Report Contents

NOTE: This report is based on the best information available at the time of writing. This information does not allow precise estimates of the time and cost of these methods, even relative to the recently completed manual recount of the 2006 auditor's race. There are some technical issues that can only be answered by knowledgeable engineers and managers at the voting equipment companies. However, each of these approaches is at least technically feasible and should be studied further to assess cost, amount of labor required, speed and accuracy. The ordering of methods by cost is necessarily based on very rough estimates for purposes of illustration. More definitive estimates would be required to make recommendations about which methods are most appropriate for Vermont.

1. Findings

1. **Bottom-line**: It is feasible to implement instant runoff voting (IRV) for statewide elections in Vermont. Options include using hand counts, precinct-based optical scanning equipment, centralized optical scanners and off-the-shelf office scanners.

2. **Full discussion of options**: There is a range of options for implementing IRV in statewide races in VT, from a hand count to a fully automated, uniform statewide system using new voting equipment.

3. **An effective process for planning implementation**: Election officials are generally very experienced at using voting systems but generally lack the specific skills, knowledge and experience needed for designing new voting systems and procedures, especially voting systems that are capable of administering instant runoff elections. Genuine experts and ample public input should be engaged for this purpose.

4. **Best practices**: San Francisco and Burlington's successful though imperfect implementations provide valuable lessons for other jurisdictions.

5. **Tested means to implement IRV:** IRV has recently been implemented in the United States by hand, by using Diebold Accu-Vote optical scanners and by using ES&S precinct and central optical scanners.

6. **The role of major equipment vendors**: American vendors have little experience with ranked ballot elections. One with limited experience is LHS Associates, which has administered ranked ballot elections in Cambridge (MA) and Burlington on a legacy, Unix-based system with severe memory limitations. The second is ES&S, which has administered three ranked ballot elections in San Francisco on legacy equipment with a highly restrictive ballot design and several significant system design shortcomings. ES&S is also currently in negotiations to implement IRV in North Carolina. The third major U.S. vendor, Sequoia, is under contract with Alameda County (CA) to deliver IRV-ready equipment, is expected to implement IRV in November 2008 in Pierce County (WA) and has negotiated a similar contract in San Francisco, whose next IRV election is November 2007.

7. **Potential role of other vendors**: Some vendors for private elections and many overseas companies and election officials have significant experience administering ranked ballot elections.

8. **Voter education**: Voters have easily adapted to instant runoff voting even with very low cost, limited voter education programs. San Francisco spent around $2 per registered voter, but exit polls showed that most of the voter awareness of IRV resulted from a small portion of the voter education spending. Burlington's quantitatively more successful voter education program cost around $0.50 per registered voter.

2. Introduction and assumptions

This report describes nine methods for implementing instant runoff voting (IRV) for statewide races in Vermont. It details lessons learned from the implementation of IRV in San Francisco and Burlington and offers guidance on ballot design, voter education and poll worker training.

Assumptions for all methods under consideration:

- First choices are counted in towns on Election Night using current procedures (hand count or machine count) and released to the public just like results are under today's rules.
- If an IRV tally is needed, it will begin at least one week and one day after the election, after ballots are transported to regional counting centers.
- As proposed in the latest versions of Vermont IRV legislation, in the event of an IRV tally, all but the top two candidates are simultaneously eliminated, and each ballot where the first choice is eliminated counts for whichever of the top two candidates is ranked higher on the ballot.
- Election Day demands on local election clerks are limited to the need to respond to questions from voters about the new voting method using state-provided materials.
- IRV methods are ordered from lowest cost to highest cost based on very rough estimates for conducting IRV tallies in at least two races.
- Based on the recommendation of the Secretary of State's office, a uniform machine-readable ballot is used in both hand count and machine towns because machine-readable ballots are easier to hand count than the bedsheet ballot used in hand count towns.
- New software for performing the IRV tabulation is not needed. The tabulation can be performed manually using standard spreadsheet or database programs and the software and code used in Burlington and Cambridge, Massachusetts is freely available at no cost. If ballots are scanned, the equipment only needs to produce the set of rankings. It does not need to perform the IRV tabulation.

Other important considerations:

Statewide races to which IRV may apply:

- Federal races (at most three in a given election year, and sometimes only one): Electors for U.S. President/Vice President, U.S. Senator, U.S. Representative
- Statewide races that have a majority requirement (three in every election): Governor, Lieutenant Governor, Treasurer
- Statewide races with no majority requirement (three in every election): Secretary of State, Auditor of Accounts, Attorney General

Initial implementation of IRV may be for a subset of the statewide races.

Election Day effect on local clerks: The biggest effect is the need to respond to questions from voters about using the new system. In some scenarios, hand count towns will continue to hand count ballots, but they will use a machine-readable ballot. Changing ballot formats requires voter education. In some scenarios, some or all towns would start using new, precinct-based optical scanning equipment, but the process of adopting and using new optical scan equipment would be no different under IRV than under traditional voting methods.

Post-election effect on local clerks: Because the IRV tally in almost all scenarios below occurs after Election Day, the post-election effect of IRV on local clerks is minimal. The Secretary of State's office has suggested that clerks would be responsible for appointing two election officials to transport ballots to regional counting centers and, under hand counting scenarios, for providing two additional officials for each increment of 1,000 ballots. Based on the total votes in the 2006 governor's race, this would entail around 800 election officials. This is dramatically more election officials than are used in places such as Ireland and Australia that have hand counted IRV ballots for many years. Authorizing legislation could allow for fewer counters.

Statutory provisions for IRV hand counts: The recent auditor's recount reveals that the entire method of paying and recruiting election officials for recounts should be updated. Whether the Court Clerk or the Secretary of State is ultimately responsible for recruiting recount election workers, the continued assistance of party officials and municipal clerks is probably beneficial. However, the responsibility of recruiting election workers for the manual IRV tally should almost certainly not fall to the municipal clerks or boards of civil authority. Also, the current manual recount law provides for four election officials to both count and recount the ballots in a recount. This would be overkill for a manual IRV tally. Instead, the legislation could specify that teams of an appropriate size count IRV ballots a single time and include additional provisions for a manual IRV recount. Any authorizing legislation should probably give the Secretary of State or court clerk wide latitude to select counting methods and procedures that are most appropriate for a statewide IRV tally in Vermont.

Sequential elimination vs. bulk elimination: Instant runoff election can be conducted either with sequential elimination or bulk elimination. In bulk elimination, which is the method specified in current versions of IRV legislation, all but the top two candidates in terms of first choices are simultaneously eliminated in bulk. Each ballot whose first choice lists an eliminated candidate is counted for whichever of the top two candidates is ranked higher on the ballot.

In sequential elimination, candidates are eliminated one by one from the bottom and ballots are counted in rounds. In each round, each ballot counts as one vote for the highest ranked candidate on the ballot who has not been eliminated. Rounds of counting continue until a candidate receives a majority of the votes in that round. In a hand count, each time a candidate is eliminated, all ballots for that eliminated candidate are transferred to the next-ranked candidate who has not been eliminated.

This report focuses on methods for conducting bulk elimination of all but the top two candidates. Ways to modify these methods to handle sequential elimination of candidates (meaning multiple rounds of IRV counts) are noted where applicable.

Voter education: The goal of voter education is to instruct voters how to rank candidates in IRV contests. This can be inexpensively achieved through good ballot design, posters and flyers in polling places and a mailing to voters. Election judges need to be trained to respond to the common questions (can I rank the same candidate more than once, does ranking a second choice hurt my first choice, etc.). In some scenarios, voters in hand count towns would use a machine-readable ballot. Voters historically have adapted well to this change, although good publicity of the change before the election and good graphics in polling places are important.

Cost: We have not yet extensively analyzed costs, but we plan to estimate the costs of the methods at least relative to a hand count after reviewing the estimates in the Secretary of State's feasibility report. The lower cost options involve using IRV-capable central scanners, Accu-Votes with IRV firmware and VTS (a Unix-based system for accumulating results) as central scanners,

or commercial, off-the-shelf scanners and form reading software. The highest cost scenario involves acquiring IRV-capable precinct scanners for every polling place in the state. The cost of these options would depend on the per unit cost of equipment, the cost of any software needed, the number of machines needed based on the number of regional counting centers, the estimated number of ballots and races requiring an IRV tally and the amount of labor required for hand counting and document preparation.

Access for people with disabilities: The president of the IVS Vote-by-phone system that Vermont uses for disability access has stated that his system can handle ranked ballots. These ballots can be counted by hand or data-entered to merge them with the rest of the votes. If a machine count is used for the IRV tally, these ballots could be re-made on compatible ballots with an appropriate change in law.

Federal testing and certification: Federal certification is not required for equipment used in federal elections. The federal Election Assistance Commission has promulgated Voluntary Voting System Guidelines, but states are not obligated to follow these standards or test voting equipment against them. Because Vermont has not adopted these standards, no federal testing or certification is needed to use voting equipment in federal elections in Vermont. Furthermore, even in states that follow the federal standards, the standards do not apply to unmodified, commercial off-the-shelf (COTS) hardware and software, such as proposed in the final option in this report.

3. Summary of methods ordered from low cost to high cost based on rough estimates

IRV Method 1:   Post-election central scan using Diebold Accu-Vote scanners
IRV Method 2:   Diebold Accu-Votes with IRV firmware in some polling places
IRV Method 3:   Use commercial, off-the-shelf office scanners and form reading software
IRV Method 4:   "One-touch" IRV hand count
IRV Method 5:   Traditional IRV hand count
IRV Method 6:   Data entry
IRV Method 7:   IRV-capable central scanners
IRV Method 8:   New IRV-capable precinct-based optical scanner for all current machine towns
IRV Method 9:   New IRV-capable precinct-based optical scanner for all or most polling places in the state.

Table 1. Summary of IRV methods
Note: All methods use a machine-readable ballot in both hand count and machine towns per recommendation of the Secretary of State's office.

#	Description of method	Rough estimate of cost	Election Day effect on hand count towns	Election Day effect on machine towns	Need for central equipment	Ability to handle multiple races	Ability to handle sequential elimination	Cost considerations for the state	Technical questions to be resolved
1	Post-election Accu-Vote central scan	Low	None	No change, but must use VTS-compatible ballots	Accu-Votes with IRV firmware and sufficient memory cards	No change	No change	LHS fees, VTS computers for counting centers	Confirm Accu-Votes can read the same ballot with both plurality and IRV firmware
2	Diebold Accu-Votes with IRV firmware in some polling places	Low	None	Use of IRV firmware in some towns, possible need to swap memory cards on Election Day	Accu-Votes for hand count towns and all machine towns not using IRV firmware	No change	No change	LHS fees, VTS computers for counting centers	None

3	Commercial off-the-shelf scanners	Low	None	No change	Commercial digital scanners	No change	No change	Access to scanners plus form-reading software	None
4	"One-touch" hand count	Medium	None	No change	None (hand count)	No change	Not suitable	Labor	Training required, accuracy, speed
5	Traditional hand count	Medium	None	No change	None (hand count)	Sequential	No change	Labor	Training required, accuracy, speed
6	Data entry	Medium	None	No change	None (data entry)	No change	No change	Labor	Training required, accuracy, speed
7	IRV-capable central scanners	High	None	No change	IRV-capable central scanners	No change	No change	Acquisition of central scanners that can store ballot images of Accu-Vote ballots	Existence of scanners that can store rankings from Accu-Vote ballot
8	IRV-capable precinct scanners for machine towns	Higher	None	New precinct scanners	IRV-capable precinct or central scanners	No change	No change	Acquisition of IRV-capable precinct scanners	None
9	IRV-capable precinct scanners in all or most polling places	Highest	New precinct scanners in most if not all hand count towns	New precinct scanners	Not needed (use precinct scanners for any remaining hand count towns)	No change	No change	Acquisition of IRV-capable scanners statewide	None

4. Methods of implementing instant runoff voting for statewide races in Vermont

Note that in some years there may be majority winners in the initial count of first choices in all statewide elections, meaning no IRV tabulation procedures (whether by hand or automation) will be needed. For elections in which one or more races require an IRV tally, there are at least nine options for conducting the tally.

The lowest-tech approach to administer IRV is the approach that was used in IRV elections for public office in the United States and other countries during most of the 20th century: hand counting ballots. It should be stressed that any hand count IRV tabulations in Vermont beyond counting first choices would not be done at the polling places on Election Night, but rather at a subsequent "recount."

These methods are approximately ordered from lowest cost to highest cost based on a very rough estimate.

IRV Method 1: Post-election central scan using Diebold Accu-Vote scanners

First choices in IRV races are counted on Election Day by hand in hand count towns and on the Accu-Votes using plurality firmware in machine towns. The 128K capacity of the memory cards would not be a limitation because on Election Day, the memory cards are simply storing vote totals for each race rather than individual rankings.

For towns using voting machines, this would not entail any change in Election Day procedures because the machines would only count first choices in the town; the machines would simply ignore 2nd, 3rd and subsequent choices. In hand count towns, election officials would simply count the ballots using existing procedures (ones not affected by the change in ballot design). They would count first choices in the IRV races and ignore marks for second and lower choices.

In the event that one or more races require an IRV tally, all ballots would be transported to regional counting centers and scanned on Accu-Votes with the IRV firmware. The rankings would be transferred from the memory cards to another computer and the IRV tally would be performed with the freely available software used in Burlington or Cambridge (MA) or manually on a spreadsheet or database program. As occurred in San Francisco and Burlington, election officials can make the rankings publicly available for the public to verify the official count and for research purposes. Burlington even made the IRV tallying software and code available on its website. That software has been tested at scales greater than required for Vermont statewide elections.

At the regional counting centers, all ballots would be fed into the Accu-Votes and rankings would be stored on the memory cards. The 128K memory cards held around 1,000 ballot images in the Burlington election, so election officials would need to replace full memory cards with blank ones periodically through the count and download the rankings. This would slow down scanning slightly. It may be possible to mount a larger memory card on the Accu-Votes using a commercially available adapter, in which case it would not be necessary to swap memory cards during scanning, but this will require testing to verify.

It is not currently known if it is possible to scan an Accu-Vote ballot with VTS codes on a scanner with plurality firmware and then scan the same ballot on a scanner with IRV firmware. *Further research and testing are necessary to determine how to resolve this question.*

For background, it should be stated that the Accu-Votes can be run both with GEMS, a Windows-based system for accumulating results, and with VTS, an older, Unix-based system for accumulating results. Accu-Votes today use one type of firmware for plurality elections and another type for ranked choice elections.

According to LHS Associates, ballots contain codes that are compatible with either the older VTS system or the newer GEMS system, but not both. Diebold has only developed ranked ballot firmware for the VTS system.

Thus, if you want to count first choices on Election Day using plurality firmware and then store ballot images a week later for an IRV tally, you have to use the older VTS system for both counts, or Diebold needs to develop ranked choice firmware for GEMS. Cambridge (MA) is interested in upgrading its system, so it might be able to share costs. Except for Burlington, all Vermont Towns with Accu-Vote machines use VTS. Burlington uses GEMS software for all elections, except for its mayoral elections, when it uses the VTS software.

Note that with the plurality firmware, the memory card stores running totals for each ballot position. At the end of the day, the machine can print out vote totals for all candidates. The ranked choice firmware stores the actual rankings and votes from each ballot and cannot print out vote totals at the end of the day.

Sequential elimination: This method is suitable for sequential elimination.

IRV Method 2: Diebold Accu-Votes with IRV firmware in some polling places

This method is similar to Method 1, except that some machine towns would use IRV firmware in the Accu-Votes on Election Day. The machines would store rankings in IRV races, so ballots from these towns would not need to be transported to a regional counting center and re-scanned. If any machine towns did not use the IRV firmware on Election Day, ballots from those towns would be transported to regional counting centers along with ballots from hand count towns and all of those ballots would be scanned with the IRV firmware.

This method was used in Burlington's successful IRV election in March 2006.

As described above, Accu-Votes currently have 128K memory cards that have a capacity to store approximately 1,000 ballot images depending on the number of races and candidates. For towns that expected more than 1,000 ballots to be cast on their machines, they would need to either swap memory cards during Election Day before 1,000 votes were reached or use an adapter coupled to a larger memory device, pending proof of the technical viability.

Note that this method would likely cost less than the previous one because fewer ballots would be transported to regional counting centers for rescanning. Because this method involves most of the steps in Method 1, it is listed after Method 1 even though it probably costs less than Method 1.

Sequential elimination: This method is suitable for sequential elimination.

IRV Method 3: Commercial, off-the-shelf office scanners and form reading software

A novel and possibly the most cost-effective approach for Vermont would be to use commercial, off-the-shelf scanners to take digital images of all ballots and then to use form-reading software to read, review and store voting marks.

In addition to minimizing cost, this approach provides unparalleled transparency, security and accuracy. It also entails no change in equipment, ballot or procedures for the machine towns and only requires minor changes to the ballot format in hand count towns. The simplest approach would be to use an Accu-Vote ballot for statewide uniformity. This would make ballot proofing and printing at the state level easier and would allow for machine recounts if needed in a hand count town. However, the only change to hand count ballots actually necessary for this method would be to reformat the ballot to fit on a paper size that can be scanned by commercial scanners.

Modestly priced, commercial office scanners can image 40-60 double-sided ballots per minute. Then commercial form-reading software can be used to process the voting marks on the ballot and review ballots to ensure they are being counted according to how the voter intended. Unclear or questionable ballots can be flagged and reviewed by election officials using the graphic image of the ballot, or even by pulling out the actual paper ballot from the stack.

TrueBallot, the company the author works for, recently conducted a complete audit of a hand counted IRV election in Takoma Park, Maryland using off-the-shelf scanners.

Note that election administration companies have used this type of system in private elections for years and that a group composed largely of volunteers recently assembled such a system for ranked choice elections for a non-profit membership organization with 100,000 voters in five cities. Several vendors produce the type of form reading software that is required. A by no means exhaustive list of vendors -- and with no endorsement or recommendation intended -- includes:

- Remark software from Gravic, Inc. (http://www.gravic.com)
- ABBBY (http://www.abbyy.com)
- I.R.I.S. (http://www.irislink.com/c2-373/Form-reading.aspx)

The benefits of this approach are:

- Security: preserving actual paper ballots along with digital images of them makes it easy to detect and correct any fraudulent post-election alterations to the ballots or data;
- Transparency: digital images can be compared to the original paper and any member of the public can review the images to verify official counts;
- Flexibility: The form reading software can read ballots of virtually any format as long as the marks are in a recognizable shape, such as a square or bubble, and the paper fits the scanner hopper. It is possible to have different ballot formats and simply tell the software where to find the voters' marking locations on each format.
- Low cost: Off-the-shelf scanners can process thousands of ballots per hour, so far fewer staff would be required with this approach than with any type of hand count. The computer work necessary to set up such a system is quite simple and straightforward,

requiring no special skills or training. Alternatively, the state could hire a company to provide a turnkey scanning and tabulation solution.

Sequential elimination: This method is suitable for sequential elimination.

IRV Method 4: "One-touch" IRV hand count

The caller looks at a ballot and calls out the name of whichever of the top two candidates is ranked higher (or "exhausted" if neither is ranked). The tally clerk then makes a mark for that candidate. Multiple IRV races can be tallied simultaneously using this method.

Although performed at the subsequent IRV "recount," this method is based on the current law for manual Election Night counts with one key innovation. Since the official canvas of first choices determines which two candidates advance in the instant runoff and which candidates are simultaneously eliminated, IRV ballots can be counted in a single operation. The caller examines an IRV ballot. If the first choice is for one of the top two candidates, the ballot counts for that candidate in the IRV tally. If the first choice is for any other candidate, the ballot counts for whichever of the top two candidates is listed higher on the ballot or for "Exhausted" if neither of the top two candidates is ranked.

Because the caller has to do something slightly more complex than simply calling out the mark in a race – she has to call out the first choice if it is one of the top two candidates, the top candidate ranked higher if the first choice is not one of the top two or exhausted if neither of the top two candidate is ranked – this method requires more training, supervision and monitoring than a hand recount in a plurality contest.

A tally table for an IRV race in which the top two candidates were Candidates A and B in the first IRV tally and candidates C and D in the second IRV tally might look like this:

Table 2. Minimal IRV hand count tally table for two races.

Race #1	Tally
Candidate A	
Candidate B	
Exhausted	
Race #2	Tally
Candidate C	
Candidate D	
Exhausted	

Each ballot then leads to a single tick mark in one row of the tally table, and counting teams can tally as many IRV races simultaneously as needed.

For auditing purposes, tally sheets could be designed to distinguish between ballots with first choices for the top two candidates and those that list an eliminated candidate first. They could also specify the top ranked candidate for all ballots that became exhausted. Tally clerks would be instructed to call out both the first choice and the candidate the ballot counts for ("First choice Smith, counts for Jones"), and clerks would make a tally mark in the correct cell. A tally sheet might look like this, where the top two candidates are A and B, and C, D, E, etc. are the

eliminated candidates.

Table 3. Detailed IRV hand count tally table.

	Ballots counting for A	**Ballots Counting for B**	**Exhausted (neither A nor B ranked at all)**
As original first choice			
First choice for C			
First choice for D			
First choice for E			
No first choice			

Using this type of tally sheet would double-check the official totals for the first choices for all candidates and would show the number of exhausted ballots that counted for each of the eliminated candidates. However, before using such a system, it would be prudent to do substantial testing of the tally sheets to assess and maximize the speed and accuracy of these two approaches.

We suggest using cross-hatches on a tally sheet simply because that comports with current recount practices. Other methods could be used. For example, when a tally clerk calls out the candidate for whom an IRV ballot counts in a race, a numbered, color-coded card could be placed in a stack for that candidate. Then instead of totaling up cross hatches on a tally sheet, the clerks simply count the votes by reading the number from the last card on each candidate's stack. In fact, any kind of counting device could be used to keep track of each candidate's votes – from thumb-operated counters typically used for recording the number of people entering an auditorium to a spreadsheet program on a laptop PC. The key considerations are accuracy and transparency.

Note that unlike the first procedure described above, in cases where there are multiple races needing IRV tabulation, this procedure means each ballot only needs to be handled once, rather than repeatedly for each race. This dramatically reduces the time required.

Sequential elimination: This method is not suitable for sequential elimination.

IRV Method 5: Traditional IRV hand count

All IRV ballots will be counted by hand once they reach the regional counting centers.

A traditional hand count involves sorting and counting ballots by first choice. When a candidate is eliminated, the pile of ballots for the eliminated candidate is sorted by next choice and counted. New totals for all remaining candidates are recorded and another candidate is eliminated until one candidate receives a majority.

Under the proposed legislation, the official canvass gives first choice totals for all candidates and all but the top two candidates are simultaneously eliminated. Thus, the traditional hand count can consist of two steps:

1. Sort all ballots into two piles based on whether they count for either of the top two

candidates (first pile) or any of the eliminated candidates (second pile).
2. Sort and count each ballot in the pile for the eliminated candidates into three piles based on whichever of the top two candidates is ranked higher (one pile for each candidate) or an exhausted pile (third pile), if neither of the top two candidates is ranked on the ballot.

It is not necessary to sort and count the first choices for any of the candidates because official vote totals were reported in the canvass. The only ballots that need to be counted in the IRV tally are the ballots whose first choices were for eliminated candidates. Those ballots are then counted for whichever of the top two candidates is ranked higher on each ballot. Because a large majority of first choices are generally cast for the top two candidates, the percentages of ballots that need to be counted, as opposed to sorted, by hand is often quite low in an IRV tally.

Note that Accu-Votes can "outstack" ballots for specific candidates. This feature could be used to sort ballots into one pile for the top two candidates and one pile for all other candidates.

It is not possible to count multiple IRV races on the same ballot simultaneously using this method. If more than one race on a single ballot paper requires an IRV tally, the tally for the second race begins after the tally for the first race is completed.

Sequential elimination: This method is easily modified for sequential elimination. It simply requires sorting and counting ballots by first choice and sequentially eliminating the candidate with the fewest votes.

IRV Method 6: Data entry

Data entry firms can do on-site data entry with 99.95% accuracy using standard double-entry techniques and can provide precise estimates of time and cost. To save keystrokes, keypunch operators can enter rankings until one of the top two candidates is reached, as subsequent rankings do not come into play in the IRV tally.

The complete set of rankings can then be tallied with the freely available software used in Burlington or Cambridge (MA), on a spreadsheet, or on a database. Following the practice established in Burlington, election officials can then make public both the official IRV tally and the raw ballot image data for public verification, as well as the code and software for any IRV tallying software used.

Community school boards in New York City used this data entry method in 1996 in the proportional voting method of ranked choice voting before the school boards were abolished for reasons unrelated to election administration.

Again, note that this procedure means handling each ballot only once regardless of the number of races needing IRV tabulation.

If it turns out not to be possible to use scanners to store rankings, the most appropriate hand count technique might depend on the number of IRV tallies required. For example, if only one IRV tally is required, a traditional IRV hand count might be most cost-effective. If more than one IRV tally is required, it would be cost-effective to use a "one touch" hand count or data entry, since both of those methods only require handling the ballots one time regardless of how many IRV tallies are required.

IRV Method 7: IRV-capable central scanners

This method requires a small number of IRV-capable central scanners for the IRV "recount" centers. New equipment would have the benefit of being higher speed, having more memory and being able to store rankings from ballots originally read by Accu-Votes in the towns with plurality firmware.

Note that it has not yet been determined if modern Diebold central scanners, higher-speed hoppers set atop Diebold precinct scanners, or central scanners from other voting equipment companies are capable of reading Accu-Vote compatible ballots and storing rankings from them. We do know that Sequoia is upgrading its latest optical scan machines to be able to run IRV elections with its own ballot formats.

Vermont voters cast approximately 315,000 ballots in the 2004 presidential election. With 14 counting centers, this would require each center to count fewer than 23,000 ballots. With high-speed central scanners operating at 150 ballots per minute, a single machine could count all the ballots in a regional counting center in less than half a day. If Vermont leased as few as four machines, you could complete the count in all 14 regional centers in two days. Using precinct-based scanners in the regional counting centers would only take six machines half a day at 1,000 ballots per hour. 42 precinct scanners could complete the entire statewide count in one day. If you can mount hoppers on the precinct scanners, the scanning will go even quicker.

If it is not possible to acquire central scanners that can store rankings from Accu-Vote ballots, then using a common central scanner to capture ballot images for a post-election IRV recount would require machine count towns to acquire new voting equipment (IRV Method 8).

Sequential elimination: This method is suitable for sequential elimination.

IRV Method 8: IRV-capable precinct-based optical scanner for use in all current machine towns

Vermont would acquire new IRV-capable precinct scanners for all current machine towns. These machines would have sufficient memory to store rankings from all ballots placed in them during Election Day. Hand count towns would continue to count ballots by hand but would use a ballot compatible with the new optical scanners.

In the event of an IRV tally, ballots from hand count towns would be transported to regional counting centers. These ballots would be fed into the same precinct scanners used in machine towns or, if they were available and cost-effective, IRV-capable high-speed central scanners. Once the hand count ballots were scanned, the complete set of rankings would be aggregated and tallied using IRV software or a spreadsheet.

Currently, about 72 towns with approximately 88 wards use machines. San Francisco has negotiated to buy IRV-ready precinct scanners for $4,800 per unit. Vermont could place one scanner in each ward that currently uses voting equipment for around $500,000, and those same scanners could be used as central scanners to count IRV ballots from hand count towns after Election Day.

<u>Sequential elimination</u>: This method is suitable for sequential elimination.

IRV Method 9: IRV-capable precinct-based optical scanner for use in all or most polling places in the state

This is the highest-cost approach described in this report. It has the benefit of only requiring that ballots be scanned once and of producing preliminary IRV tallies soon after the polls close. This would preclude the need for transporting ballots to regional counting centers because all ballot images would be scanned and stored as voters put ballots in the machine and as poll workers feed absentee and provisional ballots into the machine.

A number of the smallest towns might continue to hand count ballots and not use voting equipment in the polling place. Ballots from these towns could be transported on Election Night or the next day to a nearby town or city with machines for scanning and aggregation of rankings if any IRV tallies are needed.

Sequoia is under contract with Alameda County (CA) to deliver IRV-capable precinct scanners by November 2008 and has negotiated a contract with San Francisco to deliver IRV-ready equipment for the November 2007 election. It will need to deliver the same system for Pierce County (WA) in its first IRV elections in November 2008. ES&S will probably be running IRV elections in North Carolina in 2007 and 2008 and in Minneapolis in 2009.

It probably does not make fiscal sense to use this method in Vermont's initial IRV elections, but if the state wishes to deploy voting equipment in all of its polling places, or in all of the larger towns, it may wish to revisit this option in the future, especially as other jurisdictions in other states deploy IRV-capable equipment. If the state deploys equipment in some but not all of the wards, the same equipment could be used for post-election central scanning of ballots from towns that continue to use Election Day hand counts.

<u>Sequential elimination</u>: This method is suitable for sequential elimination.

5. Voter Education

Ballot design

The most important part of voter education is the ballot, because it is the only material that every voter sees. An intuitive, well-designed ballot will ensure a high degree of voter success.

Several successful IRV ballot designs have been used in the US and other countries. Experience shows that all types of voters are capable of ranking candidates on a decently designed ballot. There are several ways to design user-friendly IRV ballots that are compatible with Vermont's current practices and machine and hand counts.

Burlington's ballot was based on the ballot format first used in Cambridge, Massachusetts, and included several graphical features designed to steer voters to cast valid votes. Burlington's valid ballot rate was 99.9% in the IRV race, which is higher than the rate in many non-IRV races across the country.

Appendix 1 contains IRV ballots from Burlington and San Francisco.

San Francisco's voting equipment required a ballot format with three columns. Given these constraints, the San Francisco ballot was about as user friendly as possible. It incorporated several features suggested by state officials and members of the public, including creative use of shading and colors, alignment of text, and wording of instructions.

The key to designing a good ballot is public input. Of course, one should follow basic principles of graphic design and human factors (see www.designfordemocracy.org for guidance). The proof of ballot design is quite simple: do voters find it easy to use? The only way to definitely answer that question is to show the proposed ballot design to a cross-section of people, have them fill out the ballot, request their feedback, and incorporate that feedback into the next draft of the ballot. After a couple iterations, you can be confident that your ballot will be as easy as possible for voters.

Vermont's statewide IRV ballot should be designed to allow a voter to mark a ballot in the same manner as under present law, such as filling in an oval in line with the voter's first choice. Only that oval should be read by the Accu-Vote machine using standard firmware. The alternate ranking ovals should be on a part of the ballot not read by the Accu-Vote machine, such as below the candidate names or in columns of read-heads not being used in that election.

Space on the ballot is an important consideration. Depending on the number of races using IRV and the number of candidates in those races, it may be possible to fit all of the races onto a single (front and back) ballot. If that is not the case, the IRV races could be placed on a separate ballot card.

Educational materials

The principal goals of voter education for an instant runoff voting election are to inform voters that they will be able to rank candidates in the IRV races and to instruct them how to rank their choices.

Exit polls revealed that most Burlington voters were aware that they would be able to rank

candidates for mayor, knew how to do it and found it easy. Burlington's approach can serve as a model for doing effective, low-cost voter education. Key components included:

- <u>Postcards to all residences</u>: These post cards informed voters that they would be able to rank candidates for mayor, graphically illustrated how to fill out the ballot and told voters how they could get more information.
- <u>Flyer with absentee ballots</u>: The flyer included with the absentee ballots repeats the same information as the postcard and uses the same graphics and overall look.
- <u>Banners and ads on public buses</u>: During the month before the election, Burlington posted a banner over key city streets and displayed educational ads on city buses.
- <u>Posters in polling places</u>: Large posters showing how to fill out a ballot and with simple, graphical instructions to avoid spoiling the ballot (no more than one choice per candidate, no more than one choice per column) should be prominently posted so that voters see several of them as they wait in line, register and fill out their ballots.
- <u>Flyers in voting booths</u>: A one page flyer with the same graphics as the large posters and absentee flyers should be posted in each individual voting booth. This flyer graphically shows how to fill out the ballot and how to avoid an error.
- <u>Error message flyers</u>: These flyers should be posted next to voting equipment in polling places that use voting machines. When a machine rejects a ballot with an erroneous vote in an IRV contest, the poll worker explains the error message to the voter, shows the voter the flyer, and asks if they would like to correct the error or cast the ballot "as is." There are typically two or three error messages that are unique to IRV races.
- <u>Frequently Asked Questions</u>: A flyer with answers to frequently asked questions should be available at town hall and in polling places.
- <u>Media outreach</u>: Over half of respondents to Burlington's exit poll reported that they heard about the new voting system from the media. At very little cost, election officials can enlist the media to inform the public that a new system is going to be used and to show how to fill out ballots.
- <u>Website</u>: Burlington and San Francisco both made excellent use of city websites to make information available to the public and to the media. These sites included sample ballots, copies of education materials, videos and flash animations, all of which can be borrowed for statewide use.

Burlington's voter education program cost approximately $0.50 per registered voter. By borrowing materials from Burlington and San Francisco and by realizing economies of scale, Vermont could conduct an effective first-time statewide voter education program for approximately $0.25 per registered voter. IRV voter education for subsequent elections would be lower and could be folded into existing voter outreach programs for little additional cost.

Appendix 2 has samples of the voter education materials used in Burlington.

Poll worker training

The job of a poll worker is little changed under instant runoff voting, but poll workers can play an important role in ensuring a smooth and successful implementation. It thus makes sense to provide some additional training to poll workers, at least for the first few IRV elections.

San Francisco and Burlington both provided an extra hour of training to poll workers about instant runoff voting. The training focuses on:

- Handing voters the ballot card with the IRV race(s) on top and telling the voter how to indicate their 1st, 2nd, etc. choices for those races.
- Reacting when the voting equipment rejects a ballot because of an erroneous ranking (duplicate ranking, skipped ranking, same candidate ranked more than once) by explaining the error, showing the voter the error message flyer and asking if the voter would like to correct the error or submit the ballot "as is."
- Responding to questions from voters, the most common of which are, "Do I have to rank more than one candidate?" and "What if I rank the same candidate more than once?"
- How to provide inquisitive voters with more information (read the FAQ, watch an educational video, call an election official, etc.)

As any election official knows, poll workers do not always follow their training. Additional IRV training is important, but it alone is not sufficient to ensure smooth functioning of polls on Election Day. In San Francisco and Burlington, poll watchers and election officials monitored polling places after they opened. In many cases, poll workers were not following IRV procedures completely. In both cities, election officials communicated with the poll workers to correct the procedures and by the middle of the day most polling places were largely following procedures for handing ballots to voters, responding to questions about IRV and addressing ballots rejected from the voting equipment. In Burlington, some polling places never did follow the poll worker IRV procedures, but even these polling places had no problems or voter confusion, as the ballot design and posters in the polling booths proved sufficient.

Poll worker training should consist of one hour of pre-election training and election officials should monitor polling places on Election Day and intervene when necessary to ensure that proper procedures are being followed.

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