series of ballot items; accepts voter selection(s) for each ballot item; provides navigation, help, confirmation and other user interface functions; records the voter's selections by printing a paper ballot that the voter can cast in the same manner as paper ballots that were marked by hand. Some BMDs print only selection marks (e.g. bubbles) on pre-printed ballots; other BMDs print a complete ballot on a blank sheet(s) of paper.

The **Central Count Optical Scan device (CCOS)** incorporates digital image capture and digital image processing techniques to acquire an image of each sheet of a deck of paper ballots, identify voter marks on the ballot, and interpret each mark as a choice for a particular contest's candidate or choice. The votes from each scanned and counted ballot are tallied to produce vote totals from the set of ballots scanned during a single run of the device. Some CCOS devices retain ballot images and/or individual records of each counted ballot. Some CCOS devices reject ballots with ambiguous marks, while others provide a user interface for election officials to interpret the voter's intent and indicate how an ambiguous mark should be realized and recorded as a vote or non-vote.

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[37]Uniformed and Overseas Civilian Absentee Voter Act; http://web.archive.org/web/20080126231627/http://www.fvap.gov/laws/uocavalaw.html.

1 The **Precinct Count Optical Scan device (PCOS)** is similar to a CCOS device, except that a
2 PCOS device works on individual paper ballots rather than a deck of ballots, and the intervention
3 for ambiguous ballots is to offer the voter (presumed to be present while the ballot is scanned
4 and counted) options to re-try with a new or updated ballot, or to proceed with counting despite
5 ambiguous marks that might result in some of the voter's votes not being counted.

6 An agency of the U.S. Federal government, **Federal Election Assistance Commission (EAC)**
7 was created by the Help America Vote Act (HAVA) of 2002[38] with the task of assisting state and
8 local election administration organizations in improving their capability to conduct U.S.
9 government elections. The EAC primarily funds state and local election administration
10 organizations, but it also awards research contracts for investigation of election-related matters.
11 The EAC has funded the replacement of voting systems for much of the country, notably
12 including voting systems that meet HAVA mandates for accessibility.

13 The **Federal Write-In Absentee Ballot (FWAB)** is a paper form that UOCAVA voters may use
14 (a) to fill out an absentee voter affidavit, and (b) to write a list of ballot items and the voter's
15 choice for that ballot item. Use of an FWAB requires that the voter have independent knowledge
16 of the items on the ballot that the voter is entitled to vote. If a voter makes errors in following the
17 instructions for the affidavit, including the State-specific requirements, then local election
18 officials may choose not to count the voter's ballot.

19 **DRE Double Commit** refers to a DRE function that creates a risk for disenfranchisement. With
20 some DREs, when a voter casts a ballot, the voter is prompted to confirm that they are finished
21 voting, and then prompted a second time to commit and cast the electronic ballot. The
22 disenfranchisement risk arises in practice because voters sometimes leave the polling place after
23 the first confirmation, but without responding to the prompt for the second confirmation. At that
24 point, the DRE will eventually time-out the voter session and not cast or count the ballot; also,
25 until that time, poll workers have the opportunity to cast the ballot, either as is, or with
26 modifications to the voter's selections.

27 ## 2.2.3 Findings

28 ## 2.2.3.1 Ballot Accessibility and Availability

29 The current state of ballot accessibility and availability issues apply distinctly to three categories
30 of voters:

31 - **Local In-person Voter:** Voter and ballot information is provided by postal distribution
32 and Web publication of personalized sample ballots that are close facsimiles of the actual
33 paper ballots.
34

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[38]Federal Election Commission, "Help America Vote Act of 2002"; http://www.fec.gov/hava/law_ext.txt.

1   • **Uniformed and Overseas Voter:** Voter and ballot information as well as the official
2   vote-by-mail blank ballot with an associated attestation document are made available by
3   postal distribution at least and digital means at best to be compliant with Federal MOVE
4   Act regulations.[39]

5   • **Other Absentee Voters:** Voter and ballot information as well as the official vote-by-
6   mail blank ballot with an associated attestation document are provided by postal
7   distribution. Applications materials for absentee voter status are available by Web
8   download for preparation and return via postal service or in-person delivery. Special
9   needs voters are able to obtain assistance in ballot marking and casting only if they are
10   physically able to make it to a public polling place. These voters' only option is to rely on
11   paper vote-by-mail ballot if they are able.

12   **Finding 1:** Voter and ballot accessibility and availability are tailored to different types of
13   voters' needs, but there are still areas that could be improved when voters need assistance
14   completing a ballot (e.g. special-needs voters using vote-by-mail ballots).

15   ## 2.2.3.1.1 DRE Devices for Special-Needs Voter Ballot Casting

16   In addition to those issues discussed above, there are issues pertaining to accessibility and
17   usability of the ballot itself.[40] These devices do not produce a durable paper ballot of record
18   equivalent to ballots provided to non-DRE voters. For special-needs voters utilizing DRE-based
19   ballot casting services, there is an increased risk of loss of anonymity via a voter-sequence-
20   correlation privacy exposure. This exposure arises in a scenario where most voters cast a paper
21   ballot—and DREs are typically only used by special-needs voters—in small numbers.[41] Poll
22   workers are capable of recalling or recording by name the sequence of special-needs voters
23   and then communicating that information to staff members who have access to VVPATs or
24   time-stamped audit logs and who can then determine how each DRE voter voted.

25   Even when the number of DRE voters is not small, privacy exposure can occur in other ways—
26   especially during primaries and other elections with multiple ballot-styles used in a single polling
27   place. The privacy violation risk for the special-needs voter is one example of the importance of
28   the principle that all voters cast a ballot in the same manner, so the ballots of some voters are not
29   erroneously segregated, creating a risk for ballot attribution. This principle supports the use of
30   BMDs so that voters can choose to mark manually or digitally, but the ballot is cast and counted

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[39]California Secretary of State Debra Bowen government website (28 January 2010).
Memo regarding "Military and Overseas Voter Empowerment Act";
http://www.sos.ca.gov/elections/ccrov/pdf/2010/january/10042cbm.pdf.
[40]See Noel Runyan and Jim Tobias (26 July 2007), "Accessibility Review Report for California Top-to-
Bottom Voting Systems Review"; http://www.sos.ca.gov/voting-systems/oversight/ttbr/accessibility-
review-report-california-ttb-absolute-final-version16.pdf.
[41]Note: For example, if a few hundred people in a polling place vote on paper and PCOS, and a handful of
special-needs voters use a DRE, then poll workers know that the handful of special-needs voters cast that
handful of votes. Or, if one person is the only one to vote for a particular party, then poll workers would
know who cast that single ballot. However, when BMDs are used (as discussed elsewhere in this Section),
voters can choose to mark manually or digitally, but the ballot is cast and counted in the same manner
regardless.

1   the same manner regardless. The advantage of a BMD over a DRE is that a paper ballot is
2   produced for counting, audit, and verification purposes.

3   **Finding 2:** DRE devices incur a risk of loss of voter anonymity.

4   **Finding 3:** A BMD could provide a record for each ballot.

5   **2.2.3.1.2 Physical Durability of VVPAT Ballots**

6   DRE-voters are disadvantaged in audits or recounts due to the less durable nature of a VVPAT
7   ballot compared to standard paper ballots. Moreover, VVPAT rolls of paper are difficult to count
8   in the case of manual recounts and full recounts.[42]

9   Three usability limitations should be addressed:

10   1. The need exists to verify instruction text meets EAC guidelines[43] for plain-language and
11   moderate-level literacy accessibility.
12   2. The need exists to verify visual aids exist in instruction text.
13   3. There is likelihood that ballot layout does not meet guidelines of EAC-funded AIGA[44]
14   best practices in ballot design.

15   **Finding 4:** VVPAT ballots have questionable limitations in design and physical
16   makeup.

17 **2.2.3.1.3 Other Supportive Rationale**

18 The VSTF also located three areas where improvements in the system could be beneficial to
19 voters.

20 The State of California historically asserted compliance to the MOVE Act, which is a 45-day
21 advance availability provision by postal distribution means of absentee voter materials for
22 UOCAVA voters. Nevertheless, exploring opportunities to make these materials more readily
23 available by digital means pursuant to the MOVE Act could better serve U.S. overseas and
24 military voters.

25 Special-needs voters tend to be disenfranchised should their individual situation prevent their
26 ability to travel to a polling place to cast their ballot. Mobile accessible balloting services could
27 provide these voters with a more accessible means to vote.

28 As an equal protection principle, consistent enfranchisement depends on consistent ballot format
29 and ballot counting procedures. This principle is not currently met in practice because some
30 voters have their votes counted from paper ballots while other voters have their votes counted
31 relying on VVPAT devices. Therefore, aspiring to a single ballot design, layout, and presentation
32 for the ballot of record can achieve the long-term recommendation.

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[42]For example, see the VVPAT section on this page: http://www.countedascast.com/issues/audits.php.
[43]EAC guidelines, last accessed on June 23, 2011;
http://www.eac.gov/testing_and_certification/voluntary_voting_system_guidelines.aspx.
[44]See generally: http://www.aiga.org/content.cfm/election-project.

1   **Finding 5:** U.S. overseas and military voters could be better served with a digital means
2   of receiving election information and a blank ballot.

3   **Finding 6:** Special-needs voters could benefit from mobile accessible balloting services.

4   **Finding 7:** Consistent ballot format and counting procedures can help to maintain voter
5   enfranchisement.

6   2.2.3.2 Ballot Marking and Casting

7   The current state of ballot marking and casting can be divided into three methods of voting:
8   in-person; remote; and use of the Federal Write-in Absentee Ballot (FWAB).[45]

9   **In-person voting** involves the casting and counting of ballots in person in polling places using
10   two methods: (a) precinct optical scan of hand marked ballots, and (b) use of DRE devices for
11   digital casting and counting. In addition to the these methods, some voters are required to vote
12   provisionally by casting a hand-marked paper ballot that is not counted in the polling place but
13   may be counted centrally, if approved by election officials. San Francisco also employs central
14   count optical scan for vote-by-mail ballots and provisional ballots that have been approved by
15   elections officials.

16   There is significant controversy regarding the security risks of **remote voting**. It is well settled
17   that marking ballots in an uncontrolled environment is vulnerable to fraud and coercion—mostly
18   during transportation (of ballot from voter to election officials) wherein marked ballots are
19   subject to risks that are not present in ballots marked in a controlled environment.

20   Similarly, in discussing **remote digital voting**, it is well settled that all forms of remote digital
21   voting also share these vulnerabilities, although there is significant controversy regarding scope
22   and scale of the security risks of each form of remote digital voting, as compared with non-
23   digital remote voting. Among the risks specific to remote digital voting are insider technical
24   threat and Internet accessibility of remote digital voting systems to adversaries. Insider technical
25   threat is the expansion of the scope of trusted insiders to include IT operations staff charged with
26   managing remote digital voting systems, as well as anyone who is able to obtain IT operations
27   privileges. Internet accessibility is a necessary consequence of using public networks for
28   communication between remote voters and local election officials; anyone anywhere with
29   Internet access has the ability to target remote digital voting systems in order to carry out the
30   same type of Internet-based attacks that have succeeded against several organizations with
31   security expertise that far exceeds that of any voting system vendor or election jurisdiction—
32   including Google,[46] Adobe, RSA Security,[47] and dozens of other large corporations. With the
33   digital-specific risks, both ballot anonymity and ballot integrity are at risk in many ways that are
34   not applicable to ballots marked in a controlled environment with controlled transportation to
35   election offices facilities.

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[45]Federal Voting Assistance program website; http://www.fvap.gov/FWAB/fwab-ca.html.
[46] Zetter, Kim (14 January 2010), "Google Hack Attack Was Ultra Sophisticated, New Details Show,"
Wired; http://www.wired.com/threatlevel/2010/01/operation-aurora.
[47]Zetter, Kim (7 June 2011), "RSA Agrees to Replace Security Tokens After Admitting Compromise,"
Wired; http://www.wired.com/threatlevel/2011/06/rsa-replaces-securid-tokens/.

1   An interesting example was the Okaloosa Distance Balloting Pilot,[48] which used a combination
2   of early-voting center operations, kiosk-style Internet voting in controlled environment, and
3   paper ballot-like voter-verified paper records used for auditing the Internet voting tallies. More
4   recent proposals for digital-enabled kiosk voting have included methods that do not rely on
5   Internet voting techniques. In any event, the concepts of controlled environment and a verifiable
6   paper trail and audit trails have emerged as the top issues wherein any remote voting solution is
7   contemplated.[49, 50]

8   These issues were highlighted in the Okaloosa report that noted the system is vulnerable to attack
9   by trusted insiders (such as election officials behaving maliciously). Defending against such
10 attacks can be challenging in any voting system. In Scytl's system, Voter Choice Records are
11 pivotal to this defense. Manual counts of the Voter Choice Records, as well as procedural
12 controls on insider access to the system before and during an election, are the only way we have
13 identified to secure the system against insider threats. We also note that an EAC report reported
14 irregularities in the post-election audit of the Voter Choice Records.[51] There are a number of
15 open issues to be resolved, including but not limited to scalability, transparency, and independent
16 testing.

17 **Federal Write-In Absentee Ballot (FWAB)** is a method that is approved by a process similar to
18 vote-by-mail process, but it requires manual intervention for counting purposes.

19   **Finding 8:** Although all voting methods must be carefully monitored to prevent
20   malicious or negligent events, the use of remote digital voting—especially the digital
21   return of voted electronic ballots with no audited paper ballots—is far too insecure in
22   public elections application for the foreseeable future.

23 **2.2.3.2.1 Other Supportive Rationale**

24 There are several ways to ensure all voters have equal protection and enfranchisement. A single
25 kind of ballot and a single method of counting can be supported along with support for
26 accessibility. As mentioned earlier in this section, a BMD ensures two principles: (a) special-
27 needs voters obtain automated assistance in ballot marking; and (b) all voters have a paper ballot
28 that is consistently counted in the same manner. Ballot image retention can also be used for
29 improved audit and verification. Moreover, CCOS logging capability can provide improved
30 accountability, audit, and verification.

31   **Finding 9:** The use a single type of ballot, BMDs, image retention, and CCOS logging
32   can equally protect and enfranchise all voters.

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[48]Okaloosa Distance Balloting Pilot, last accessed on June 23, 2011; http://election.dos.state.fl.us/voting-systems/pdf/ODBPplanJune_19.pdf.
[49]See http://www.operationbravo.org/documents/NASS%20VP%20Briefing.pdf.
[50]See http://election.dos.state.fl.us/voting-systems/pdf/ODBPplanJune_19.pdf.
[51]See http://www.eac.gov/assets/1/AssetManager/Martha%20Mahoney%20-%20Comment%20on%20Pilot%20Project%20Testing%20and%20Certification.pdf.

2.2.4 Recommendations

2.2.4.1 Ballot Accessibility and Availability

2.2.4.1.1 Near-Term Recommendations

To improve ballot accessibility and availability in the near future, the VSTF offers the following recommendations:

1. Support provisions of the Federal MOVE Act regulations for digital blank ballot distribution.
2. For special-needs San Francisco-based voters who are physically unable to cast their ballot in a polling place, experiment with mobile accessible ballot marking and printing services.
3. Promote the opportunity for San Francisco voters to access voting information online, including sample ballots.
4. Adopt a stronger privacy-enhancing procedure that requires a larger minimum number of voters using the DRE machines in order to reduce the risk of ballot attribution.[52] Enhance poll worker training to stress this procedure and the need to comply with it. Measure compliance, and publish compliance findings, based on polling-place records of number of checked in voters and number of DRE voters.
5. Create, train, and enforce a requirement that the accessible voting system be set up and working (according to specific criteria communicated in poll worker training) before the polling place is opened for general voting at the start of the Election Day.

2.2.4.1.2 Longer-Term Recommendations

We recommend these long-term actions:

6. Extend the intent of the California Election Code Section 15360[53] by requiring the ballot of record be specifically a paper record of uniform style, layout, and presentation consistent with its hand-marked counterpart instead of a paper artifact fulfilled by VVPAT devices.
7. Use paper ballot layout practices and/or tools that follow the EAC guidelines on visual design and plain language, and deliver these benefits to all voters.
8. Rather than providing polling-place disabled access via DREs, instead provide access via the combination of (a) ballot-marking devices for enhanced access to the ballot, and (b) use of the same precinct-count casting method used by voters without special needs. In addition to removing a ballot anonymity threat of DREs, this approach would have additional benefits: lacking the so-called "double-commit issue" of DREs; providing for a digital count for audit purposes; and adhering to the EAC guidelines on visual design and plain language.

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[52]See Footnote 41.
[53]California Legislative Counsel government website, "Election Code Section 15360"; http://www.leginfo.ca.gov/cgi-bin/displaycode?section=elec&group=15001-16000&file=15360.

2.2.4.2 Ballot Marking and Casting

2.2.4.2.1 Longer-Term Recommendations

9. The official "ballot of record" should be a paper **artifact** in uniform design, layout, and presentation consistent with its hand-marked counterpart, in order to enable a consistent method of counting, audit, and verification as well as to ensure a consistent method of ballot anonymity.

10. Enhanced access to ballots should be provided by non-tabulating ballot marking devices rather than tabulating DREs.

11. All in-person voters should have the options of either marking paper ballots by hand, or via the use of a ballot-marking device.[54]

12. Encourage voters who use BMDs to review their printed ballots before casting.

13. All optical scanning devices should retain a good-resolution scanned image of each ballot, together with a complete cast-vote record for auditing support.

14. CCOS devices should provide a user interface for election officials to interpret ambiguous ballots as needed—with full logging of every interpretation—and that said logs should be publicly available.

15. If not done so already, provide data to track cases of UOCAVA voters receiving absentee voting materials, but not having a ballot arrive in time to be counted.

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[54]Note: In California, the voters do have the choice of using paper ballots or DREs with VVPATS. However, as a policy matter, the use of DREs is discouraged since all votes cast on a DRE with VVPAT must be counted by hand.

2.3 Security

2.3.1 Introduction

3 Elections security is vital to protect each voter's rights and assure the integrity of election data.
4 Security throughout the election cycle—including use of the voting systems—must be
5 implemented with procedures. Equally important is the security of the voting system's design,
6 engineering, and manufacture—all elements are fundamental in garnering the trust voters must
7 have in the system they are using to cast and count their ballots. Essentially, each voter relies on
8 the soundness of the security of the voting procedures and the use and design of the system to
9 ensure his or her vote is counted. If not, the integrity of elections and the jurisdictions that
10 manage them can be compromised.

11 Steps must be taken to build and maintain the voter's trust that (a) the digital chain of custody
12 has not been broken and (b) no event has occurred that might affect the integrity of the election
13 data. Unfortunately, for both physical ballots and the voting system, there are opportunities for
14 fraud or error. The VSTF has scrutinized the issue of security and has determined
15 recommendations that may lead to safer and more secure elections.

2.3.2 Concepts and Definitions

17 When considering voting system security, the vulnerabilities throughout its use in the election
18 cycle must be examined. The following are major parts of the end-to-end election process that
19 must be considered in system and procedural security:

20 • **Cryptography:** protecting data from theft or alteration by transforming it (encrypting it)
21 into an unreadable format, called cipher text that requires a secret key to decipher (or
22 decrypt) the data back into plain text

23 • **Ballot Definition:** the description of the ballot for ballot cards and for the digital vote
24 records

25 • **Logic and Accuracy (L&A) Testing:** pre-election testing of voting system elements and
26 devices to assure that cast votes will be properly recorded in the voting system

27 • **Vote Capture:** the point at which the voter's intent becomes a digital record, which will
28 ultimately be aggregated with other votes to determine the election result

29 • **Vote Transmission:** the movement of electronic data to an electronic/digital data store so
30 that all votes for San Francisco can be read by a computer that tabulates the election
31 results

32 • **Vote Tabulation:** the tallying of ballots to determine the result for each election contest

33 For paper ballots, the precinct- or central-ballot **optical scanner device** (e.g. Sequoia Eagle and
34 400C, respectively) translates the marked, paper ballot to a digital record of the vote. When a
35 **direct recording electronic device** (e.g. Sequoia Edge DRE) is used, the digital vote record is
36 created by touching the devices screen to cast a vote that also produces the voter verifiable paper
37 audit trail (VVPAT). In advance of use for an election, all of these machines undergo a L&A test
38 and recalibrated or repaired as needed to assure they are fit for use in the election.

1   Data can be **sneaker netted** (downloading data to a device that is physically transported to
2   another location and connected to another device for data upload) or may be transmitted
3   electronically over a network. In San Francisco, the data recorded by the precinct optical scanner
4   and the precinct DRE (Sequoia Eagle and Edge respectively) is saved to a removable memory
5   pack that is transported from the precinct to the election center for upload to the central election
6   data store. San Francisco processes vote-by-mail ballots and validated provisional ballots at the
7   election center with a large, fast optical scanning machine (Sequoia 400C) that transmits data to
8   the central data store over a private computer/data network of CCSF.

9   For contests that are determined by a plurality, this is a matter of summing of the votes to
10   determine passage of a measure or winner of a race. For **Ranked-Choice Voting (RCV)**—when
11   there is no one candidate who received 50% +1 vote as a first choice—computer algorithms are
12   then used to eliminate candidates and redistribute votes where needed for the voter's second- or
13   third-choice candidate.[55]

14   2.3.3 Findings

15   Without proper system security, handling of physical ballots can be open to fraud and error;
16   however, malicious manipulation or negligent management of an electronic version of ballot data
17   can be executed in greater volume, be more precise in intended impact, and be harder to detect.
18   Thus, the level of security in voting systems is essential to assuring an accurate, correct election
19   outcome and in garnering public trust in the election outcome. Effective procedural measures
20   must be implemented throughout the election process to bolster security and to detect issues. A
21   voting system that is designed with security—which is integrated into all of its elements
22   (hardware, software, firmware, data, and network)—that supports effective security procedures
23   will improve voter confidence in the system and election outcome. A system that is designed in
24   concert with effective security procedure can reduce the cost of manual procedures required for
25   security assurance of a system that has poor system security.

26   Generally, the focus of voting system security is on preventing malicious or negligent events that
27   cause corrupt or inaccurate voting data or otherwise disrupt the ability for a jurisdiction to obtain
28   an accurate election result from its election system. Unfortunately, the jurisdiction conducting an
29   election cannot rely solely on preventive security measures because a completely invulnerable
30   system is impossible to construct. Thus, the review and audit of the election and system
31   information are essential procedures in (a) providing the assurance that security measures were
32   successful or (b) determining that events had transpired that somehow compromised the system.
33   Only with this step is the security regimen complete.

34   **Finding 1:** Security must be considered in every feature of a voting system to ensure
35   voter confidence.

36   **Finding 2:** A voting system that is designed to be highly secure and designed in concert
37   with security procedures can reduce the cost of security assurance.

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[55]See "Section 2: Election Records and Post-Election Audit Procedures" for a more detailed definition of RCVs.

2.3.3.1 San Francisco's Current Voting System: Existing Security Issues and Mitigation

2.3.3.1.1 San Francisco's Procurement Action and Voting System Security Concerns

In 2002, the Federal government mandated a modernization of voting systems with the enactment of the Help America Vote Act (HAVA); funds were allocated for implementation of this mandate.[56] HAVA was timely law for San Francisco, which needed to replace an aging voting system for which its maintenance contract was about to expire. As detailed in the Introduction of this report, San Francisco issued a Request for Proposal (RFP)[57] for the procurement of a new voting system in May 2005. The RFP consisted of an Introduction and 15 appendices that totaled 197 pages. Appendix E "Design, Fabrication and Performance Requirements" (25 pages) contains all requirements, including security. This was not due to disinterest on the part of San Francisco or its Department. of Elections (DOE) on the importance of security, but it does reflect the reliance on the vendor and other agencies to detect and correct security flaws.

The systems that could be implemented to satisfy HAVA requirements and were certified for both Federal and California elections were few. Only two vendors responded to the San Francisco's RFP: Sequoia Voting Systems and ES&S. Public objections to the vendors—which were primarily rooted in transparency and security concerns—stalled execution of the contract for 15 months. However, because no other certified voting systems were available and no viable alternatives were emerging, San Francisco proceeded with the Sequoia procurement. From the standpoint of DOE, this was the prudent course of action: (a) it would bring the DOE into compliance with Federal law, and (b) it would serve its operational needs. Any additional consideration of security was unnecessary and superfluous to fulfillment of its legal obligations under HAVA and support to its operational mission.

2.3.3.1.2 Top-to-Bottom Review

In January 2007, Debra Bowen was sworn in as the California Secretary of State (CA SoS); on that day, she reiterated her campaign promise to assure transparency in the voting systems used in California.[58] She created a project known at the "Top-to-Bottom Review" (TTBR)[59] of the voting systems certified for use in California. The TTBR consisted of a review of software, accessibility, documentation, and a security evaluation. It eventually evidenced many security issues within California's voting systems, including the Sequoia system procured by San Francisco. Security issues were found with all systems that were tested, but we here focus on the Sequoia System used in San Francisco to provide some relevant and insightful specifics on

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[56]Federal Election Commission, "Help America Vote Act of 2002," http://www.fec.gov/hava/law_ext.txt.
[57]City and County of San Francisco government website, "RFP," (VSTF page, Appendix E) http://www.sfgov2.org/index.aspx?page=1869.
[58]California Secretary of State Debra Bowen government website, "Secretary of State Debra Bowen, Inaugural Speech" (Monday, January 8, 2007); http://www.sos.ca.gov/bowen_event/inaugural_speech.pdf.
[59]California Secretary of State Debra Bowen government website, "Top-to-Bottom Review"; http://www.sos.ca.gov/voting-systems/oversight/top-to-bottom-review.htm.

1 security flaws of existing voting systems. The "Source Code Review of the Sequoia Voting
2 System" of the TTBR's Executive Summary[60] pinpointed serious security issues concerning data
3 integrity, cryptography, access control, and software engineering.

4 *2.3.3.1.2.1 Data Integrity Flaws*

5 The review discussed how the Sequoia system "lacked effective safeguards against corrupted or
6 malicious data" that was injected into removable media. This was a particular issue with the
7 devices used by polls workers and other temporary staff with limited authority.

8 **Finding 3:** The Sequoia voting system's lacked effective safeguards against corrupted or
9 malicious data into removable data recording media.

10 *2.3.3.1.2.2 Cryptography Problems*

11 The review also stated that many of the security features of the Sequoia system—particularly
12 "those that protect the integrity of the precinct results"—employed cryptography. Every case that
13 the TTBR examined proved how simple it was to circumvent the cryptography. As the review
14 explained, many cryptography functions are not implemented correctly, are based on weak and
15 flawed algorithms, or are used in an ineffective or insecure manner. Because of these issues,
16 "virtually all cryptographic key material is permanently hardcoded into the system" and identical
17 in all of the hardware that was shipped off to other jurisdictions. In short, a person who is able to
18 hack into a similar hardware—within or outside of California—can then extract and obtain the
19 secret cryptographic key that were initially created to protect elections throughout every
20 California county that employs that system.

21 **Finding 4:** Sequoia's cryptography was poorly implemented, hard coded into the system,
22 and identical in all of the Sequoia systems used throughout California.

23 *2.3.3.1.2.3 Access Control and Security Mechanisms Issues*

24 The TTBR also discovered issues with access control and other computer security
25 mechanisms that were easily circumvented—despite being designed to protect against
26 "unauthorized use of central vote counting computers and polling place equipment." The
27 WinEDS back-up system was designed to be used for ballot preparation, voting machine
28 configuration, absentee ballot processing, and post-election vote counting. However, its
29 security features and audit logs were found to be ineffective against "inside attackers"
30 who may try to gain access to the WinEDS computers or the network to which these
31 computers are attached.

32 **Finding 5:** The security features and audit logs of the WinEDS back-up system
33 could have been easily comprised by insiders.

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[60]Blaze, Matt, Arel Cordero, Sophie Engle, Chris Karlof, Naveen Sastry, Micah Sherr, Till Stegers, and
Ka-Ping Yee (2007). "Source Code Review of the Sequoia Voting System," p. 2 (report, University of
California, Berkeley under contract to the California Secretary of State's TTBR);
http://www.sos.ca.gov/voting-systems/oversight/ttbr/sequoia-source-public-jul26.pdf.

2.3.3.1.2.4 Software Engineering Weaknesses

1

2 The software engineering of the Sequoia voting system was also found at fault by the
3 TTBR. According to the review, the software contained numerous programming errors,
4 many of which had the "high potential to introduce or exacerbate security weaknesses."
5 Basically, the software did not reflect "defensive software engineering practices normally
6 associated with high-assurance critical systems." The review also pointed out that there
7 were many examples of poor or absent error and exception handling and that there were
8 also many cases where the software behavior did not match its corresponding comments
9 and documentation. Some of the problems were the root of the many of the issues the
10 review identified, and even the problems discovered in the software that were not specific
11 to "an obvious vulnerability identified," the number of errors reduced the review's
12 "overall confidence in the soundness of the system as a whole."

13 **Finding 6:** The software for the Sequoia voting system contained serious
14 programming errors that reduced the overall trust in the reliability of the voting
15 system.

2.3.3.1.2.5 "Red Team" Security Testing

16

17 The CA SoS's security group "acted as a 'Red Team' [penetration testers] and performed a series
18 of security tests of both the hardware and the software,"[61] concluding that—although there was
19 not sufficient time to perform a complete evaluation of the Sequoia voting system—the number
20 of serious security issues that were exposed was cause for concern. Essentially, a determined
21 hacker could modify or invalidate the results of an election. The review impressed that several
22 types of attacks could be launched without any knowledge of the source code. In fact, the Red
23 Team was able to analyze the Edge's firmware binary representation and extend the firmware by
24 using binary patching. This technique allowed them to create a "'debugging' version of the
25 firmware, as well as several different 'malicious' versions"; again, access to the source code to
26 implement these attacks was not necessary.

27 **Finding 7:** Access to the source code was not necessary to attack the hardware and
28 software of the voting system.

29 **Finding 8:** Public concern over DOE's procurement of the Sequoia Voting Systems was
30 not unfounded.

31

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[61]Computer Security Group (2007). "Security Evaluation of the Sequoia Voting System Public Report,"
Dept. of Computer Science, University of California, Santa Barbara; http://www.sos.ca.gov/voting-
systems/oversight/ttbr/red-sequoia.pdf.

1   **2.3.3.1.3 Security Mitigations Measures Required for Use of the Sequoia Voting System**

2   As a result of the TTBR's findings, on 25 October 2007 SoS Bowen issued the "Withdrawal of
3   Approval of Sequoia Voting Systems, Inc."[62] (updated version issued 1 October 2009)—a
4   document that also provides the requirements needed for re-approval of the system. The result
5   was the generation of the "Optech Insight, AVC Edge 5.0, & Optech 400C California
6   Procedures,"[63] deemed the "Sequoia 4.0 Approved Use Procedures" that allowed conditional
7   re-approval of the system and—with implementation of these procedures—the use of the system
8   in San Francisco.

9   San Francisco and Sequoia have implemented the mitigation plans approved by the CA SoS. San
10   Francisco DOE maintains a Voting System Security Plan[64] that addresses policies, practices, and
11   procedures for voting system security and that addresses specific requirements for continued
12   approval for use of Sequoia by the California Secretary of State.

13   **Finding 9:** The public interest would be served by raising awareness of (a) the Sequoia
14   system vulnerabilities identified in the TTBR, (b) the mitigation measures prescribed by
15   the CA SoS, and (c) the procedures that implement these measures in San Francisco.

16   **2.3.3.2 Current Voting System Security Posture**

17   Based on optical scanning of paper ballots, the fundamental security posture of San Francisco's
18   existing counting methods consists of (1) implementing practices, policies and procedures to
19   meet legal requirements for security, and (2) validation of machine counts by conducting partial
20   hand counts of the vote a technology independent manner as required by California Election
21   Law. The security practices and requirements include reducing or eliminating exposure to attack
22   points such as connections to wireless devices or the Internet as well as using tamper-evident
23   seals, signature checks, and other chain-of-custody procedures that increase the chances of
24   detecting errors or tampering.

25   "Technology independent" validation (as the phrase applies in this section of the Report) means
26   that vote counts and election results are not produced by the sole reliance on the potentially
27   fallible software and hardware of a voting system, but instead they are produced by a
28   combination of the following:

29   1. Machine count of virtually 100 percent[65] of paper ballots

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[62]California Secretary of State Debra Bowen government website, "Withdrawal of Approval of Sequoia
Voting Systems, Inc., WinEDS v 3.1.012/AVC Edge/Insight/Optech 400-C DRE & Optical Scan Voting
System And Conditional Re-approval of Use of Sequoia Voting Systems, Inc., WinEDS v 3.1.012/AVC
Edge/Insight/Optech 400-C DRE & Optical Scan Voting System (December 31, 2009 Revision);
http://www.sos.ca.gov/voting-systems/vendors/sequoia/sequoia-31012-revision-1209.pdf.
[63]Optech Insight (August 2008), "AVC Edge 5.0, & Optech 400C California Procedures," (document
version 3.03); http://www.sos.ca.gov/voting-systems/vendors/use-procedures/sequoia-use-procedures.pdf.
[64]City and County of San Francisco government website, "VSTF Voting System Security Plan";
http://www.sfgov2.org/ftp/uploadedfiles/VotingSystemsTaskForce/VotingSystemSecurityPlan.pdf.
[65]Note: If Federal Write-in Absentee Ballots (FWAB) are cast, they must be hand counted.

1   2. Audit of the machine counts via hand-count of a randomly selected subset of the
2   machine-counted ballots[66]

3 The audit procedure is intended to detect discrepancies in the vote count as tabulated by the
4 voting system versus a hand count of the ballot of record. This procedure should audit a
5 statistically significant sample relative to the number of races and voters, and it should provide a
6 threshold to expand the scope of the audit in the event that significant variances are detected.

7 As already discussed with respect to security, the audit approach is a forensic method for
8 "detection of errors" and could only discover exploitation of security vulnerabilities with
9 secondary investigation. "Prevention of errors" by exploitation of security vulnerabilities means
10 seeking to create a secure or trustworthy system. However, a perfectly secure system is an
11 impossible goal because all software is potentially fallible.

12   **Finding 10:** Basic, prudent security measures are already in practice including but not
13   limited to (a) keeping voting systems components disconnected from public networks,
14   and (b) checking the integrity of device firmware and/or software on voting systems
15   components through pre-election L&A tests.

16 ## 2.3.3.3 Security for San Francisco's Future Voting Systems

17 ### 2.3.3.3.1 Comprehensive Voting System Security Examination Not Attempted by VSTF

18 The VSTF did not attempt a comprehensive examination of information security as it applies to
19 voting systems. The threefold reasoning for this became clear during the course of our research:

20   1. The state of the voting systems industry is bleak: only two major vendors remain,
21   controlling some 87% of U.S. voting systems in use, with a few smaller vendors serving
22   small pockets of opportunity.
23   2. Voting technology experts concur that future voting systems design will require a
24   wholesale change in the technology model as well as testing and certification methods
25   and requirements for Federal certification in order for these systems to increase accuracy,
26   transparency, verification, security, and, above all, the voters' trust.
27   3. The prospective fourth version of the NIST/US EAC Voluntary Voting System
28   Guidelines (VVSG)—which provides the most extensive set of voting system
29   requirements, including both specifications and procedures for security—was expected to
30   be released in 2009, but it has yet to be adopted in a final form.

31   **Finding 11:** The VSTF found with regard to voting systems security considerations that a
32   more focused study by more qualified security experts is necessary.

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[66]Note: Precinct cast ballots on the Sequoia Edge Direct Recording Electronic (aka DRE) device do not produce a paper record that is machine read. Instead, the vote data is recorded directly to the memory pack that is then transported to a central location and loaded into the main tabulator along with the memory pack from the Sequoia Eagle Optical Scan device. The DRE does produce a paper tape record of the voter's selection by contest (Voter Verified Paper Audit Trail, aka VVPAT). This paper tape record can be used for audit purposes.

2.3.4 Recommendations

2.3.4.1 Security Mitigations Measures Required for Use of the Sequoia Voting System

Accordingly, this Report recommends increased transparency of and communication about San Francisco's implementation of the CA SoS's-mandated mitigations. Specifically the City should create an online resource to complement voter information resources that describe the current system, features, and functions, complete with a walk-through of the steps taken to comply with the CA SoS mandates for the current voting system.

2.3.4.2 Near- to Mid-term Recommendations

Beyond the immediate security concerns specific to San Francisco's current voting system, there are also broader concerns about information security of voting systems. The Report's near- to mid-term recommendations are that San Francisco should increase (a) public awareness and education of the security posture of computer-based vote counting, and (b) transparency of operations with regard to this posture.

2.3.4.3 The Current Voting System Security Posture

Many basic security posture measures are specified as TTBR mitigations, L&A testing practices, and post-election operations reviews. With that in mind, in the interim period between the current state of San Francisco's voting system and any future system to be acquired, the Report advocates the following recommendations:

1. San Francisco should further public trust by increasing communication of the basic points of the security posture and, in particular, by impressing upon the voter that—
   a. The creation of a perfectly secure voting system software is impossible;
   b. Manual audits can provide assurance of a clean and accurate election, thus minimizing the voters' focus on the correctness and integrity of software.
2. San Francisco should continue to maintain the existing practices of L&A testing and TTBR mitigation.
3. San Francisco should increase the operational transparency and adequacy thresholds of statistical audit practices to include the following:
   a. Greater information on and availability of audit results;
   b. Voter education about auditing and results through online resources that complement existing voter information services.

San Francisco should consider various options for increasing the scope of audits beyond the minimum requirements of California Election Law. (See Section 2.1: Election Records and Post-Election Audit Procedures for further discussion and recommendations on this topic.)

2.3.4.4 Security for San Francisco's Future Voting Systems

Accordingly, this Report's overarching recommendation with regard to voting system security is that San Francisco collaborate with or create a new, highly qualified, agile team of 4-6 computer systems scientists to develop a set of guidelines for security aspects of any future voting system to be acquired.

For a procured system, these guidelines should comprise new security requirements to be incorporated into any future RFPs to be responded to by any provider of voting systems to San Francisco. Should San Francisco proceed with a decision to make a system to their requirements, these guidelines should be further developed to become requirements that are incorporated into overall systems design.

This new "Security Guidelines Team" could be a new Task Force or simply collaboration with both academia and computer industry professionals outside of the voting systems industry on a consultative basis. It is crucial, though, that these team members have demonstrated domain expertise in elections technology and related information security matters.[67]

2.3.4.5 Longer-Term Recommendations

Aside from assembling a team of digital security experts to develop RFP guidelines for future voting systems, this Report suggests several features that can support increased voting systems security and elections process integrity (many of which are discussed elsewhere in this Report):

4. Assuring a system that allows for hand marking and machine-assisted creation of marked paper ballots of like media versus providing VVPAT for ballots cast by voters with requirements for enhanced access

5. Continuing the use of precinct-count optical scan for in-person cast ballots and central-count optical scan for absentee and provisional ballots

6. Providing digital images of each counted ballot, with a cast-vote record for each that would be made available for examination

7. Establishing strong protections to assure that all actions that change or update the system are known and that only approved software and hardware are implemented and used in an election with documented, approved change management procedures during an update and deployment of the system

    a. Voting system capabilities for strong authentication, access, and logging of system events and operator actions with notification and audit procedures that assure only authorized access and approved actions were taken in any part of the system

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[67]Note: By way of example, but not limitation, three example sources of domain experts include: (a) the California Institute of Technology and Massachusetts Institute of Technology joint project known as the CalTech/MIT Voting Project (see http://vote.caltech.edu/drupal/); (b) ACCURATE: A Center for Correct, Usable, Reliable, Auditable, and Transparent Elections, the organization involved with the TTBR (see http://accurate-voting.org/); and (c) The OSDV Foundation's TrustTheVote Project (see http://www.osdv.org and http://www.trustthevote.org).

1   b. Logging that should involve actions executed with respect to the system hardware and
2   software and election data, including any change to vote records, such as resolution of
3   under-votes, over-votes, and identification and recording of write-ins

4 8. Utilizing election management system features and reporting system features for
5   publication of ballot definition data and vote count data as recorded by counting devices.

6 9. Using common data formats to facilitate publication of such data mentioned above

7 10. Establishing features related to voting system verification loops, testing practices, and
8   transparency of records of such practices, including (but not limited to) the following:

9   a. Straightforward and easily repeatable measures for testing software integrity of voting
10   system components

11   b. Election management system features and reporting system features for recording and
12   publishing both components of and results of L&A testing (e.g. test decks and test-
13   count results)

14 11. Providing a well-documented system that can be maintained and operated with
15   commonly and widely available skill sets (versus vendor dependence that is due to
16   proprietary elements and non-disclosure of system technology)

17 12. Maintaining transparency throughout the system hardware, firmware and software
18   life-cycle including system design, engineering, and manufacture as well as data formats,
19   encryption and communications protocols, and network security requirements

20 13. Having the ability to validate only authorized software used to execute the election in the
21   system

22 These capabilities and features should also be considerations of the proposed Security Guidelines
23 Team for when those team members prepare a set of security guidelines for future RFP and
24 competitive vendor bidding.

25

2.4 Ranked-Choice Voting

2.4.1 Introduction

Ranked-Choice Voting has been the law in San Francisco since 2002. In March of that year, San Franciscans passed Proposition A,[68] amending the City Charter to make Instant-Runoff Voting (IRV)—commonly referred to as Ranked-Choice Voting (RCV)—the method of electing Mayor, Sheriff, District Attorney, City Attorney, Treasurer, Assessor-Recorder, Public Defender, and members of the Board of Supervisors. This was codified in the San Francisco Charter as Article XIII, Section 13.102.[69] Federal and California State provisional certifications of the required changes to San Francisco's then current Elections Systems and Software (ES&S) voting system were obtained by April 2004, and this method was first used in November 2004 to elect seven supervisors.[70] RCV has also been implemented by more than a dozen other U.S. cities—including three in the Bay Area (Berkeley, Oakland, and San Leandro)—and some States for military and overseas voters; it is also in use in a number of other countries.[71,72]

RCV is existing law in San Francisco. While there remains public debate about RCV as a voting method, the VSTF has assumed its use in San Francisco as a given, and thus we have limited its examination to certain aspects of RCV implementation in San Francisco that relate to voting systems and public understanding of the election process.

2.4.2 Concepts and Definitions

- **Ranked-Choice Voting (RCV):** allows the voter to make multiple selections in a single race in an order of preference. As currently implemented in San Francisco, voters are allowed to vote for three choices among the candidates in an RCV race in a ranked order of first choice, second choice, and third choice.

- **RCV Algorithm:** determines the RCV winner by tabulating votes in a series of rounds. The first round of tabulation counts votes for the first choices in a race. If the top vote getting candidate also has a majority of the votes, that candidate is declared the winner. If no candidate has a majority, then the candidate with the fewest first-choice votes is eliminated from the race. A new round of vote tabulation is then performed in which each vote that had counted for an eliminated candidate is transferred to that ballot's most preferred candidate who remains in the race and the votes are again tallied to see if the top vote getting candidate has a majority of votes. If so, that candidate is declared the

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[68]For complete text of Proposition A, see http://www.smartvoter.org/2002/03/05/ca/sf/prop/A/.
[69]For complete text of Section 13.102—Instant Runoff Elections, see http://library.municode.com/index.aspx?clientId=14130&stateId=5&stateName=California.
[70]Fair Vote: The Center for Voting and Democracy website, "San Francisco Successfully Uses Ranked Choice Voting for Citywide Elections, Nov. 2005"; http://www.sfrcv.com.
[71]Fair Vote The Center for Voting and Democracy, "Where Instant Runoff Is Used"; http://www.fairvote.org/where-instant-runoff-is-used.
[72]*Wikipedia*, s.v. "Instant-runoff voting, Global Use," last modified 12 June 2011; http://en.wikipedia.org/wiki/Instant-runoff_voting#Global_use.

winner. If not, subsequent rounds of elimination and transfer are performed until a winner
is determined.

- **Continuing and Exhausted Ballots**: A ballot is "continuing" if after a round of
  elimination the ballot has valid marked choices for a candidate who remains in the race.
  A ballot is "exhausted" if after an elimination round the ballot does not have marked
  choices for a candidate who remains in the race.

2.4.3 Findings

2.4.3.1 Public Understanding of RCV

In San Francisco's November 2010 elections there were contests for five County Supervisor
seats that were RCV races as called for in the City Charter. In two of these contests, District 2
and 10, the ultimate winner did not receive the most first-choice votes and thus were not the front
runners in the first RCV round. This also happened in Oakland's mayoral RCV race. All of these
races were competitive and close. District 10 race was perhaps most exceptional. There were 21
candidates listed on the ballot. In a race where nearly 17,808 ballots were cast, there was only a
181 vote spread between the top five first-choice vote getting candidates. The winning candidate
had placed third when first-choice votes were tallied in the first RCV round.

Since the November 2010 election cycle various sources—press accounts as well as statements
from candidates and other organizations—have scrutinized the RCV elections process and
outcome. Some are positive stating that RCV worked as expected and proved its benefits while
others are critical claiming the method is undemocratic, or that RCV delivers surprise outcomes
that voters do not understand.[73]

The San Francisco Department of Elections (DOE) is required by the City Charter Article XIII
Section 13.102(g) to "conduct a voter education campaign to familiarize voters with the ranked-
choice...method of voting." The DOE developed a training plan in advance of the first RCV
election in November of 2004.[74] This has been a significant effort that produced hard copy and
on-line educational materials on the RCV voting method and over 700 outreach events
coordinated with 11 community-based organizations.[75] A study conducted by San Francisco
State University after the November 2004 election concluded that 87% of voters understood

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[73]The following is an article that is representative of various perspectives: Zusha Elinson and Gerry Shih
(11 November 2010), "The Winning Strategy in Oakland: Concentrate on Being 2nd or 3rd Choice";
http://www.nytimes.com/2010/11/12/us/politics/12bcvoting.html.
[74]Department of Elections Ranked Choice Voting Public Education Plan November 2, 2004 Consolidated
General Election,
http://politicalreform.newamerica.net/files/San%20Francisco%20Dept%20of%20Elections%20RCV%20
Education%20Outreach%20Plan.pdf.
[75]California Secretary of State Debra Bowen government website, "Implementation of Ranked-Choice
Voting: The City and County of San Francisco: November 2, 2004 Municipal Election" (p. 4);
http://www.sos.ca.gov/voting-systems/vendors/ess/rcv-final-report.pdf.

1 RCV "fairly well" or "perfectly well."[76] Though this indicates a high degree of understanding of
2 the process among most voters, that 13 % of voters had a lower understanding of the voting
3 system is significant; this group tended to be (1) lower income, minority voters and
4 (2) those who have a lower incidence of voting. In a considerably less exhaustive but more
5 recent study by the San Francisco Chamber of Commerce "55 percent of voters say they are
6 unsure whether or not their vote is counted if their first, second and third choice candidates are
7 eliminated."[77]

8 The voter education materials do still exist and can be found on the DOE's website. The level of
9 outreach and educational activity on RCV has not been at the levels they were in 2004.

10   **Finding 1:** Public understanding of the RCV election process may have declined since
11   the initial RCV education campaign starting in 2004.

2.4.3.2 Reporting Preliminary Early Election Results

13 Once votes are cast and captured in the election system as data, they are gathered into the
14 central database to determine the election outcome. For RCV races, the software and algorithms
15 for tabulating the election result are more complex than for elections where the outcome is
16 determined by simply summing the votes of the choices on the ballot. This may contribute to a
17 perception of some voters that they do not understand how RCV works. On the other hand,
18 computerization of the election process has made it easier to frequently produce preliminary
19 election results, and San Francisco DOE has set a very high standard for its frequency of
20 publishing preliminary election results. The DOE's schedule of results reporting for the
21 2 November 2010 election was the following:[78]

22 • **Election Night:** Preliminary results for early return, pre-processed vote-by-mail ballots
23   and precinct-counted ballots. The first preliminary results are reported approximately 45
24   minutes after the close of polls, and updates are reported approximately every half-hour
25   to an hour until midnight. For RCV contests, only first-choice totals are reported.

26 • **Subsequent Days:** Every day in which new votes are processed, the Department will
27   release updated results until all ballots have been counted and the results are certified.

28 • **Preliminary Ranked-Choice Results:** Release of preliminary results represent how
29   ranked-choice voting plays out on only the votes counted to date. The first of these
30   preliminary RCV results are released on the Friday after Election Day.

31

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[76]Public Research Institute website (December 2004), "An Assessment of Ranked-Choice Voting in the San Francisco 2004 Election: Preliminary Report" (p. 9); http://pri.sfsu.edu/reports/SFSU-PRI%20Ranked%20Choice%20Voting%20Preliminary%20Report.pdf.
[77]San Francisco Chamber of Commerce (February 2011), "2011 City Beat Poll Results"; http://www.sfchamber.com/2011CityBeatPoll/2011pollresults.pdf.
[78]City and County of San Francisco Department of Elections (November 2010), "Schedule of Results Reporting for November 2, 2010 Consolidated General Election"; http://www.sfelections.org/ec/?m=201011.

1 Release of results with this frequency is a good practice for transparency. However transparency
2 is reduced by not reporting the preliminary results with the full RCV algorithm applied,
3 involving eliminations and transfers and the detail cast vote records on election night or with
4 every daily update. It should be noted that in San Francisco's first RCV election in November
5 2004, the DOE had planned to produce a "preliminary and initial RCV Algorithm report the day
6 after the election at 4:00 p.m. as well as up to three times a week until results were final."[79]
7 However, during the first attempt to apply "the RCV algorithm, ES&S [the voting system
8 vendor] realized the system was not tabulating all of the processed ballots and could not produce
9 complete preliminary RCV results."[80] ES&S attributed the issue to a software limitation which
10 was removed and by "that Friday, ES&S isolated and removed this particular limitation on the
11 software."[81] DOE has continued to adhere to this practice of producing the first result with the
12 full RCV algorithm on the Friday after the election with the Sequoia voting system.

13 As seen in November 2010 RCV contests, second and third choices have a significant effect on
14 the outcome of an RCV contest. Not producing results with the full algorithm applied could
15 contribute to a perception on the part of the public that they do not understand RCV. Timely
16 disclosure of preliminary results with the full RCV algorithm applied will improve transparency
17 and give the public a better understanding of the ultimate election result. It is also important for
18 public monitoring of elections. Full reporting of RCV results avoids reliance on potentially
19 misleading vote totals based only on first choices.

20 Finally, a substantial area of findings and recommendations in this report is in Election Records
21 and Post-Election Audit Procedures (see Section 2.1). Early release of election results with a
22 fully run RCV algorithm is complementary to improved audit procedures.

23   **Finding 2:** The Department of Elections has a good practice of frequently releasing
24   preliminary vote counts, but it does not apply RCV algorithms at each release. And this
25   may contribute to a perception of lack of understanding and/or transparency in the RCV
26   election process.

27 ## 2.4.3.3 Three-Choice Limit

28 San Francisco Charter Section 13.102(b)[82] states that:

29   The ballot shall allow voters to rank a number of choices in order of preference equal to
30   the total number of candidates for each office;

31

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[79]California Secretary of State Debra Bowen government website, "Implementation of Ranked-Choice Voting: The City and County of San Francisco: November 2, 2004 Municipal Election" (p. 8); http://www.sos.ca.gov/voting-systems/vendors/ess/rcv-final-report.pdf.
[80]Ibid, p. 8.
[81]Ibid, p. 8.
[82]San Francisco, Calif., Charter, Article XIII, Section 13.102(b).

1 It is clear that the intent is to allow the voter to be afforded the opportunity to rank all candidates
2 in a race, but the same passage goes on to state:

3 ...provided, however, if the voting system, vote tabulation system or similar or related
4 equipment used by the City and County cannot feasibly accommodate choices equal to
5 the total number of candidates running for each office, then the Director of Elections may
6 limit the number of choices a voter may rank to no fewer than three.

7 Thus, three choices is the minimum allowed, but this limitation should only be imposed if the
8 voting system is not able to accommodate more choices. San Francisco has been using RCV with
9 this minimum level of capability due to San Francisco's Sequoia voting system limitations.

10 However, the law says the voter should be able to rank all candidates for good reasons: the
11 three-choice limit imposed by the voting system limits voters full expression. In a recent court
12 decision, the U.S. 9th Circuit Court of Appeals concluded:

13 If aspects of the City's restricted IRV scheme...impose any burdens on the voters' rights
14 to vote, they are minimal at best. Moreover, the City has advanced valid, sufficiently-
15 important interests to justify using the system.[83]

16 So although San Francisco's current implementation of RCV does not violate the voters'
17 constitutional rights, "restricted IRV" does limit the voter's ability to fully express their choices
18 in an RCV election. In the case that voters would want to express more than three choices in an
19 RCV election and that the ballot and voting system could accommodate those choices (which is
20 the clear intent of Section 13.102[b] of the City Charter), the ability of voters to fully express
21 those choices could materially affect the outcome of an RCV election.

22 The November 2010 District 10 Supervisor election is an instructive example. In this race 17,808
23 valid ballots were processed in the first RCV round. The top five candidates were separated by
24 only 181 first-choice votes. The winner was finally determined in the 20th RCV round, winning
25 by only 442 votes of the 8200 continuing ballots.[84] By the 20th round, 4977 ballots (28%) were
26 exhausted with less than 3 valid choices; however, 4631 ballots[85] (26%) were exhausted with
27 three valid choices. It is highly conceivable that enough of the 4631 voters whose ballots were
28 exhausted due to the 3-choice limit would have wanted to express more than 3 choices, and—
29 given the spread of votes throughout the RCV elimination rounds—this expression could very
30 well have changed the outcome of the election.

31 **Finding 3:** San Francisco's Charter states that voters should be able to rank a number of
32 choices in order of preference equal to the total number of candidates in an RCV race but
33 may be limited to as few as 3 choices should it be infeasible, which it currently is due to

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[83]U.S. Courts for the 9th Circuit government website, "Court of Appeals: Dudum v. Arntz, No 10-17198,
May 20, 2011" (p. 32); http://www.ca9.uscourts.gov/datastore/opinions/2011/05/20/10-17198.pdf.
[84]City and County of San Francisco Department of Elections website, "Official Ranked-Choice Results
Report, November 2, 2010: Consolidated Statewide Direct Primary Election Board of Supervisors,
District 10"; http://sfelections.org/results/20101102/data/d10.html.
[85]City and County of San Francisco government website, "Department of Elections, San Francisco 2010
District 10: Table of Involuntarily Exhausted Ballots" (pdf file produced by David Cary for the VSTF);
http://www.sfgov2.org/Modules/ShowDocument.aspx?documentid=461.

1   San Francisco's existing Sequoia voting system. This "restricted IRV" has been
2   determined not to be a violation of a voter's constitutional right to vote. It does, however,
3   impair the ability of the voter to fully express their preferences for candidates and such
4   full expression of choices could change the outcome of RCV elections.

2.4.4 Recommendations

2.4.4.1 Public Understanding of RCV

7   1. San Francisco should reenergize its voter outreach and education efforts on RCV to better
8   assure that voters have a good understanding of how votes are to be cast and counted.
9   The Board of Supervisors should work with the Department of Elections to identify
10   options and resources for renewed education efforts as soon as possible—preferably in
11   advance of the November 2011 RCV elections. DOE has good, existing materials, and
12   social networking sites such as Facebook and You Tube could offer an opportunity for
13   low cost, high impact outreach. The VSTF encourages the Supervisors themselves to
14   assist in public outreach to individuals and organizations in their districts.

2.4.4.2 Reporting Preliminary Early Election Results

16   2. Continue to release preliminary results for RCV contests as frequently as they are
17   released for non-RCV contests. Include the full RCV algorithm and the supporting detail
18   cast vote records (aka "ballot images") as part of preliminary results.
19   3. Implement Recommendation 2 to the extent feasible with the current system. Make this
20   capability a requirement for any system to be acquired by San Francisco in the future.
21   4. Assure that RCV public awareness, outreach, and education includes the information on
22   what interim result reporting information is available as well as how to access it and use
23   it to track and understand the RCV election process and results.

2.4.4.3 Three-Choice Limit

25   5. Explore the possibility of increasing the number of choices with the existing Sequoia
26   voting system. Make the ability to rank more than three choices a strong preference for
27   any future voting system to be acquired by San Francisco with a preference for a system
28   that will allow the voter to rank all candidates in a race.
29

2.5 Acquisition Strategies

2.5.1 Introduction

This section considers the voting systems "marketplace," including the state and federal regulatory/certification environment, economic considerations, and models for acquiring or developing a next generation system. It examines obstacles to innovation as well as potential partnership approaches that could break through existing barriers. It examines legal licensing options, including (1) proprietary, (2) disclosed, and (3) open source software and hardware approaches. It also puts forth software best practices that should be adopted regardless of the development strategy selected.

2.5.2. Concepts and Definitions

Public domain license: the class of license that is not limited by copyright and therefore essentially has no single owner to grant licenses. Since the work is not protected by copyright, it can be used, modified, and distributed by anyone without limitation.

Open source software: a range of concepts—such as software development practices—along with licensing rules. In this document we are using the Open Source Initiative (OSI) definition[86] of open source software; our focus is on licensing.

Disclosed source license: in this document, refers to a license that gives the licensee permission to review all source code—including that of firm-ware—and the ability to share all source code with other parties. All requestors should be able to run the code for testing purposes. No one should be restricted from publishing his/her findings. The code, however, can have a proprietary license that would restrict some rights; for example, the copyright owners could require a fee to run the code in production.

2.5.3 Findings

2.5.3.1 Regulatory/Certification Environment

The existing regulatory environment offers significant barriers to innovation. The certification process is shifting and cumbersome; it is extremely costly and time-consuming to bring a voting system through existing regulatory channels.

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[86]Note: For the complete OSI definition for "open source software" that the VSTF is using, see http://opensource.org/docs/osd.

1 The State of California requires both state certification and federal certification by the U.S.
2 Elections Assistance Commission (EAC) before a direct-record election device (DRE) can be
3 used by a jurisdiction.[87] Testing is done by voting system test laboratories, which are labs
4 accredited by the EAC.[88]

5 In the federal certification process, any modification to a voting system requires a re-testing of
6 the entire system, even if the change is to an isolated part of the system. Therefore, even a small
7 change to a voting system (such as a fix of a software defect) requires a very significant
8 investment to achieve re-certification under the federal process. Estimates on the cost of federal
9 certification vary; however, most estimates are in the range of $3-4 million dollars. Only six
10 voting systems have been certified by the EAC. Congress is currently considering a proposal to
11 dissolve the EAC, further contributing to lack of certainty about the future regulatory
12 environment.

13 The following are some of the requirements for a new voting system to be certified by the
14 Secretary of State in California:[89]

15 • Review of the application and documentation of the system
16 • End-to-end functional examination and testing of the system
17 • Volume testing under election-like conditions of the system and/or all voting devices
18   with which the voter directly interacts
19 • Security testing that includes a full source code review and penetration (red-team) testing
20   of the system
21 • Accessibility examination and testing of the system
22 • Public hearing and public comment period

23 The VSTF interviewed several Bay Area registrars as part of its research for this report, and all
24 identified the regulatory process as a significant barrier to innovation/expansion of the
25 marketplace.

26 **Finding 1:** The existing regulatory environment creates obstacles to innovation in voting
27 systems.

28 ## 2.5.3.2 Business and Partnership Models

29 The voting systems industry today is highly concentrated, and there are many barriers to entry:
30 regulatory/certification barriers (as described in the previous section); a fragmented marketplace
31 with varying systems requirements; and high development costs.

32

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[87]See http://www.sos.ca.gov/voting-systems/cert-and-approval/vsysapproval/vs-conditions.htm.
[88]See http://www.eac.gov/testing_and_certification/testing_and_certification_program.aspx.
[89]California Secretary of State Debra Bowen government website, "Requirements of New Voting
Systems"; http://www.sos.ca.gov/voting-systems/cert-and-approval/vsysapproval/vs-conditions.htm.

1   Currently, the State of California does not have consistent voting systems requirements across its
2   58 counties. Each jurisdiction must initiate an independent process for establishing its needs and
3   must negotiate independently with private vendors to acquire a voting system that satisfies those
4   needs. While it might be preferable for the State of California (i.e. the California Secretary of
5   State) to develop statewide voting systems requirements, no such effort is currently envisioned.

6   Therefore, today the dominant model for implementing elections is for jurisdictions to purchase
7   or lease proprietary voting systems from commercial vendors (see Sample Model A below).
8   While this is currently the prevailing course of action, other models for acquiring a voting system
9   warrant examination. Each possible approach brings a different set of economic and partnership
10   considerations.

11   A range of sample models includes the following:

12   **A. Purchase a Commercial Off-The-Shelf (COTS) Voting System**
13   A jurisdiction purchases a voting system (equipment and services) from a private vendor
14   that funded its development and certification. The code is proprietary and owned by the
15   vendor. San Francisco employs this model with Sequoia Voting Systems.

16   **B. Engineer to Order (Vendor Developed or Self-Developed)**
17   A jurisdiction establishes system requirements and either uses a Request for Proposals
18   (process to select a vendor to build the voting system) or employs a full development
19   team to build the voting system. In either case the jurisdiction owns the system. The
20   voting system may be based on existing software components or may be built entirely
21   from scratch. The jurisdiction funds the costs of development and certification.

22   **C. Public Partnership**
23   Jurisdictions with similar systems and regulatory requirements partner and share
24   resources to build and maintain a voting system. The jurisdictions pool their resources to
25   fund the costs of development and certification.

26   **D. Public/Private Partnership**
27   A jurisdiction seeks partners that may include academic institutions, non-profits, other
28   government entities, or even private sector technology companies willing to produce
29   non-proprietary components. Based on system requirements, the consortium develops
30   the code and component parts. However, the code is not proprietary and the jurisdiction
31   either owns the code outright or has the ability to make modifications. The potential
32   funding for this model could vary greatly depending on the specific solution, but it could
33   include a combination of money from jurisdictions and from donors/volunteers.

34   There are existing non-profits that are building open source voting systems that are in various
35   stages of readiness for elections. Two such organizations are the Open Voting Consortium
36   (OVC) and Open Source Digital Voting Foundation (OSDV). There are also myriad systems that
37   have been built by individuals and groups at academic institutions. Although many were built for
38   specific research purposes and aren't made to be extended, some have the potential to be the

1   basis for full voting systems. The Caltech/MIT Voting Technology Project[90] is a good source of
2   information on existing systems.

3   Los Angeles County is engaged in a robust effort (the Voting Systems Assessment Project or
4   VSAP) to modernize its voting systems and is considering a variety of models/partnerships
5   (including public/private partnerships) to acquire or develop such a system. Its goal, presented in
6   the VSAP Incremental Plan,[91] is to have a new system in place by the end of 2015. Los Angeles
7   is the largest and most diverse voting jurisdiction in the nation with 4.5 million registered voters.
8   While the outcome of their VSAP is unknown and while San Francisco's needs will differ from
9   those of Los Angeles County, their comprehensive effort has the potential to pioneer new
10 approaches that might bring innovation to this stagnant marketplace.

11 Closer to home, Alameda County shares similar systems requirements with San Francisco,
12 notably Ranked-Choice Voting.

13 It should be noted that, while all of the Bay Area registrars interviewed for this report were open
14 to innovation in the voting systems marketplace, they expressed concern about the complexity of
15 developing future voting systems using new acquisition models and getting them certified via the
16 existing regulatory process.

17   **Finding 2:** While there are barriers to moving away from the dominant model of
18   purchasing a voting system from a private vendor, other acquisition models are possible
19   and are being actively considered by other jurisdictions.

20 ## 2.5.3.3 Transparency, Source-Code Disclosure, Licensing, and Contingency
21 ## Planning

22 Sequoia Voting Systems developed San Francisco's current voting system using the company's
23 proprietary system design and software development methodologies. The source code has been
24 reviewed by some voting experts (through the California Secretary of State's 2007 Top-to-
25 Bottom Review) and regulators, but the majority of the system is not open source and is not
26 available for the general public to inspect. This makes it difficult for voters to establish
27 confidence that the software is free of unknown software defects or design flaws. It is difficult to
28 replace any aspect of the current voting system because the code is neither open source nor
29 designed with clear modules.

30 The ability to review source code and systems design is an essential property of a trustworthy
31 voting system. By giving the public access to the source code of a voting system, there is an
32 increased chance that a defect will be found in a voting system, whether by the election

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[90]CalTech/MIT Voting Technology Project, last accessed on June 23, 2011;
http://vote.caltech.edu/drupal/.
[91]See http://www.lavote.net/General/PDFS/BOARD_CORRESPONDENCE/01272011-054459.pdf.

1 administrator or a member of the public. In his paper, Hall includes ideas for contingency plans
2 to address possible discoveries.[92]

3 **Finding 3:** Public review of source code increases the chance that defects will be
4 identified and addressed.

5 ## 2.5.3.4 Innovation

6 Although many jurisdictions have expressed interest in using alternative voting systems, most
7 have not been able to go beyond researching and reporting on alternatives. Running a county-
8 wide election is very complex, so it can be risky to try out new technologies. Several
9 jurisdictions have tried out innovative solutions by initially testing redundant systems in limited
10 ways in order to independently verify the accuracy of election results from the jurisdiction's
11 proprietary voting systems.

12 Innovation can be done incrementally—it does not require a new elections system to be
13 implemented and can be achieved with innovative processes in addition to technologies. For
14 example, San Francisco is planning to open voting locations on Saturdays in the November 2011
15 election if the cost can be covered by private donations.[93] This is an innovation that has the
16 potential to increase voter turnout without requiring any new technologies.

17 While this section has primarily discussed innovation for a jurisdiction's official results, there are
18 several innovations for independently confirming the results of a jurisdiction's official system.
19 One example is Takoma Park, Maryland, which used an open source system called Scantegrity in
20 a municipal election (e.g. an election with no state or federal races).[94] Another is Humboldt
21 County, California, that has used a project called the Humboldt County Election Transparency
22 Project,[95] discussed in detail in Section 2.1: Election Records and Post-Election Audit.

23 **Finding 4:** Innovation is possible even in conjunction with existing systems, but
24 redundant methods of verifying the election result should be implemented whenever new
25 innovations are tested.

26 ## 2.5.3.5 Software Best Practices

27 There are standard software engineering best practices that have been found to create more
28 reliable, maintainable software irrespective of the precise software development methodology
29 used.[96] These include making sure code has ample unit-tests and is built using well-defined
30 modules. An open source license does not ensure that code is high quality, so it is important to

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[92]Hall, Joseph (2006), "Transparency Access to Source Code in Electronic Voting" (unpublished paper).
http://josephhall.org/papers/jhall_evt06.pdf.
[93]See http://www.sfgov2.org/index.aspx?page=2390 for details.
[94]See http://www.scantegrity.org/takoma/ for details on how Scantegrity was used in Takoma Park, MD.
[95]See http://humtp.com/.
[96]For a comprehensive overview of best practices, see
http://www.ibm.com/developerworks/websphere/library/techarticles/0306_perks/perks2.html.

1   make sure that any voting system under consideration has been built using best practices that
2   have been accepted across the software industry.

3   2.5.4 Recommendations

4   2.5.4.1 Regulatory/Certification Environment

5   1. San Francisco should advocate with the California Secretary of State and the State
6   legislature for a new, comprehensive state certification process to replace the existing
7   requirement for federal certification. The state should aspire to a certification process that
8   is more agile, efficient, and cost effective to enable innovation. The new state
9   certification process should be sound enough to ensure that any new voting system would
10   still meet the minimum federal requirements.

11   2.5.4.2 Business and Partnership Models

12   2. The VSTF supports the stated intention of the San Francisco Department of Elections
13   (DOE) to renew its contract with Sequoia Voting Systems through 2013 with the
14   stipulation that the short-term recommendations contained in this report—particularly
15   concerning auditing—are implemented whenever feasible. We are also open to extending
16   this contract through 2015 if doing so would allow San Francisco to take advantage of
17   new technologies or partnership options that would be available in the middle term as a
18   result of Los Angeles County's VSAP project. DOE should use the intervening period to
19   consider a broad range of possibilities regarding the business and partnership model it
20   will pursue to acquire/develop San Francisco's next voting system, including
21   collaborating with other jurisdictions, academic institutions, or non-profit organizations.
22   3. To leverage its negotiating position, the DOE should consider reaching across the bay to
23   Alameda County, which shares some similar requirements—notably Ranked-Choice
24   Voting.
25   4. The DOE should take current academic research, including research on risk-limiting
26   audits and end-to-end voting, into account to ensure that this work is considered in the
27   selection of the City's next voting system.[97]
28   5. The DOE should closely monitor innovations in the voting systems vendor marketplace
29   to determine if new products that meet the minimum requirements outlined in this report
30   may be available in the required time frame.

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[97]The Caltech/MIT Voting Project (http://vote.caltech.edu/) is a good resource for current academic
research.

2.5.4.3 Transparency, Source Code Disclosure, Licensing, and Contingency Planning

6. The DOE should give strong preference to a voting system licensing structure that gives San Francisco all of the rights provided by an OSI-approved license,[98] even if the system is maintained by an external party.

   If an open source model is used, we recommend that the City of San Francisco work with other jurisdictions and organizations to develop and manage the code-base in order to leverage additional resources and expertise. The City of San Francisco should participate during the requirements gathering stage of development so that its unique requirements can be incorporated into the system design and implementation.

   If circumstances dictate that a solution that provides an OSI-approved license cannot be implemented by the time the contract for the City's current system expires, San Francisco should purchase voting equipment and services from a vendor who will provide a system that moves toward the following goals, irrespective of the other details of the license, so that any member of the public can perform the following tasks:

   - Review the source code of the entire system
   - Run code for testing
   - Distribute changes to code (i.e. documentation on defects and defect fixes can be distributed openly)

7. The DOE should set up a contingency plan in case a defect is found in the source code of the voting system. The contingency plan should include a volunteer committee of experts that can rapidly address any discovered defects and recommend procedures that can address those defects. The committee of experts should include computer scientists with expertise in voting systems and security and members of the DOE with deep knowledge on the voting systems and procedures in San Francisco.

8. San Francisco should be an active participant in the movement toward more open and transparent voting systems. We acknowledge the complexity of moving from the existing marketplace toward more innovative voting systems and urge San Francisco to move steadily toward the goal of transparency—even if it must do so in incremental steps. We encourage the City to be a strong advocate in the private sector marketplace for more transparent systems and to be open as well to new collaborative development models.

2.5.4.4 Innovation

9. It should be the policy of San Francisco to conduct pilot projects of alternative election technologies and procedures in municipal elections. This could initially involve a small number of precincts. These pilot projects would provide opportunities to learn how well alternative approaches work, such as using open source systems and hand counting paper

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[98]For an alphabetical list of OSI-approved licenses, see http://www.opensource.org/licenses/alphabetical.

1 ballots at the polling places. All results of a pilot project should be confirmed using
2 hand-counting.

3 **2.5.4.5 Software Best Practices**

4 10. All voting systems software should be designed and implemented using the following
5 modern, high-quality industry methodologies:

6 a. Peer reviews of source code should be done throughout development of the new
7 voting system.
8 b. All source code should include extensive unit tests.
9 c. The system should be modular in design with open data formats for exchanging data.
10 d. There should be well-documented code, a clear technical architecture, and a detailed
11 database design.
12 e. The system should be delivered with extensive administrative (i.e. election workers)
13 and end-user documentation (e.g. how system will be used by voters, including voters
14 with different accessibility requirements).
15

Section 3: Appendices

3.1 Appendix A: San Francisco's RCV Manual Tally Process

This appendix shows that the RCV manual tally process currently used in San Francisco does not audit the outcome of an election. Consider the following example of an RCV contest with three candidates (A, B, and C) and two precincts (5 ballots in Precinct 1, and 4 ballots in Precinct 2):

Precinct 1

first choice   A A C C C
second choice   B B

Manual precinct tally results:
A has 2 first-choice votes.
B has 2 second-choice votes.
C has 3 first-choice votes.
RCV: C wins in first round (3 to 2).

Precinct 2

first choice   B B B C

Manual precinct tally results:
A has no votes.
B has 3 first-choice votes.
C has 1 first-choice vote.
RCV: B wins in first round (3 to 1).

When all 9 ballots are counted together, no candidate has a majority of first-choice votes. Candidate A is eliminated, transferring 2 votes to Candidate B. In the second round of counting, Candidate B now has a majority (5 out of 9 votes) and wins the election.

Compare this to an alternate scenario with slightly different votes cast:

Precinct 1

first choice   A A C C C
second choice   B B

Manual precinct tally results:
A has 2 first-choice votes.
B has 2 second-choice votes.
C has 3 first-choice votes.
RCV: C wins in first round (3 to 2).

Precinct 2

first choice   B B B C

Manual precinct tally results:
A has no votes.
B has 3 first-choice votes.
C has 1 first-choice vote.
RCV: B wins in first round (3 to 1).

When all 9 ballots are counted together, again no candidate has a majority of first-choice votes, and Candidate A is eliminated. In the second round of counting, Candidate C now has a majority (4 out of 7 votes) and wins the election.

Notice that in both scenarios, manual tallies *within each precinct* produce exactly the same results. The total number of first-choice and second-choice votes for each candidate is the same. The RCV procedure, carried out within each precinct, produces the same result. So, even a 100% manual tally, using the current procedure, cannot distinguish these two scenarios—yet they yield different winners. This demonstrates that the current manual tally procedure does not correctly assure the RCV election outcome.

3.2 Appendix B: Summary of Outreach

In addition to welcoming public comment at its regular public meetings, the Voting Systems Task Force conducted the following research and outreach:

- Roger Donaldson and Jody Sanford met with John Arntz, Director of the Department of Elections for the City and County of San Francisco. (Fall 2009)

- Roger Donaldson, Jim Soper, and Ka-Ping Yee met with Lowell Finley, California Deputy Secretary of State. (9 October 2009)

- VSTF member Roger Donaldson (with Jim Soper) organized and attended a demonstration of the Prime III voting system (http://www.primevotingsystem.com) created by Dr. Juan Gilbert of Clemson University. This system is designed to address accessibility issues of concern to the disabled. (January 2010)

- A public comment period on "Draft VSTF Recommendations Under Consideration" document was held. (February 2010)

- Roger Donaldson (by phone) and Ka-Ping Yee met with San Francisco DOE staff members Nataliya Kuzina and Crispin Tirso on post-election audit procedures. (23 July 2010)

- VSTF members organized and attended a demonstration of the Trachtenberg Election Verification System (http://www.tevsystems.com) at San Francisco City Hall. (15 September 2010)

- Roger Donaldson, Ka-Ping Yee, and Jody Sanford met with Richard Matthews, Commissioner, San Francisco Elections Commission. (November 2010)

- Beth Mazur and Jody Sanford met with Dave MacDonald, Alameda County Registrar/Chief Information Officer. (27 January 2011)

- A public comment period on "Draft Recommendations on Voting Systems for the City and County of San Francisco" document was held. (February/March 2011)

- Beth Mazur and Jody Sanford met with Elaine Ginnold, Marin County Registrar. (1 March 2011)

- Jim Soper and Jody Sanford met with Stephen Weir, Contra Costa Elections Clerk. (22 March 2011)

Section 4: About the VSTF

4.1 Membership of the VSTF

The Voting Systems Task Force has seven members with backgrounds in good government, computer science/software development, and accommodations serving persons with disabilities. Members serve as individuals and represent no other organization or group. The VSTF members are:

Jody Sanford, Chair
Ka-Ping Yee, Vice-Chair
Roger Donaldson
Tim Mayer
Beth Mazur
Gregory Miller
Jim Soper

Further information about the VSTF can be found at www.sfgov.org/vstf.

4.2 Biographies of VSTF Members

Roger Donaldson is currently a senior director at the Oracle Corporation where he has been employed since 1995. He began working on elections integrity and voting systems issues as a monitor with Election Protection during the 2004 Presidential election. He has served in nine San Francisco elections as a precinct inspector and field election deputy working for the San Francisco Department of Elections. He holds a Bachelor's degree in Economics and a Master's degree in Public Administration from the University of Southern California, and a Certificate in Government Contracts Administration from the University of California Los Angeles.

Tim Mayer is CEO of a business services company in San Francisco. He began his voter advocacy work in 2006. He has met with numerous county registrars and various voter advocacy groups, and he attended many government and private research and information meetings. He has observed and participated in precinct and county Election Day activities. Tim has observed several demonstrations of prototypical election systems developed by both for-profit and non-profit organizations. In 2008 he participated in the Open Voting Consortium[99] demonstration of open source/paper ballot printing voting systems developed by, amongst others, VSTF member Ka-Ping Yee.

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[99]See http://www.openvotingconsortium.org/.

1   **Beth Mazur** is a technology consultant with extensive experience in open-source software and
2   product management. She has held consulting and Product Management positions at a variety of
3   software companies and non-profit organizations including Jaspersoft and Grameen Foundation.
4   She has a longstanding interest in the use of technology for the improvement of the U.S. political
5   process. Beth holds a Bachelor's of Science in Computer Science and Electrical Engineering
6   from MIT.

7   **Gregory Miller** is the CEO for the Open Source Digital Voting Foundation. He has 28 years of
8   technical and business experience in development and eventual commercialization of the
9   Internet. He is a trained computer scientist with graduate business education and a law degree
10   focused on intellectual property, technology law, and public policy. He is also active in the
11   American Bar Association addressing technology law and public policy issues—including
12   Cyberlaw, Information Privacy & Security, and Internet Governance. Greg is a member of the
13   Congressional Internet Caucus Advisory Committee and a sustaining member of the Internet
14   Society.

15   **Jody Sanford** served on the Board of the League of Women Voters of San Francisco from 2004
16   to 2009 and was its president from 2005 to 2007. She is a communications manager with the
17   Presidio Trust, the agency leading the transformation of the Presidio of San Francisco from a
18   military post to an innovative urban national park.

19   **Jim Soper** is a senior software consultant and the author of CountedAsCast.com. He is a
20   co-chair of the Voting Systems Task Force in Alameda County, California, and a member of the
21   California Election Protection Network's steering committee. Jim has been active in
22   programming since the 1980s and in election integrity issues since 2005.

23   **Ka-Ping Yee** received his Ph.D. in Computer Science at University of California, Berkeley, for
24   research in usability, security, and electronic voting. He served as a source code reviewer on the
25   California Secretary of State Debra Bowen's "Top-to-Bottom Review of Voting Systems" in
26   2007. His dissertation, "Building Reliable Voting Machine Software,"[100] examines issues of
27   security and verifiability, and proposes simplification as the path toward high-assurance voting
28   machines. Ka-Ping joined Google.org as a software engineer in 2008.

29   *This Report was edited by Lisa McFarren, www.mcfarrenwritingandediting.com.*

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[100]See http://zesty.ca/voting.

Senate Bill No. 360

CHAPTER 602

An act to amend Section 19100 of, to amend the heading of Article 1 (commencing with Section 19200) of Chapter 3 of Division 19 of, to amend the headings of Chapter 3 (commencing with Section 19200) and Chapter 3.5 (commencing with Section 19260) of Division 19 of, to amend the heading of Division 19 (commencing with Section 19001) of, to amend and renumber Sections 19103, 19200.5, 19202, 19203, 19204, 19207, 19209, 19210, 19211, 19212, 19212.5, 19213, 19214, 19214.5, 19215, 19216, 19217, 19220, 19221, 19222, 19223, 19225, 19226, 19227, 19227.5, 19228, 19229, 19229.5, 19230, 19231, 19232, 19233, 19234, 19234.5, 19235, 19236, 19237, 19238, 19239, 19240, 19241, 19242, 19243, 19244, 19245, 19250, 19251, 19252, 19253, 19254, 19255, 19260, 19261, 19262, 19263, 19264, 19267, 19269, 19270, 19271, 19272, 19273, 19274, and 19275 of, to amend and renumber the headings of Article 2 (commencing with Section 19220), Article 2.5 (commencing with Section 19225), Article 3 (commencing with Section 19230), and Article 4 (commencing with Section 19250) of Chapter 3 of Division 19 of, to amend, renumber, and add Sections 19101, 19102, and 19201 of, to add Sections 19006, 19282, 19283, and 19286 to, to add Article 2 (commencing with Section 19220) to Chapter 3 of Division 19 of, to repeal Sections 19205, 19208, 19265, 19266, and 19268 of, and to repeal and add Section 19206 of, the Elections Code, relating to voting systems.

LEGISLATIVE COUNSEL'S DIGEST

SB 360, Padilla. Certification of voting systems.

(1) Existing law establishes various procedures and criteria for the approval by the Secretary of State of voting systems, including ballot marking systems, to be used in elections.

This bill would recast and revise those provisions by changing the term "approval" to the term "certification" and would authorize the Secretary of State to certify, conditionally approve, as specified, or withhold approval of a voting system. The bill would provide that it is the intent of the Legislature that a local jurisdiction be authorized to use available public funds to research and develop a nonproprietary voting system, as specified, for use in a pilot program or for submission to the Secretary of State, and that the Secretary of State certify all voting systems before they are used in future elections, adopt and publish testing standards, and encourage the development of voting systems that are easy to audit. The bill would require the Secretary of State to adopt and publish voting system standards and

regulations, as specified, and would require the Secretary of State to study the performance of the voting systems in use in the state.

This bill would additionally require the Secretary of State to publish requirements for the approval of state-approved testing agencies, as defined, that are authorized to conduct the testing and examination of voting systems and to approve and publish a list of authorized testing agencies. The bill also would provide that the person, corporation, or public agency applying for certification of a voting system is responsible for all costs associated with the testing of the voting system.

(2) Existing law prohibits the use of a voting system unless it has received the approval of the Secretary of State, as specified.

This bill would provide that a voting system that has been tested and approved for use in all elections by the Secretary of State before January 1, 2014, would be deemed to be certified or conditionally approved by the Secretary of State and would be authorized for use in elections, as specified. The bill would authorize a vendor or county that has submitted a voting system for federal qualification before August 1, 2013, to request approval of the voting system from the Secretary of State, as specified. The bill also would prohibit a jurisdiction from purchasing or contracting for a voting system unless the voting system has been certified or conditionally approved by the Secretary of State, except as specified. The bill would further authorize the Secretary of State to grant conditional approval to a voting system or part of a voting system under specified circumstances.

(3) Existing law provides that a person or corporation owning or being interested in a voting system or a part of a voting system may apply to the Secretary of State to examine it and report on its accuracy and efficiency to fulfill its purpose. As part of its application, existing law requires the vendor of a voting system or the part of a voting system to notify the Secretary of State in writing of any known defect, fault, or failure of the version of the hardware, software, or firmware of the voting system or a part of the voting system submitted, and the Secretary of State is required to notify the United States Election Assistance Commission or its successor entity of the problem as soon as practicable so as to present a reasonably complete description of the problem, as specified.

This bill would delete the requirement that the Secretary of State notify the United States Election Assistance Commission or its successor entity of any known defect, fault, or failure of the version of the hardware, software, or firmware of the voting system or a part of the voting system submitted by the applicant.

(4) Existing law requires the Secretary of State to provide for a 30-day public review period and conduct a public hearing prior to publishing his or her decision to certify, conditionally approve, or withhold certification of a voting system, part of a voting system, or a ballot marking system. Under existing law, the Secretary of State is required to transmit notice of the hearing at least 30 days prior to the public review period and hearing, as specified.

This bill would instead require the Secretary of State to transmit notice of the hearing at least 14 days prior to the public review period and hearing.

(5) Within 30 days after completing the examination of any voting system, existing law requires the Secretary of State to file a report stating whether the voting system can safely be used, as specified.

This bill would instead require the Secretary of State to file a report within 60 days after the completion of the examination of the voting system, as specified.

(6) Existing law authorizes a governing board to adopt any kind of voting system, any combination of voting systems, or any combination of a voting system and paper ballots for use at elections, as specified. Provisions of existing law authorize the use of the voting systems at any or all elections held in any county, city, or any of their political subdivisions for voting, registering, and counting votes cast, and prohibit candidates for a single office from being split between voting systems or between a voting system and paper ballots.

This bill would delete those provisions.

(7) Existing law authorizes a governing board to provide for the experimental use of a voting system in one or more precincts without formally adopting the system and provides that the experimental use of the system at the election is valid for all purposes as if it were lawfully adopted.

This bill would authorize a governing board to conduct a pilot program for the experimental use of voting systems, as specified, and would require the Secretary of State to adopt and publish regulations governing voting system pilot programs. No later than 9 months before the election at which a pilot program is proposed to be conducted, the bill would require the governing board to submit to the Secretary of State a plan for the proposed pilot program, and would require the Secretary of State to approve or reject the plan within 3 months of receipt of the plan. The bill would require votes cast on a voting system during a pilot program, as specified, to be subject to risk-limiting audits, as defined. Upon completion of the pilot program, the bill would require the governing board to notify the Secretary of State in writing of any defect, fault, or failure in the hardware, software, or firmware of the voting system.

(8) Upon examination of a voting system or a ballot marking system, existing law provides that if a report is issued that states that the voting system or ballot marking system can be used, it is deemed approved by the Secretary of State for use at elections.

This bill would delete the above provision and would make conforming changes.

(9) The Voting Modernization Bond Act of 2002 authorizes the issuance of bonds in the amount of $200,000,000 pursuant to the State General Obligation Bond Law for the purpose of assisting counties in the purchase of updated voting systems.

This bill would authorize a county to use fund moneys to contract and pay for research and development of a new voting system that has not been certified or conditionally approved by the Secretary of State, as specified,

and for the manufacture of the minimum number of voting system units, as specified.

(10) Existing law prohibits the Secretary of State, on and after January 1, 2005, from approving a direct recording electronic voting system unless the system has received federal qualification and includes an accessible voter verified paper audit trail.

This bill would prohibit a city or county from contracting for or purchasing a direct recording electronic voting system unless the system has been certified by the Secretary of State, and would require all direct recording electronic voting systems in use as of January 1, 2006, to have received federal qualification and include an accessible voter verified paper audit trail, as specified.

This bill would incorporate additional changes to be operative only if Assembly Bill 214 and this bill are both chaptered and become effective January 1, 2014.

The people of the State of California do enact as follows:

SECTION 1. The heading of Division 19 (commencing with Section 19001) of the Elections Code is amended to read:

DIVISION 19. CERTIFICATION OF VOTING SYSTEMS

SEC. 2. Section 19006 is added to the Elections Code, to read:

19006. It is the intent of the Legislature that:

(a) All voting systems be certified or conditionally approved by the Secretary of State, independent of voluntary federal qualification or certification, before they are used in future elections to ensure that the voting systems have the ability to meet accuracy, accessibility, and security standards.

(b) The Secretary of State adopt and publish testing standards that meet or exceed federal voluntary standards set by the United States Election Assistance Commission or its successor agency.

(c) The Secretary of State study and encourage the development of voting systems that use nonproprietary source code and that are easy to audit.

(d) A local jurisdiction may use available public funds to purchase and maintain any certified or conditionally approved voting system or part of a voting system.

(e) California receive the benefits of the publicly funded development of a nonproprietary voting system in the state.

(f) A local jurisdiction may use available public funds to research and develop a nonproprietary voting system that uses disclosed source codes, including the manufacture of a limited number of voting system units, for use in a pilot program or for submission to the Secretary of State for certification.

SEC. 3. Section 19100 of the Elections Code is amended to read:

19100. The Secretary of State shall study and adopt regulations governing the use of voting machines, voting devices, vote tabulating devices, and ballot marking systems, and shall be responsible for certifying voting systems for use in this state.

SEC. 4. Section 19101 of the Elections Code is amended and renumbered to read:

19103. The Chairperson of the Senate Standing Committee on Elections and Constitutional Amendments and the Chairperson of the Assembly Standing Committee on Elections and Redistricting shall meet with the Secretary of State and assist the Secretary of State to the extent that the participation is not incompatible with their positions as Members of the Legislature. For purposes of this division, the chairpersons of the committees named shall constitute a joint interim legislative committee on the subject of this chapter and Chapter 3 (commencing with Section 19200) and shall have the powers and duties imposed upon those committees by the Joint Rules of the Senate and Assembly.

SEC. 5. Section 19101 is added to the Elections Code, to read:

19101. (a) The Secretary of State shall adopt and publish voting system standards and regulations governing the use of voting systems. The Secretary of State shall adopt standards that meet or exceed federal voluntary voting system guidelines set forth by the United States Election Assistance Commission or its successor agency. Until state standards are adopted, the Voluntary Voting System Guidelines Draft Version 1.1, as submitted to the United States Election Assistance Commission on August 31, 2012, shall be used as state standards to the extent that they do not conflict with this code. The Secretary of State may require additional testing to ensure that voting systems meet the requirements of this code.

(b) Voting system standards adopted by the Secretary of State pursuant to subdivision (a) shall include, but not be limited to, all of the following requirements:

(1) The machine or device and its software shall be suitable for the purpose for which it is intended.

(2) The system shall preserve the secrecy of the ballot.

(3) The system shall be safe from fraud or manipulation.

(4) The system shall be accessible to voters with disabilities pursuant to Section 19242 and applicable federal laws.

(5) The system shall be accessible to voters who require assistance in a language other than English if the language is one in which a ballot or ballot materials are required to be made available to voters pursuant to Section 14201 and applicable federal laws.

SEC. 6. Section 19102 of the Elections Code is amended and renumbered to read:

19104. The Secretary of State may investigate any alleged violation of this code or the Secretary of State's regulations with the power to subpoena all necessary persons and records.

SEC. 6.5. Section 19102 of the Elections Code is amended and renumbered to read:

19105. The Secretary of State may investigate any alleged violation of this code or the Secretary of State's regulations with the power to subpoena all necessary persons and records.

SEC. 7. Section 19102 is added to the Elections Code, to read:

19102. The Secretary of State shall study the performance of voting systems in use in the state.

SEC. 8. Section 19103 of the Elections Code is amended and renumbered to read:

19212. (a) (1) No later than 10 business days after the Secretary of State certifies or conditionally approves the use of a new or updated voting system, the vendor or county seeking certification or approval of the voting system shall cause an exact copy of the approved source code for each component of the voting system, including complete build and configuration instructions and related documents for compiling the source code into object code, to be transferred directly from either the United States Election Assistance Commission or the voting system testing agency that evaluated the voting system and is approved by the Secretary of State, and deposited into an approved escrow facility.

(2) No later than 10 business days after the Secretary of State certifies or conditionally approves a new or updated ballot marking system, the vendor or county seeking certification or approval of the ballot marking system shall cause an exact copy of the approved source code for each component of the ballot marking system, including complete build and configuration instructions and related documents for compiling the source code into object code, to be deposited into an approved escrow facility.

(b) The Secretary of State shall adopt regulations relating to all of the following:

(1) The definition of source code components of a voting system or ballot marking system, including source code for all firmware and software of the voting system or ballot marking system. Firmware and software shall include commercial off-the-shelf or other third-party firmware and software that is available and able to be disclosed by the vendor or county seeking certification or approval of a voting system or ballot marking system.

(2) Specifications for the escrow facility, including security and environmental specifications necessary for the preservation of the voting system or ballot marking system source codes.

(3) Procedures for submitting voting system or ballot marking system source codes.

(4) Criteria for access to voting system or ballot marking system source codes.

(5) Requirements for the applicant to include in the materials deposited in escrow build and configuration instructions and documents so that a neutral third party may create, from the source codes in escrow, executable object codes identical to the code installed on certified or conditionally approved voting systems or ballot marking systems.

(c) The Secretary of State shall have reasonable access to the materials placed in escrow, under any of the following circumstances:

(1) In the course of an investigation or prosecution regarding vote counting or ballot marking equipment or procedures.

(2) Upon a finding by the Secretary of State that an escrow facility or escrow company is unable or unwilling to maintain materials in escrow in compliance with this section.

(3) In order to fulfill the provisions of this chapter related to the examination and certification or conditional approval of voting systems or ballot marking systems.

(4) In order to verify that the software on a voting system is identical to the certified or conditionally approved version.

(5) For any other purpose deemed necessary to fulfill the provisions of this code or Section 12172.5 of the Government Code.

(d) The Secretary of State may seek injunctive relief requiring the elections officials, approved escrow facility, or any vendor or manufacturer of a voting system or part of a voting system to comply with this section and related regulations. Venue for a proceeding under this section shall be exclusively in Sacramento County.

(e) This section applies to all elections.

SEC. 9. The heading of Chapter 3 (commencing with Section 19200) of Division 19 of the Elections Code is amended to read:

CHAPTER 3. CERTIFICATION OF VOTING SYSTEMS

SEC. 10. The heading of Article 1 (commencing with Section 19200) of Chapter 3 of Division 19 of the Elections Code is amended to read:

Article 1. Procedures for Certification of Voting Systems

SEC. 11. Section 19200.5 of the Elections Code is amended and renumbered to read:

19204. The Secretary of State shall not certify or conditionally approve any voting system that includes features that permit a voter to produce, and leave the polling place with, a copy or facsimile of the ballot cast by the voter at that polling place.

SEC. 12. Section 19201 of the Elections Code is amended and renumbered to read:

19202. (a) Except as authorized by Section 19209, a voting system, in whole or in part, shall not be used unless it has been certified or conditionally approved by the Secretary of State prior to any election at which it is to be used.

(b) A voting system that has been tested and approved for use in all elections by the Secretary of State before January 1, 2014, shall be deemed certified or conditionally approved by the Secretary of State and may be used in an election subject to any conditions placed on the use of the voting system by the Secretary of State before January 1, 2014, including conditions imposed in the reapproval documents issued by the Secretary of State in

2007 and 2008 following the Top-to-Bottom Review, and its subsequent revisions. The voting systems described in this subdivision shall remain subject to review and decertification by the Secretary of State at any time pursuant to Section 19232.

(c) A vendor or county that has submitted a voting system for federal qualification before August 1, 2013, upon obtaining federal qualification before January 1, 2015, may request approval of the voting system from the Secretary of State based on the examination and review requirements in place before January 1, 2014.

(d) A jurisdiction shall not purchase or contract for a voting system unless it has been certified or conditionally approved by the Secretary of State.

(e) Notwithstanding subdivision (d), a local jurisdiction may contract and pay for the following:

(1) Research and development of a new voting system that has not been certified or conditionally approved by the Secretary of State and uses only nonproprietary software and firmware with disclosed source code, except for unmodified commercial off-the-shelf software and firmware, as defined in paragraph (1) of subdivision (a) of Section 19209.

(2) Manufacture of the minimum number of voting system units reasonably necessary for either of the following purposes:

(A) To test and seek certification or conditional approval of the voting system pursuant to Sections 19210 to 19214, inclusive.

(B) To test and demonstrate the capabilities of the voting system in a pilot program pursuant to paragraph (2) of subdivision (b) of, and subdivision (c) of, Section 19209.

SEC. 13. Section 19201 is added to the Elections Code, to read:

19201. (a) The Secretary of State may grant conditional approval to a voting system or part of a voting system under either of the following circumstances:

(1) A voting system or part of a voting system was decertified as a result of a review by the Secretary of State pursuant to Section 19232.

(2) A certified voting system or part of that voting system is modified to comply with voting system standards or changes in statute.

(b) The Secretary of State may withdraw conditional approval at any time pursuant to Section 19232.

SEC. 14. Section 19202 of the Elections Code is amended and renumbered to read:

19210. (a) A person, corporation, or public agency owning or having an interest in the sale or acquisition of a voting system or a part of a voting system may apply to the Secretary of State for certification that includes testing and examination of the applicant's system by a state-approved testing agency or expert technicians and a report on the findings, which shall include the accuracy and efficiency of the voting system. As part of its application, the applicant shall notify the Secretary of State in writing of any known defect, fault, or failure of the version of the hardware, software, or firmware of the voting system or a part of the voting system submitted. The Secretary of State shall not begin his or her certification process until he or she receives

a completed application. The applicant shall also notify the Secretary of State in writing of any defect, fault, or failure of the version of the hardware, software, or firmware of the voting system or a part of the voting system submitted that is discovered after the application is submitted and before the Secretary of State submits the report required by Section 19213. The Secretary of State shall complete his or her certification process without undue delay.

(b) The Secretary of State shall publish and make publicly available on his or her Internet Web site a quarterly report of regulatory activities related to voting systems.

(c) As used in this article:

(1) "Defect" means any flaw in the hardware or documentation of a voting system that could result in a state of unfitness for use or nonconformance to the manufacturer's specifications or applicable law.

(2) "Failure" means a discrepancy between the external results of the operation of any software or firmware in a voting system and the manufacturer's product requirements for that software or firmware or applicable law.

(3) "Fault" means a step, process, or data definition in any software or firmware in a voting system that is incorrect under the manufacturer's program specification or applicable law.

SEC. 15.   Section 19203 of the Elections Code is amended and renumbered to read:

19223.   The Secretary of State shall use a state-approved testing agency or expert technicians to examine and test voting systems or parts of voting systems proposed for use or sale in this state. He or she shall furnish a complete report of the findings of the examination and testing to the Governor and the Attorney General.

SEC. 16.   Section 19204 of the Elections Code is amended and renumbered to read:

19211.   (a) Prior to publishing his or her decision to certify, conditionally approve, or withhold certification of a voting system or part of a voting system, the Secretary of State shall provide for a 30-day public review period and conduct a public hearing to give persons interested an opportunity to review testing and examination reports and express their views for or against certification or conditional approval of the voting system.

(b) The Secretary of State shall give notice of the public review period and hearing in the manner prescribed in Section 6064 of the Government Code in a newspaper of general circulation published in Sacramento County. The Secretary of State shall also provide notice of the hearing on his or her Internet Web site. The Secretary of State shall transmit written notice of the hearing, at least 14 days prior to the public review period and hearing, to each county elections official, to any person that the Secretary of State believes will be interested in the public review period and hearing, and to any person who requests, in writing, notice of the public review period and hearing.

(c) The decision of the Secretary of State to certify, conditionally approve, or withhold certification of a voting system or part of a voting system shall be in writing and shall state the findings of the Secretary of State. The decision shall be open to public inspection.

SEC. 17. Section 19205 of the Elections Code is repealed.

SEC. 18. Section 19206 of the Elections Code is repealed.

SEC. 19. Section 19206 is added to the Elections Code, to read:

19206. Except as authorized by Section 19209, both of the following apply:

(a) If more than one voting system is used to count ballots, the names of candidates shall, insofar as possible, be placed on the primary voting system.

(b) If more than one voting system or a combination of a voting system and paper ballots is used to count ballots, a single ballot measure or the candidates for a single office may not be split between voting systems or between a voting system and paper ballots.

SEC. 20. Section 19207 of the Elections Code is amended and renumbered to read:

19213. Within 60 days after the completion of the examination of a voting system, the Secretary of State shall make publicly available a report stating whether the voting system has been certified or conditionally approved, or whether certification has been withheld. The report shall also contain a written or printed description and drawings and photographs that clearly identify the machine or device and its mechanical operation.

SEC. 21. Section 19208 of the Elections Code is repealed.

SEC. 22. Section 19209 of the Elections Code is amended and renumbered to read:

19214. Within 10 days after issuing and filing a certification decision and associated testing reports, the Secretary of State shall make available to the public a full and complete copy of the certification report and all associated documentation, except that portions of the report or documentation that contain information that the Secretary of State determines to be confidential or proprietary shall not be made publicly available. The Secretary of State shall also notify the board of supervisors and elections official of each county of the availability of the report and associated documentation.

SEC. 23. Section 19210 of the Elections Code is amended and renumbered to read:

19207. The governing board may adopt for use at elections any kind of voting system, any combination of voting systems, or any combination of a voting system and paper ballots, provided that the voting system or systems involved have been certified or conditionally approved by the Secretary of State or specifically authorized by law pursuant to Section 19209.

SEC. 24. Section 19211 of the Elections Code is amended and renumbered to read:

19209. (a) For purposes of this section, the following terms have the following meanings:

(1) "Commercial off-the-shelf" means mass-produced, readily available hardware devices, including card readers, printers, or personal computers, and their firmware or software products, including operating systems, programming language compilers, or database management systems.

(2) "Incorrect in part" means a full manual tally of the votes cast on the pilot system would reveal rates of error in the pilot system tally that, if extrapolated to the entire contest, would alter the electoral outcome.

(3) "Partial risk-limiting audit" means a procedure that guarantees a large minimum chance of a full manual tally of the votes cast on the pilot system if the electoral outcome is incorrect in part.

(4) "Risk-limiting audit" means a procedure that ensures a large, predetermined minimum chance of requiring a full manual tally whenever a full manual tally would show an electoral outcome that differs from the outcome reported by the voting system for the audited contest.

(b) The governing board, without formally adopting a voting system, may provide for the experimental use of the voting system in a pilot program held in one or more precincts at a single election or, in the case of a special election, the special primary election and the special general election, if the voting system complies with either of the following:

(1) The voting system is certified or conditionally approved prior to its experimental use.

(2) The voting system meets all of the following requirements:

(A) Uses only software and firmware with disclosed source code, except for unmodified commercial off-the-shelf software and firmware.

(B) Meets the requirements of subdivision (b) of Section 19101.

(C) Meets the requirements of the regulations adopted by the Secretary of State pursuant to subdivision (g).

(D) Implements risk-limiting audits.

(c) A voting system that meets all of the requirements of paragraph (2) of subdivision (b) need not be certified or conditionally approved prior to its experimental use in a pilot program if the number of voting system units deployed in the pilot program is limited to the number necessary to test and demonstrate the capabilities of the voting system in a limited number of precincts or locations, including a prudent number of reserve units to ensure that sufficient working units will be available to conduct the pilot program. In no event shall the number of voting system units exceed 50 percent of the estimated number of units that would be required for full deployment of the voting system at every polling place and early voting site in a statewide election throughout the jurisdiction. Capabilities that may be taken into account in determining the number of voting system units reasonably necessary to test and demonstrate the capabilities of the voting system include, but are not limited to, all of the following:

(1) The capability of the voting system to accommodate voting in all languages in which the jurisdiction is required to provide ballots under applicable state and federal laws.

(2) The capability of the voting system to accommodate voting by persons with a broad range of physical and cognitive disabilities, as required by applicable state and federal laws.

(3) The current and projected number of voting-eligible individuals in the jurisdiction.

(4) The geography and distribution of the population in the jurisdiction.

(d) No later than nine months before the election at which the pilot program of a voting system is proposed to be conducted, the governing board shall submit to the Secretary of State a plan for the pilot program. The Secretary of State shall approve or reject the plan no later than three months after receipt of the plan.

(e) The votes cast on a voting system during a pilot program pursuant to subdivision (b) shall be subject to risk-limiting audits.

(1) For each contest conducted entirely on the pilot voting system, the jurisdiction conducting the pilot program shall conduct a risk-limiting audit with at least a 90-percent chance of requiring a full manual tally of the contest whenever a full manual tally would show an outcome that differs from the outcome reported by the pilot voting system.

(2) For each contest conducted partially on the pilot voting system, the jurisdiction conducting the pilot program shall conduct a partial risk-limiting audit of the portion of the contest in which the voters cast their votes on the pilot voting system, with at least a 90-percent chance of requiring a full manual tally of all votes cast using the pilot voting system whenever the outcome is incorrect in part.

(3) (A) If a risk-limiting audit of a contest leads to a full manual tally of all of the ballots cast in the contest, then the contest outcome according to that manual tally shall become the official result.

(B) If a partial risk-limiting audit of a contest leads to a full manual tally of the ballots cast using the pilot voting system, the vote counts according to that manual tally shall replace the vote counts reported by the pilot voting system for the purpose of determining the official contest results.

(4) Risk-limiting audit procedures shall comply with all other requirements in regulations adopted by the Secretary of State pursuant to subdivision (g).

(f) Upon completion of the pilot program, the governing board shall notify the Secretary of State in writing of any defect, fault, or failure of the hardware, software, or firmware of the voting system or a part of the voting system.

(g) A voting system pilot program shall not be conducted in a legally binding election without the prior approval of the Secretary of State. The Secretary of State shall adopt and publish regulations governing voting system pilot programs.

SEC. 25. Section 19212 of the Elections Code is amended and renumbered to read:

19208. The governing board may provide for the payment of the cost of the voting system equipment in any manner and by any method as it deems best for local interests, and also may for that purpose issue bonds,

certificates of indebtedness, or other obligations that shall be a charge on the county or city. The bonds, certificates, or other obligations may be issued with or without interest, payable at any time as the authorities may determine, but shall not be issued or sold at less than par. The governing board may enter into lease agreements or lease-purchase agreements for the use of equipment.

SEC. 26. Section 19212.5 of the Elections Code is amended and renumbered to read:

19215. (a) If a voting system or a part of a voting system has been certified or conditionally approved by the Secretary of State or has been federally qualified, the vendor or, in cases where the system is publicly owned, the jurisdiction shall notify the Secretary of State and all local elections officials who use the system in writing of any defect, fault, or failure of the hardware, software, or firmware of the voting system or a part of the voting system within 30 calendar days after the vendor learns of the defect, fault, or failure.

(b) After receiving written notification of a defect, fault, or failure pursuant to subdivision (a), the Secretary of State shall notify the United States Election Assistance Commission or its successor agency of the problem as soon as practicable so as to present a reasonably complete description of the problem. The Secretary of State shall subsequently submit a report regarding the problem to the United States Election Assistance Commission or its successor agency. The report shall include any report regarding the problem submitted to the Secretary of State.

SEC. 27. Section 19213 of the Elections Code is amended and renumbered to read:

19216. If a voting system or a part of a voting system has been certified or conditionally approved by the Secretary of State, it shall not be changed or modified until the Secretary of State has been notified in writing and has determined that the change or modification does not impair its accuracy and efficiency sufficient to require a reexamination and recertification, or conditional approval, pursuant to this article. The Secretary of State may adopt rules and regulations governing the procedures to be followed in making his or her determination as to whether the change or modification impairs accuracy or efficiency.

SEC. 28. Section 19214 of the Elections Code is amended and renumbered to read:

19217. The Secretary of State may seek injunctive and administrative relief if a voting system or a part of a voting system has been compromised by the addition or deletion of hardware, software, or firmware without prior approval or is defective due to a known hardware, software, or firmware defect, fault, or failure that has not been disclosed pursuant to Section 19210 or 19215.

SEC. 29. Section 19214.5 of the Elections Code is amended and renumbered to read:

19218. (a) The Secretary of State may seek all of the following relief for an unauthorized change in hardware, software, or firmware in a voting system certified or conditionally approved in California:

(1) A civil penalty from the offending party or parties, not to exceed ten thousand dollars ($10,000) per violation. For purposes of this subdivision, each voting system component found to contain the unauthorized hardware, software, or firmware shall be considered a separate violation. A penalty imposed pursuant to this subdivision shall be apportioned 50 percent to the county in which the violation occurred, if applicable, and 50 percent to the office of the Secretary of State for purposes of bolstering voting systems security efforts.

(2) Immediate commencement of proceedings to withdraw certification or conditional approval for the voting system in question.

(3) Prohibiting the manufacturer or vendor of a voting system from doing elections-related business in the state for one, two, or three years.

(4) Refund of all moneys paid by a local agency for a voting system or a part of a voting system that is compromised by an unauthorized change or modification, whether or not the voting system has been used in an election.

(5) Any other remedial actions authorized by law to prevent unjust enrichment of the offending party.

(b) (1) The Secretary of State may seek all of the following relief for a known but undisclosed defect, fault, or failure in a voting system or part of a voting system certified or conditionally approved in California:

(A) Refund of all moneys paid by a local agency for a voting system or part of a voting system that is defective due to a known but undisclosed defect, fault, or failure, whether or not the voting system has been used in an election.

(B) A civil penalty from the offending party or parties, not to exceed fifty thousand dollars ($50,000) per violation. For purposes of this subdivision, each defect, fault, or failure shall be considered a separate violation. A defect, fault, or failure constitutes a single violation regardless of the number of voting system units in which the defect, fault, or failure is found.

(C) In addition to any other penalties or remedies established by this section, the offending party or parties shall be liable in the amount of one thousand dollars ($1,000) per day after the applicable deadline established in Section 19215 until the required disclosure is filed with the Secretary of State.

(2) A penalty imposed pursuant to subparagraph (B) or (C) of paragraph (1) shall be deposited in the General Fund.

(c) Before seeking any measure of relief under this section, the Secretary of State shall hold a public hearing. The Secretary of State shall give notice of the hearing in the manner prescribed by Section 6064 of the Government Code in a newspaper of general circulation published in Sacramento County. The Secretary of State also shall transmit written notice of the hearing, at least 30 days prior to the hearing, to each county elections official, the

offending party or parties, a person that the Secretary of State believes will be interested in the hearing, and a person who requests, in writing, notice of the hearing.

(d) The decision of the Secretary of State to seek relief under this section shall be in writing and state his or her findings. The decision shall be open to public inspection.

SEC. 30. Section 19215 of the Elections Code is amended and renumbered to read:

19219. (a) The Secretary of State may seek injunctive relief requiring an elections official, or any vendor or manufacturer of a voting machine, voting system, or vote tabulating device, to comply with the requirements of this code, the regulations of the Secretary of State, and the specifications for voting machines, voting devices, vote tabulating devices, and any software used for each, including the programs and procedures for vote tabulating and testing.

(b) Venue for a proceeding under this section shall be exclusively in Sacramento County.

SEC. 31. Section 19216 of the Elections Code is amended and renumbered to read:

19203. The Secretary of State shall not certify or conditionally approve a voting system or a part of a voting system that uses paper ballots unless the paper used for the ballots is of sufficient quality that it maintains its integrity and readability throughout the retention period specified in Chapter 4 (commencing with Section 17300) of Division 17.

SEC. 32. Section 19217 of the Elections Code is amended and renumbered to read:

19205. A voting system shall comply with all of the following:

(a) No part of the voting system shall be connected to the Internet at any time.

(b) No part of the voting system shall electronically receive or transmit election data through an exterior communication network, including the public telephone system, if the communication originates from or terminates at a polling place, satellite location, or counting center.

(c) No part of the voting system shall receive or transmit wireless communications or wireless data transfers.

SEC. 33. The heading of Article 2 (commencing with Section 19220) of Chapter 3 of Division 19 of the Elections Code is amended and renumbered to read:

Article 3. Inspection of Certified and Conditionally Approved Voting Systems

SEC. 34. Section 19220 of the Elections Code is amended and renumbered to read:

19230. The elections official of any county or city using a voting system shall inspect the machines or devices at least once every two years to

determine their accuracy. Any county or city using leased or rented equipment shall determine if the equipment has been inspected for accuracy within the last two years before using it for any election. The inspection shall be made in accordance with regulations adopted and promulgated by the Secretary of State. The elections official shall certify the results of the inspection to the Secretary of State.

SEC. 35. Article 2 (commencing with Section 19220) is added to Chapter 3 of Division 19 of the Elections Code, to read:

Article 2. Voting System Testing Agencies

19220. For purposes of this division, "state-approved testing agency" means a person or entity that is authorized by the Secretary of State to conduct the testing and examination of a voting system in connection with certification or conditional approval of the voting system pursuant to this division.

19221. The Secretary of State shall do all of the following:

(a) Publish requirements for the approval of state-approved testing agencies that are authorized to conduct the testing and examination of voting systems. Until the requirements are published, federally accredited voting system laboratories shall be used to conduct testing and examination.

(b) Approve and publish a list of authorized state-approved testing agencies.

19222. The person, corporation, or public agency applying for certification of a voting system is responsible for all costs associated with the testing of the voting system.

SEC. 36. Section 19221 of the Elections Code is amended and renumbered to read:

19231. (a) If the Secretary of State has reason to believe that a local inspection of equipment is not adequate, he or she may cause the equipment to be reexamined, at any time prior to six months before a statewide election, to ensure that the voting system or parts of the voting system perform to adopted standards and tabulate votes accurately.

(b) For the purpose of reexamining voting equipment, the Secretary of State may use state-approved testing agencies or expert technicians at the cost of the elections official.

(c) The Secretary of State shall furnish a complete report of the findings to the Governor, to the Attorney General, to each county elections official, to the chairpersons of the elections committees of the Assembly and Senate, and to the manufacturer of the equipment.

SEC. 37. Section 19222 of the Elections Code is amended and renumbered to read:

19232. The Secretary of State shall review voting systems periodically to determine if they are defective, obsolete, or otherwise unacceptable. The Secretary of State has the right to withdraw his or her certification or conditional approval previously granted under this chapter of any voting

system or part of a voting system should it be defective or prove unacceptable after such review. Six months' notice shall be given before withdrawing certification or conditional approval unless the Secretary of State for good cause shown makes a determination that a shorter notice period is necessary. Any withdrawal by the Secretary of State of his or her previous certification or conditional approval of a voting system or part of a voting system shall not be effective as to any election conducted within six months of that withdrawal.

SEC. 38. Section 19223 of the Elections Code is amended and renumbered to read:

19233. The Secretary of State shall conduct random audits of the software installed on direct recording electronic voting systems, as defined in Section 19271, to ensure that the installed software is identical to the software that has been approved for use on that voting system. The Secretary of State shall take steps to ensure that the process for conducting random audits does not intentionally cause a direct recording electronic voting system to become more vulnerable to any unauthorized changes to the software that has been approved for its use.

SEC. 39. The heading of Article 2.5 (commencing with Section 19225) of Chapter 3 of Division 19 of the Elections Code is amended and renumbered to read:

Article 4. Accessible Voting Systems

SEC. 40. Section 19225 of the Elections Code is amended and renumbered to read:

19240. It is the intent of the Legislature that California voting system standards and elections comply with the provisions of the federal Help America Vote Act of 2002 (42 U.S.C. Sec. 15301 et seq.) that require voting systems be accessible for individuals with disabilities, including nonvisual accessibility for the blind and visually impaired, in a manner that provides the same opportunity for access and participation, including privacy and independence, as provided to other voters who are not disabled.

SEC. 41. Section 19226 of the Elections Code is amended and renumbered to read:

19241. As used in this article:

(a) "Access" means the ability to receive, use, select, and manipulate data and operate controls included in voting technology and systems.

(b) "Nonvisual" means synthesized speech, braille, and other output methods that do not require sight.

SEC. 42. Section 19227 of the Elections Code is amended and renumbered to read:

19242. (a) The Secretary of State shall adopt and publish rules and regulations governing any voting technology and systems used by the state or any political subdivision that provide voters with disabilities the access

required under the federal Help America Vote Act of 2002 (42 U.S.C. Sec. 15301 et seq.).

(b) At each polling place, at least one voting unit certified or conditionally approved by the Secretary of State shall provide voters with disabilities the access required under the federal Help America Vote Act of 2002 (42 U.S.C. Sec. 15301 et seq.).

(c) A local agency is not required to comply with subdivision (b) in an election in which a candidate for federal office does not appear on the ballot unless sufficient funds are available to implement that provision. Funds received from the proceeds of the Voting Modernization Bond Act of 2002 (Article 5 (commencing with Section 19250)), from federal funds made available to purchase new voting systems, or from any other source except the General Fund, shall be used for that purpose.

SEC. 43. Section 19227.5 of the Elections Code is amended and renumbered to read:

19243. In requiring access for voters with disabilities pursuant to this article, the Secretary of State shall obtain recommendations from representatives of blind consumer organizations, experts in accessible software and hardware design, and any other individual or organization the Secretary of State determines to be appropriate.

SEC. 44. Section 19228 of the Elections Code is amended and renumbered to read:

19244. Compliance with this article in regard to voting technology and systems purchased prior to the effective date of this article shall be achieved at the time of procurement of an upgrade or replacement of existing voting equipment or systems.

SEC. 45. Section 19229 of the Elections Code is amended and renumbered to read:

19245. (a) A person injured by a violation of this article may maintain an action for injunctive relief to enforce this article.

(b) An action for injunctive relief shall be commenced within four years after the cause of action accrues.

(c) For purposes of this section, a cause of action for a continuing violation accrues at the time of the latest violation.

SEC. 46. Section 19229.5 of the Elections Code is amended and renumbered to read:

19246. This article does not apply to voting by vote by mail ballot.

SEC. 47. The heading of Article 3 (commencing with Section 19230) of Chapter 3 of Division 19 of the Elections Code is amended and renumbered to read:

Article 5. Voting Modernization Bond Act of 2002 (Shelley-Hertzberg Act)

SEC. 48. Section 19230 of the Elections Code is amended and renumbered to read:

19250. This article shall be known and may be cited as the Voting Modernization Bond Act of 2002 (Shelley-Hertzberg Act).

SEC. 49. Section 19231 of the Elections Code is amended and renumbered to read:

19251. The State General Obligation Bond Law (Chapter 4 (commencing with Section 16720) of Part 3 of Division 4 of Title 2 of the Government Code), except as otherwise provided herein, is adopted for the purpose of the issuance, sale, and repayment of, and otherwise providing with respect to, the bonds authorized to be issued by this article, and the provisions of that law are included in this article as though set out in full.

SEC. 50. Section 19232 of the Elections Code is amended and renumbered to read:

19252. As used in this article:

(a) "Board" means the Voting Modernization Board, established pursuant to Section 19256.

(b) "Bond" means a state general obligation bond issued pursuant to this article adopting the provisions of the State General Obligation Bond Law.

(c) "Bond act" means this article authorizing the issuance of state general obligation bonds and adopting the State General Obligation Bond Law by reference.

(d) "Committee" means the Voting Modernization Finance Committee, established pursuant to Section 19253.

(e) "Fund" means the Voting Modernization Fund, created pursuant to subdivision (b) of Section 19254.

(f) "Voting system" means any voting machine, voting device, or vote tabulating device that does not use prescored punch card ballots.

SEC. 51. Section 19233 of the Elections Code is amended and renumbered to read:

19253. (a) The Voting Modernization Finance Committee is hereby established for the purpose of authorizing the issuance and sale, pursuant to the State General Obligation Bond Law, of the bonds authorized by this article.

(b) The committee consists of the Controller, the Director of Finance, and the Treasurer, or their designated representatives, all of whom shall serve without compensation, and a majority of whom shall constitute a quorum. The Treasurer shall serve as chairperson of the committee. A majority of the committee may act for the committee.

(c) For purposes of this article, the Voting Modernization Finance Committee is "the committee" as that term is used in the State General Obligation Bond Law.

SEC. 52. Section 19234 of the Elections Code is amended and renumbered to read:

19254. (a) The committee may create a debt or debts, liability or liabilities, of the State of California, in the aggregate amount of not more than two hundred million dollars ($200,000,000), exclusive of refunding bonds, in the manner provided herein for the purpose of creating a fund to assist counties in the purchase of updated voting systems.

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(b) The proceeds of bonds issued and sold pursuant to this article shall be deposited in the Voting Modernization Fund, which is hereby established.

(c) A county is eligible to apply to the board for fund money if it meets all of the following requirements:

(1) The county has purchased a new voting system after January 1, 1999, and is continuing to make payments on that system on the date that this article becomes effective.

(2) The county matches fund moneys at a ratio of one dollar ($1) of county moneys for every three dollars ($3) of fund moneys.

(3) The county has not previously requested fund money for the purchase of a new voting system. Applications for expansion of an existing system or components related to a previously certified or conditionally approved application shall be accepted.

(d) (1) Fund moneys shall only be used to purchase systems certified or conditionally approved by the Secretary of State.

(2) A county may use fund moneys to contract and pay for the following:

(A) Research and development of a new voting system that has not been certified or conditionally approved by the Secretary of State and uses only nonproprietary software and firmware with disclosed source code, except for unmodified commercial off-the-shelf software and firmware, as defined in paragraph (1) of subdivision (a) of Section 19209.

(B) Manufacture of the minimum number of voting system units reasonably necessary for either of the following purposes:

(i) To test and seek certification or conditional approval for the voting system pursuant to Sections 19210 to 19214, inclusive.

(ii) To test and demonstrate the capabilities of the voting system in a pilot program pursuant to paragraph (2) of subdivision (b) of, and subdivision (c) of, Section 19209.

(3) Fund moneys shall not be used to purchase a voting system that uses prescored punch card ballots.

(e) Any voting system purchased using bond funds that does not require a voter to directly mark on the ballot must produce, at the time the voter votes his or her ballot or at the time the polls are closed, a paper version or representation of the voted ballot or of all the ballots cast on a unit of the voting system. The paper version shall not be provided to the voter but shall be retained by elections officials for use during the 1 percent manual recount or other recount, audit, or contest.

SEC. 53. Section 19234.5 of the Elections Code is amended and renumbered to read:

19255. The Legislature may amend subdivisions (c) and (d) of Section 19254 and Section 19256 by a statute, passed in each house of the Legislature by rollcall vote entered in the respective journals, by not less than two-thirds of the membership in each house concurring, if the statute is consistent with, and furthers the purposes of, this article.

SEC. 54. Section 19235 of the Elections Code is amended and renumbered to read:

19256. The Voting Modernization Board is hereby established and designated the "board" for purposes of the State General Obligation Bond Law, and for purposes of administering the Voting Modernization Fund. The board consists of five members, three selected by the Governor and two selected by the Secretary of State. The board shall have the authority to reject any application for fund money it deems inappropriate, excessive, or that does not comply with the intent of this article. A county whose application is rejected shall be allowed to submit an amended application.

SEC. 55. Section 19236 of the Elections Code is amended and renumbered to read:

19257. (a) All bonds authorized by this article, when duly sold and delivered as provided herein, constitute valid and legally binding general obligations of the State of California, and the full faith and credit of the state is hereby pledged for the punctual payment of both principal and interest thereof. The bonds issued pursuant to this article shall be repaid within 10 years from the date they are issued.

(b) There shall be collected annually, in the same manner and at the same time as other state revenue is collected, a sum of money, in addition to the ordinary revenues of the state, sufficient to pay the principal of, and interest on, the bonds as provided herein. All officers required by law to perform any duty in regard to the collection of state revenues shall collect this additional sum.

(c) On the dates on which funds are remitted pursuant to Section 16676 of the Government Code for the payment of the then maturing principal of, and interest on, the bonds in each fiscal year, there shall be returned to the General Fund all of the money in the fund, not in excess of the principal of, and interest on, any bonds then due and payable. If the money so returned on the remittance dates is less than the principal and interest then due and payable, the balance remaining unpaid shall be returned to the General Fund out of the fund as soon as it shall become available, together with interest thereon from the dates of maturity until returned, at the same rate of interest as borne by the bonds, compounded semiannually. This subdivision does not grant any lien on the fund or the moneys therein to holders of any bonds issued under this article. However, this subdivision shall not apply in the case of any debt service that is payable from the proceeds of any refunding bonds. For purposes of this subdivision, "debt service" means the principal (whether due at maturity, by redemption, or acceleration), premium, if any, or interest payable on any date to any series of bonds.

SEC. 56. Section 19237 of the Elections Code is amended and renumbered to read:

19258. Notwithstanding Section 13340 of the Government Code, there is hereby continuously appropriated from the General Fund, for purposes of this article, a sum of money that will equal both of the following:

(a) That sum annually necessary to pay the principal of, and the interest on, the bonds issued and sold as provided herein, as that principal and interest become due and payable.

(b) That sum necessary to carry out Section 19259, appropriated without regard to fiscal years.

SEC. 57. Section 19238 of the Elections Code is amended and renumbered to read:

19259. For purposes of this article, the Director of Finance may, by executive order, authorize the withdrawal from the General Fund of a sum of money not to exceed the amount of the unsold bonds that have been authorized by the committee to be sold pursuant to this article. Any sums withdrawn shall be deposited in the fund. All moneys made available under this section to the board shall be returned by the board to the General Fund, plus the interest that the amounts would have earned in the Pooled Money Investment Account, from the sale of bonds for the purpose of carrying out this article.

SEC. 58. Section 19239 of the Elections Code is amended and renumbered to read:

19260. The board may request the Pooled Money Investment Board to make a loan from the Pooled Money Investment Account, in accordance with Section 16312 of the Government Code, for the purpose of carrying out this article. The amount of the request shall not exceed the amount of unsold bonds which the committee has, by resolution, authorized to be sold for the purpose of carrying out this article. The board shall execute whatever documents are required by the Pooled Money Investment Board to obtain and repay the loan. Any amounts loaned shall be deposited in the fund to be allocated by the board in accordance with this article.

SEC. 59. Section 19240 of the Elections Code is amended and renumbered to read:

19261. Upon request of the board, supported by a statement of its plans and projects approved by the Governor, the committee shall determine whether to issue any bonds authorized under this article in order to carry out the board's plans and projects and, if so, the amount of bonds to be issued and sold. Successive issues of bonds may be authorized and sold to carry out these plans and projects progressively, and it is not necessary that all of the bonds be issued or sold at any one time.

SEC. 60. Section 19241 of the Elections Code is amended and renumbered to read:

19262. (a) The committee may authorize the Treasurer to sell all or any part of the bonds authorized by this article at the time or times established by the Treasurer.

(b) Whenever the committee deems it necessary for an effective sale of the bonds, the committee may authorize the Treasurer to sell any issue of bonds at less than their par value, notwithstanding Section 16754 of the Government Code. However, the discount on the bonds shall not exceed 3 percent of the par value thereof.

SEC. 61. Section 19242 of the Elections Code is amended and renumbered to read:

19263. Out of the first money realized from the sale of bonds as provided by this article, there shall be redeposited in the General Obligation Bond

Expense Revolving Fund, established by Section 16724.5 of the Government Code, the amount of all expenditures made for purposes specified in that section, and this money may be used for the same purpose and repaid in the same manner whenever additional bond sales are made.

SEC. 62. Section 19243 of the Elections Code is amended and renumbered to read:

19264. Any bonds issued and sold pursuant to this article may be refunded in accordance with Article 6 (commencing with Section 16780) of Chapter 4 of Part 3 of Division 2 of Title 2 of the Government Code. The approval of the voters for the issuance of bonds under this article includes approval for the issuance of bonds issued to refund bonds originally issued or any previously issued refunding bonds.

SEC. 63. Section 19244 of the Elections Code is amended and renumbered to read:

19265. Notwithstanding any provision of the bond act, if the Treasurer sells bonds under this article for which bond counsel has issued an opinion to the effect that the interest on the bonds is excludable from gross income for purposes of federal income tax, subject to any conditions which may be designated, the Treasurer may establish separate accounts for the investment of bond proceeds and for the earnings on those proceeds, and may use those proceeds or earnings to pay any rebate, penalty, or other payment required by federal law or take any other action with respect to the investment and use of bond proceeds required or permitted under federal law necessary to maintain the tax-exempt status of the bonds or to obtain any other advantage under federal law on behalf of the funds of this state.

SEC. 64. Section 19245 of the Elections Code is amended and renumbered to read:

19266. The Legislature hereby finds and declares that, inasmuch as the proceeds from the sale of bonds authorized by this article are not "proceeds of taxes" as that term is used in Article XIII B of the California Constitution, the disbursement of these proceeds is not subject to the limitations imposed by Article XIII B.

SEC. 65. The heading of Article 4 (commencing with Section 19250) of Chapter 3 of Division 19 of the Elections Code is amended and renumbered to read:

Article 6. Direct Recording Electronic Voting Systems

SEC. 66. Section 19250 of the Elections Code is amended and renumbered to read:

19270. (a) The Secretary of State shall not certify or conditionally approve a direct recording electronic voting system unless the system includes an accessible voter verified paper audit trail.

(b) On and after January 1, 2006, a city or county shall not contract for or purchase a direct recording electronic voting system unless the system

has been certified or conditionally approved for use by the Secretary of State.

(c) As of January 1, 2006, all direct recording electronic voting systems in use on that date, regardless of the date it was contracted for or purchased, shall have received federal qualification and include an accessible voter verified paper audit trail. If the direct recording electronic voting system does not include an accessible voter verified paper audit trail, the system shall be replaced or modified to include an accessible voter verified paper audit trail.

(d) All direct recording electronic voting systems shall include a method by which a voter may electronically verify, through a nonvisual method, the information that is contained on the paper record copy of that voter's ballot.

(e) A paper record copy that is printed by a voter verified paper audit trail component shall be printed in the same language that the voter used when casting his or her ballot on the direct recording electronic voting system. For languages that lack a written form, the paper record copy shall be printed in English.

SEC. 67.   Section 19251 of the Elections Code is amended and renumbered to read:

19271. As used in this article:

(a) "Accessible" means that the information provided on the paper record copy from the voter verified paper audit trail mechanism is provided or conveyed to voters via both a visual and a nonvisual method, such as through an audio component.

(b) "Direct recording electronic voting system" means a voting system that records a vote electronically and does not require or permit the voter to record his or her vote directly onto a tangible ballot.

(c) "Voter verified paper audit trail" means a component of a direct recording electronic voting system that prints a contemporaneous paper record copy of each electronic ballot and allows each voter to confirm his or her selections before the voter casts his or her ballot.

(d) "Federal qualification" means the system has been certified, if applicable, by means of qualification testing by a nationally recognized test laboratory and has met or exceeded the minimum requirements set forth in the Performance and Text Standards for Punch Card, Mark Sense, and Direct Recording Electronic Voting Systems, or in any successor voluntary standard document, developed and promulgated by the Federal Election Commission, the Election Assistance Commission, or the National Institute of Standards and Technology.

(e) "Paper record copy" means an auditable document printed by a voter verified paper audit trail component that corresponds to the voter's electronic vote and lists the contests on the ballot and the voter's selections for those contests. A paper record copy is not a ballot.

(f) "Parallel monitoring" means the testing of a randomly selected sampling of voting equipment on election day designed to simulate actual election conditions to confirm that the system is registering votes accurately.

SEC. 68. Section 19252 of the Elections Code is amended and renumbered to read:

19272. To the extent that they are available for expenditure for the purposes of this article, federal funds or moneys from the Voting Modernization Fund, created pursuant to subdivision (b) of Section 19254, shall be used. No moneys from the General Fund shall be expended for the purposes of this article.

SEC. 69. Section 19253 of the Elections Code is amended and renumbered to read:

19273. (a) On a direct recording electronic voting system, the electronic record of each vote shall be considered the official record of the vote, except as provided in subdivision (b).

(b) (1) The voter verified paper audit trail shall be considered the official paper audit record and shall be used for the required 1-percent manual tally described in Section 15360 and any full recount or post-election audit.

(2) The voter verified paper audit trail shall govern if there is any difference between it and the electronic record during a 1-percent manual tally, full recount, or post-election audit.

SEC. 70. Section 19254 of the Elections Code is amended and renumbered to read:

19274. The Secretary of State shall not certify or conditionally approve a direct recording electronic voting system unless the paper used for its voter verified paper audit trail is of sufficient quality that it maintains its integrity and readability throughout the retention period specified in Chapter 4 (commencing with Section 17300) of Division 17.

SEC. 71. Section 19255 of the Elections Code is amended and renumbered to read:

19275. (a) For each statewide election, the Secretary of State shall conduct parallel monitoring of each direct recording electronic voting system on which ballots will be cast. This section shall only apply to precincts that have more than one direct recording electronic voting system.

(b) The results of the parallel monitoring shall be made available prior to the certification of the election.

SEC. 72. The heading of Chapter 3.5 (commencing with Section 19260) of Division 19 of the Elections Code is amended to read:

CHAPTER 3.5. CERTIFICATION OF BALLOT MARKING SYSTEMS

SEC. 73. Section 19260 of the Elections Code is amended and renumbered to read:

19280. The Secretary of State shall not certify or conditionally approve a ballot marking system, or part of a ballot marking system, unless it fulfills the requirements of this code and the regulations of the Secretary of State.

SEC. 74. Section 19261 of the Elections Code is amended and renumbered to read:

19281. (a) A ballot marking system, in whole or in part, shall not be used unless it has been certified or conditionally approved by the Secretary of State prior to the election at which it is to be first used.

(b) All other uses of a ballot marking system shall be subject to the provisions of Section 19202.

SEC. 75. Section 19262 of the Elections Code is amended and renumbered to read:

19284. (a) A person, corporation, or public agency owning or having an interest in the sale or acquisition of a ballot marking system or a part of a ballot marking system may apply to the Secretary of State for certification or conditional approval that includes testing and examination of the applicant's system and a report on the findings, which shall include the accuracy and efficiency of the ballot marking system. As part of its application, the applicant of a ballot marking system or a part of a ballot marking system shall notify the Secretary of State in writing of any known defect, fault, or failure of the version of the hardware, software, or firmware of the ballot marking system or a part of the ballot marking system submitted. The Secretary of State shall not begin his or her certification process until he or she receives a completed application from the applicant of the ballot marking system or a part of the ballot marking system. The applicant shall also notify the Secretary of State in writing of any defect, fault, or failure of the version of the hardware, software, or firmware of the ballot marking system or a part of the ballot marking system submitted that is discovered after the application is submitted and before the Secretary of State submits the report required by Section 19288. The Secretary of State shall complete his or her examination without undue delay.

(b) After receiving an applicant's written notification of a defect, fault, or failure, the Secretary of State shall notify the United States Election Assistance Commission or its successor entity of the problem as soon as practicable so as to present a reasonably complete description of the problem. The Secretary of State shall subsequently submit a report regarding the problem to the United States Election Assistance Commission or its successor entity. The report shall include any report regarding the problem submitted to the Secretary of State by the applicant.

(c) As used in this chapter:

(1) "Defect" means any flaw in the hardware or documentation of a ballot marking system that could result in a state of unfitness for use or nonconformance to the manufacturer's specifications or applicable law.

(2) "Failure" means a discrepancy between the external results of the operation of any software or firmware in a ballot marking system and the manufacturer's product requirements for that software or firmware or applicable law.

(3) "Fault" means a step, process, or data definition in any software or firmware in a ballot marking system that is incorrect under the manufacturer's program specification or applicable law.

SEC. 76. Section 19263 of the Elections Code is amended and renumbered to read:

19285. The Secretary of State shall use a state-approved testing agency or expert technicians to examine ballot marking systems proposed for use or sale in this state. He or she shall furnish a complete report of the findings of the examination and testing to the Governor and the Attorney General.

SEC. 77. Section 19264 of the Elections Code is amended and renumbered to read:

19287. (a) Prior to publishing his or her decision to certify, conditionally approve, or withhold certification of a ballot marking system, the Secretary of State shall provide for a 30-day public review period and conduct a public hearing to give interested persons an opportunity to review testing and examination reports and express their views for or against certification or conditional approval of the ballot marking system.

(b) The Secretary of State shall give notice of the public review period and hearing in the manner prescribed in Section 6064 of the Government Code in a newspaper of general circulation published in Sacramento County. The Secretary of State shall also provide notice of the hearing on his or her Internet Web site. The Secretary of State shall transmit written notice of the hearing, at least 14 days prior to the public review period and hearing, to each county elections official, to any person that the Secretary of State believes will be interested in the public review period and hearing, and to any person who requests, in writing, notice of the public review period and hearing.

(c) The decision of the Secretary of State to certify, conditionally approve, or withhold certification of a ballot marking system shall be in writing and shall state the findings of the Secretary of State. The decision shall be open to public inspection.

SEC. 78. Section 19265 of the Elections Code is repealed.

SEC. 79. Section 19266 of the Elections Code is repealed.

SEC. 80. Section 19267 of the Elections Code is amended and renumbered to read:

19288. Within 60 days after the completion of the examination of a ballot marking system, the Secretary of State shall make publicly available a report stating whether the ballot marking system has been certified or conditionally approved, or whether certification has been withheld.

SEC. 81. Section 19268 of the Elections Code is repealed.

SEC. 82. Section 19269 of the Elections Code is amended and renumbered to read:

19289. Within 10 days after issuing and filing a certification decision and associated testing reports, the Secretary of State shall make available to the public a full and complete copy of the certification report and all associated documentation, except that portions of the report or documentation that contain information that the Secretary of State determines to be confidential or proprietary shall not be made publicly available. The Secretary of State shall notify the board of supervisors and elections official of each county of the availability of the report and associated documentation.

SEC. 83. Section 19270 of the Elections Code is amended and renumbered to read:

19290. (a) If a ballot marking system has been certified or conditionally approved by the Secretary of State, the vendor or, in cases where the system is publicly owned, the jurisdiction shall notify the Secretary of State and all local elections officials who use the system in writing of any defect, fault, or failure of the hardware, software, or firmware of the system or a part of the system within 30 calendar days after the vendor or jurisdiction learns of the defect, fault, or failure.

(b) After receiving written notification of a defect, fault, or failure pursuant to subdivision (a), the Secretary of State shall notify the United States Election Assistance Commission or its successor entity of the problem as soon as practicable so as to present a reasonably complete description of the problem. The Secretary of State shall subsequently submit a report regarding the problem to the United States Election Assistance Commission or its successor entity. The report shall include any report regarding the problem submitted to the Secretary of State.

SEC. 84. Section 19271 of the Elections Code is amended and renumbered to read:

19291. If a ballot marking system has been certified or conditionally approved by the Secretary of State, it shall not be changed or modified until the Secretary of State has been notified in writing and has determined that the change or modification does not impair its accuracy and efficiency sufficient to require a reexamination and recertification or reapproval pursuant to this chapter. The Secretary of State may adopt rules and regulations governing the procedures to be followed in making his or her determination as to whether the change or modification impairs accuracy or efficiency.

SEC. 85. Section 19272 of the Elections Code is amended and renumbered to read:

19292. The Secretary of State may seek injunctive and administrative relief if a ballot marking system has been compromised by the addition or deletion of hardware, software, or firmware without prior approval or is defective due to a known hardware, software, or firmware defect, fault, or failure that has not been disclosed pursuant to Section 19284 or 19290.

SEC. 86. Section 19273 of the Elections Code is amended and renumbered to read:

19293. (a) The Secretary of State may seek all of the following relief for an unauthorized change in hardware, software, or firmware in a ballot marking system certified or conditionally approved in California:

(1) A civil penalty from the offending party or parties, not to exceed ten thousand dollars ($10,000) per violation. For purposes of this subdivision, each ballot marking system component found to contain the unauthorized hardware, software, or firmware shall be considered a separate violation. A penalty imposed pursuant to this subdivision shall be apportioned 50 percent to the county in which the violation occurred, if applicable, and 50 percent to the office of the Secretary of State for purposes of bolstering ballot marking system security efforts.

(2) Immediate commencement of proceedings to withdraw certification or conditional approval for the ballot marking system in question.

(3) Prohibiting the manufacturer or vendor of a ballot marking system from doing elections-related business in the state for one, two, or three years.

(4) Refund of all moneys paid by a local agency for a ballot marking system or a part of a ballot marking system that is compromised by an unauthorized change or modification, whether or not the ballot marking system has been used in an election.

(5) Any other remedial actions authorized by law to prevent unjust enrichment of the offending party.

(b) (1) The Secretary of State may seek all of the following relief for a known but undisclosed defect, fault, or failure in a ballot marking system or part of a ballot marking system certified or conditionally approved in California:

(A) Refund of all moneys paid by a local agency for a ballot marking system or part of a ballot marking system that is defective due to a known but undisclosed defect, fault, or failure, whether or not the ballot marking system has been used in an election.

(B) A civil penalty from the offending party or parties, not to exceed fifty thousand dollars ($50,000) per violation. For purposes of this subdivision, each defect, fault, or failure shall be considered a separate violation. A defect, fault, or failure constitutes a single violation regardless of the number of ballot marking system units in which the defect, fault, or failure is found.

(C) In addition to any other penalties or remedies established by this section, the offending party or parties shall be liable in the amount of one thousand dollars ($1,000) per day after the applicable deadline established in Section 19290 until the required disclosure is filed with the Secretary of State.

(2) A penalty imposed pursuant to subparagraph (B) or (C) of paragraph (1) shall be deposited in the General Fund.

(c) Before seeking any measure of relief under this section, the Secretary of State shall hold a public hearing. The Secretary of State shall give notice of the hearing in the manner prescribed by Section 6064 of the Government Code in a newspaper of general circulation published in Sacramento County. The Secretary of State also shall transmit written notice of the hearing, at least 30 days prior to the hearing, to each county elections official, the offending party or parties, any persons that the Secretary of State believes will be interested in the hearing, and any persons who request, in writing, notice of the hearing.

(d) The decision of the Secretary of State to seek relief under this section shall be in writing and state his or her findings. The decision shall be open to public inspection.

SEC. 87. Section 19274 of the Elections Code is amended and renumbered to read:

19294. (a) The Secretary of State may seek injunctive relief requiring an elections official, or any vendor or manufacturer of a ballot marking

system, to comply with the requirements of this code, the regulations of the Secretary of State, and the specifications for the ballot marking system and its software, including the programs and procedures for vote marking and testing.

(b) Venue for a proceeding under this section shall be exclusively in Sacramento County.

SEC. 88. Section 19275 of the Elections Code is amended and renumbered to read:

19295. A ballot marking system or part of a ballot marking system shall not do any of the following:

(a) Have the capability, including an optional capability, to use a remote server to mark a voter's selections transmitted to the server from the voter's computer via the Internet.

(b) Have the capability, including an optional capability, to store any voter identifiable selections on any remote server.

(c) Have the capability, including the optional capability, to tabulate votes.

SEC. 89. Section 19282 is added to the Elections Code, to read:

19282. The Secretary of State shall not certify or conditionally approve any ballot marking system that includes features that permit a voter to produce, and leave the polling place with, a copy or facsimile of the ballot cast by the voter at that polling place.

SEC. 90. Section 19283 is added to the Elections Code, to read:

19283. (a) The Secretary of State shall adopt and publish standards and regulations governing the use of ballot marking systems. The Secretary of State may also adopt, in whole or in part, voluntary federal ballot marking voting system standards established by the United States Election Assistance Commission or its successor agency.

(b) Ballot marking system standards adopted by the Secretary of State pursuant to subdivision (a) shall include, but not be limited to, all of the following requirements:

(1) The machine or device and its software shall be suitable for the purpose for which it is intended.

(2) The ballot marking system shall preserve the secrecy of the ballot.

(3) The ballot marking system shall be safe from fraud or manipulation.

(4) The ballot marking system shall be accessible to voters with disabilities and to voters who require assistance in a language other than English if the language is one in which a ballot or ballot materials are required to be made available to voters.

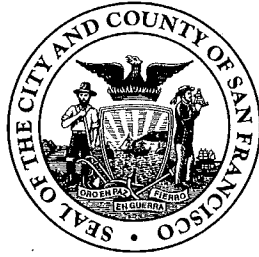SEC. 91. Section 19286 is added to the Elections Code, to read:

19286. The person, corporation, or public agency applying for certification of a ballot marking system is responsible for all costs associated with the testing and examination of the ballot marking system.

SEC. 92. Section 6.5 of this bill shall only become operative if (1) this bill and Assembly Bill 214 are both enacted and become effective on or before January 1, 2014, and (2) Assembly Bill 214 adds Section 19104 to

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the Elections Code, in which case Section 6 of this bill shall not become operative.

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BOARD of SUPERVISORS

City Hall
Dr. Carlton B. Goodlett Place, Room 244
San Francisco 94102-4689
Tel. No. 554-5184
Fax No. 554-5163
TDD/TTY No. 554-5227

MEMORANDUM

TO: John Arntz, Director, Department of Elections

FROM: Alisa Somera, Clerk, Rules Committee
            Board of Supervisors

DATE: November 26, 2014

SUBJECT: LEGISLATION INTRODUCED

The Board of Supervisors' Rules Committee has received the following **substitute** legislation, introduced by Supervisor Wiener on November 25, 2014. This matter is being referred to your department for informational purposes.

File No. 141105-2

Resolution committing the City and County of San Francisco to work with the California Association of Voting Officials and other jurisdictions and organizations to create new voting systems using open source software; and to study the feasibility of the City and County of San Francisco developing and using a new voting system, either whole or in part, through a collaborative model like the Los Angeles County Voting Systems Assessment Project.

If you wish to submit any reports or documentation to be considered with the legislation, please send those to me at the Board of Supervisors, City Hall, Room 244, 1 Dr. Carlton B. Goodlett Place, San Francisco, CA 94102.

BOARD of SUPERVISORS

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MEMORANDUM

TO: John Arntz, Director, Department of Elections

FROM: Alisa Somera, Clerk, Rules Committee
            Board of Supervisors

DATE: October 28, 2014

SUBJECT: LEGISLATION INTRODUCED

The Board of Supervisors' Rules Committee has received the following proposed legislation, introduced by Supervisor Campos on October 21, 2014. This matter is being referred to your department for informational purposes.

File No. 141105

Resolution committing the City and County of San Francisco to become a member of the California Association of Voting Officials and pledging to join efforts with participating jurisdictions to create new voting systems utilizing free open source software for elections.

If you wish to submit any reports or documentation to be considered with the legislation, please send those to me at the Board of Supervisors, City Hall, Room 244, 1 Dr. Carlton B. Goodlett Place, San Francisco, CA 94102.

Introduction Form

By a Member of the Board of Supervisors or the Mayor

I hereby submit the following item for introduction (select only one):

☐   1. For reference to Committee.

     An ordinance, resolution, motion, or charter amendment.

☐   2. Request for next printed agenda without reference to Committee.

☐   3. Request for hearing on a subject matter at Committee.

☐   4. Request for letter beginning "Supervisor [   ] inquires"

☐   5. City Attorney request.

☐   6. Call File No. [   ] from Committee.

☐   7. Budget Analyst request (attach written motion).

☒   8. Substitute Legislation File No. | 141105

☐   9. Request for Closed Session (attach written motion).

☐   10. Board to Sit as A Committee of the Whole.

☐   11. Question(s) submitted for Mayoral Appearance before the BOS on [   ]

Please check the appropriate boxes. The proposed legislation should be forwarded to the following:

     ☐   Small Business Commission   ☐   Youth Commission   ☐   Ethics Commission

           ☐   Planning Commission   ☐   Building Inspection Commission

Note: For the Imperative Agenda (a resolution not on the printed agenda), use a Imperative
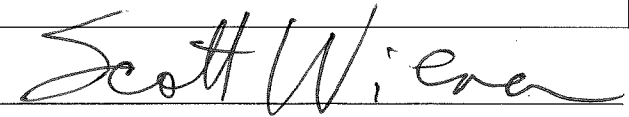
Sponsor(s):

Wiener

Subject:

Supporting the Creation of Open Source Voting Systems and Studying New Models of Voting System Development

The text is listed below or attached:

Resolution committing the City and County of San Francisco to work with the California Association of Voting Officials and other jurisdictions and organizations to create new voting systems using open source software and to study the feasibility of the City and County of San Francisco developing and using a new voting system, either whole or in part, through a collaborative model like the Los Angeles County Voting Systems Assessment Project (VSAP).

Signature of Sponsoring Supervisor: _Scott Wiener_

For Clerk's Use Only:

Introduction Form

By a Member of the Board of Supervisors or the Mayor

I hereby submit the following item for introduction (select only one):

☒   1. For reference to Committee.

        An ordinance, resolution, motion, or charter amendment.

☐   2. Request for next printed agenda without reference to Committee.

☐   3. Request for hearing on a subject matter at Committee.

☐   4. Request for letter beginning "Supervisor [   ] inquires"

☐   5. City Attorney request.

☐   6. Call File No. [   ] from Committee.

☐   7. Budget Analyst request (attach written motion).

☐   8. Substitute Legislation File No. [   ]

☐   9. Request for Closed Session (attach written motion).

☐   10. Board to Sit as A Committee of the Whole.

☐   11. Question(s) submitted for Mayoral Appearance before the BOS on [   ]

Please check the appropriate boxes. The proposed legislation should be forwarded to the following:

☐ Small Business Commission   ☐ Youth Commission   ☐ Ethics Commission

☐ Planning Commission   ☐ Building Inspection Commission

Note: For the Imperative Agenda (a resolution not on the printed agenda), use a Imperative
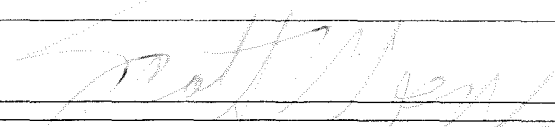
Sponsor(s):

Wiener

Subject:

Resolution Joining the California Association of Voting Officials in Support of Open Source Software for Elections

The text is listed below or attached:

Resolution committing San Francisco to become a member of the California Association of Voting Officials and pledging to join efforts with participating jurisdictions to create new voting systems utilizing free open source software for elections.

Signature of Sponsoring Supervisor: _____

For Clerk's Use Only: