HAND COUNTING PAPER BALLOT ELECTIONS

Paper Ballot Election Administration Training Videos

The NH Dept of State and Attorney General's office have provided excellent training materials for running (hand count paper ballot (HCPB) elections.

Please see the slides here:
Counting and Reconciliation on Election Night
http://www.democracyfornewhampshire.com/files/democracyfest_reconciliation_handcounting.pdf

Hand Count Methods and Costs
http://www.democracyfornewhampshire.com/files/Hand_count_training_D-fest_July_5_2007.pdf

Improving Disability Access for Voters
http://www.democracyfornewhampshire.com/files/Dem4NH_DisabilityVoting.pdf

Paper Ballot Election Basics

New Hampshire has many years' experience with hand counted paper ballot election administration and management. This document shares some information from the New Hampshire experience.

Management Considerations

Running a (hand count paper ballot (HCPB) election involves good management:

- YOU MANAGE PROCESS
- YOU MANAGE PEOPLE
- YOU MANAGE PAPER
- YOU MANAGE NUMBERS

With the right methodology and management in place, the costs come down; the integrity of outcome goes up.

Methods for Hand Counting Paper Ballots

New Hampshire has identified two accepted and widely used methods for hand counting paper ballots. The sort and stack method is considered much more effective and efficient than the read and mark method.

When you have 3-4 people on a team you have built in double checks. You don't need post count audits because you are doing simultaneous verification.

Why Hand Counting on Election Night is Better then Post Election Audits

There are legitimate concerns about chain of custody if you allow the counting to go past election night, and if you rely on post election "audits" rather than election night first count verification to ensure the integrity of election results.

 In NH our law requires that all counting is concluded on election night and local election officials may not leave the polls until this is done. Ballot boxes are then sealed and signed by election officials and stored locally unless collected for a recount.

Checks and balances are facilitated by the candidate-requested recounts, which begin the Wednesday of the week following election day, and are conducted centrally by the Secretary of State office; these are manual counts in full public observance.

NH has the most liberal recount laws in the country, and conducts 10-30 recounts every election. Typically at least one outcome is changed in the recount because we have close races – mostly due to the structure of our government, which includes a very large 400+-person citizen legislature (1 rep for every 3089 voters).

You can see a state recount on our website:
See our "**We're Counting the Votes and You can Too"** videos:
http://www.democracyfornewhampshire.com/node/view/2648

The Basics of Hand Count Paper Ballot Elections

Legal Infrastructure

In the Granite State all counting is done at the city ward or town polling places. It is all local. By constitutional law, local election officials and jurisdictions make decisions about which State-approved method of counting they will employ. Each jurisdiction has 8 constitutionally elected election officials. The election (rather than appointment) of community election officials results in a fairly intimate grassroots democratic election administration, wherein neighbors are beholden to each other in the conduct of their elections. Lyndeborough election official Walter Holland, when training his hand counters, admonishes them to "handle their neighbors' votes with care."

This is quite different from some of the bureaucratic management of elections seen outside of New England. This community-based election system is very supportive of grassroots democracy, and is one of the reasons visitors to NH often remark that "democracy works" here.

New Hampshire also has more than 200 years of case law relating to **voter intent.** The State Election Procedure Manual (http://www.sos.nh.gov/HAVA/Procedure%20Manual-90403.pdf) prescribes legally accepted protocols for determining voter intent in disputed cases.

Our state law also recognizes the hand counted paper ballot as the vote of record, and mandates all recounts to be manually counted.

The NH Constitution requires that our votes be "sorted and counted" in "open meeting."

55% of our polling places use Diebold optical scanners and 45% hand count. The NH legislature, citizen advocacy groups, and the NH HAVA State Plan Committee, are currently researching questions around the constitutionality of using secret vote counting technologies, and alternative solutions to rid the state of secret vote counting technologies.

Training for and Implementation of HCPB Elections

The State invests a lot into poll worker and election official training, and the State also holds forums for our election officials to facilitate information sharing and transmission of local traditions, lessons learned, and what not.

At close of the count and reconciliation, local jurisdictions communicate their numbers to the Secretary of State's office for centralized tallying.

Hand Counting Large Numbers of Paper Ballots, even Complex Ballots

Some of our hand count towns count up to 3600+ ballots on election night. I point this out because the national average number of ballots in any polling place is less than 1000. In other words, NH hand count towns manage up to 3-4 times the national average of ballots processed in any given polling place. Because of our large legislature, we also have some of the more complex ballots in the nation (many multi-member districts).

Hand Count Systems as Self Authenticating Systems for Election Integrity

With proper management, you can hand count your ballots using teams of 3-4 people, meaning **3-4 sets of eyes on every count, every tally mark, every contest, every ballot.** This is a self-authenticating system. Complex audit protocols, as defined in HR811, for instance, and as lobbied for by some activists, is moot in this type of system. Because we have identified methodologies that integrate reconciliation into the process of counting, the self-auditing mechanisms are quite advanced and ensure a high level of integrity for the system overall.

In this way, the "auditing" occurs during the first count itself, when it matters, because this, after all, is the count that declares the winner (as opposed to machine "audits" promoted in HR811 and elsewhere, which are intended, albeit weakly, to identify problems with the system but not intended to affect outcomes).

Hand Count Teams, Times, and Costs

Five or so self-auditing teams of 2-4 people can count roughly 1000 ballots in less than 2 hours. All told, with final reconciliation of registration checklists, number of ballots in and out, etc. the whole process is complete in less than 3 hours on election night. Many New Hampshire counters are community volunteers (all sworn in to office on election night).

We have found the local hand count method - using teams of 2 - 4 - cost 7 cents per contest on a ballot, meaning $1.05/ballot for a typical 15 contest general election ballot.

The State of NH, which conducts 10-30 manual recounts every election cycle, estimates cost for hand counting at around 7 cents per race on the ballot. This is for a 3-person team, each getting paid $10/hr.

What all this means is that it doesn't matter how large is the population of your state or county, it matters how many ballots are processed in any given polling place, and whether or not you have the political and community will and the infrastructural integrity to conduct hand count, observable, self-authenticating, elections.

Manual Central Tabulation

On election night in New Hampshire, results are tabulated manually by the Secretary of State's office. The State Police pick up the signed Return of Votes from each town and carry them in manually to the Secretary of State's office by around 8 AM in the morning after the election. The results are then entered manually to a spreadsheet program, and aggregated.

In the case of city wards, the signed Return of Votes from the Wards are manually carried to City Hall and the city results are then aggregated there. The city results are manually carried to the Secretary of State's office.

Hand Count and Reconciliation Methodology

The following information is found in the New Hampshire Election Procedure Manual.

HAND COUNTING INSTRUCTIONS

COUNTING INSTRUCTIONS – MODEL 1

SORT AND STACK BY CANDIDATE METHOD

NOTE: This is a model describing how some moderators have chosen to count ballots. State law authorizes the moderator to choose the system of hand counting to be used and to supervise the counting. RSA 659:60. This model is presented as a best practice in hand counting, based on the secretary of state's experience with hand recounts. However, neither state law nor the Secretary of State require that any particular system of counting be used. Moderators should ensure that the system of counting they adopt is accurate and efficient.

This process enables team members to simultaneously examine each mark on each ballot at least once, and to keep things simple by identifying choices in a single race at a time. If one team member makes a mistake, the other can catch it. This ballot sort and stack method is considered the faster and easier method, even though each mark is seen more times than the method using ballot reading and tally marks. Counters who have tried other methods express more pleasure with the sort and stack method because (a) it is simpler to count, and (b) counters are more confident in the results.

The instructions through step # 7 are the same as for counting using Model 2, the ballot-by-ballot method.

Step #1 – Close the Polls.

Step #2 – Verify that all absentee ballots have been processed.

Step #3 – Rearrange the polling place for counting. Counting tables must be at least 4 feet from the rail. All counting, however, must occur where it is visible to members of the public located outside the rail.

Step #3a – (Optional whether done election night or later)   Have the supervisors count the number of registered voters (including those who registered on election day) who are checked off as having voted on the checklist.

Step #4 – Identify all those who will be counting.

Step #5 – Identify those who will be counting who are not election officials and who have not taken an oath of office.

Step # 6 – Swear in these non-election officials as election officials (inspectors of election pro tempore). RSA 658:7 gives the moderator authority to appoint such election officials as he or she deems necessary. As election officials, the ballot counters are swearing or affirming that they will perform their duties lawfully and they become subject to criminal prosecution for official misconduct pursuant to RSA 666:3.

Step # 7 – Read the instructions for counting to all the election officials who will be counting.

Overview of the counting process: Ballots will be sorted into piles, with one pile for each candidate or alternative on a question, with separate piles for skipped (abstentions) and defective ballots. The piles will then be counted by grouping the ballots into groups of ten, then counting the number of groups. Where a close race is at issue, the process may be repeated by a second counting team and the results of the two teams compared to ensure they are the same. Once the results for one office or question are determined, the ballots will be re-sorted into piles for the next office or question.

Step # 8 - Open the ballot box(es) in view of the public. Place an established quantity of ballots on the table to be used by each counting team. Experience suggests that by counting ballots in groups of 50, when it becomes necessary to redo a particular part of the process because the results do not equal the number of ballots, this number is manageable.

Step #- 9 - Have the counting teams sort the ballots by the first race that is to be counted.

For example, at a town election where there is only one contested race, for selectman and there are three candidates for that single office, the ballots would be separated into 5 piles. One pile for each of the three candidates, one pile for skipped or abstention ballots (where no candidate received a vote) and defective ballots (where two or more candidates received a vote) and a final pile for write-in votes.

Step #10 – As the teams sort ballots into piles, if there is any question regarding how a ballot should be counted, call the moderator to your table and seek his or her instructions on how the ballot should be counted.

If a ballot is marked for any office or question in a way that does not leave the intention of the voter clear, or if, after getting basic instructions on how different marks are counted from the moderator, there is disagreement over how to count a particular ballot for a particular office, a vote should be taken of the election officers present and counting votes. RSA 659:64. The moderator should call together the election officers, discuss the ballot in question and take a vote. The majority rules, and if there if no alternative receives a majority of the votes, the ballot shall be treated as defective and therefore as an abstention for that office or question.

If there are many questioned ballots that need to be voted on, the moderator may choose to hold these ballots aside and vote on several at one time. If this is done, however, it is the best practice that all questionable ballots be voted on before the team totals are tallied up. This ensures that the election officials do not know whether the vote on a particular ballot will affect the outcome of the election. This process reinforces the neutrality and enhances the legitimacy of the counting process.

Step # 11 - Prepare a tally sheet. (Tally sheets should be prepared ahead of time.) The easiest procedure is to use sample ballots or photocopies of sample ballots. The tally sheet should have a space for the team to write in the total votes for each candidate, and the total skipped, defective, and write-in ballots.

Step #12 – Once each table has the ballots assigned to it sorted, start with the pile of ballots for the first candidate on the ballot. All other ballots (the other 5 piles) should be set aside, but remain in public view on that table. The team should then count the ballots in the first candidate's pile into groups of ten. The process used to make the groups of ten ballots should include the team members looking at the ballot to ensure (double check) it was initially sorted into the correct candidate's pile. Each group of ten ballots should be stacked at right angles, one on top of the other. Once a pile is completely grouped into piles of ten ballots each, the team can count the piles to obtain the total votes for that candidate in the pile. The team should write in the total votes for that candidate on the tally sheet. Then, start the grouping and counting process for the next candidate.

Step # 13 – When all the piles have been counted, that counting team is done with that set of ballots for that race.   The team should add the votes for each candidate and the number of skipped/abstention ballots and the number of defective or overvote ballots. This total should equal the total number of ballots in the pile (for example 50 if the recommendation to count ballots in groups of 50 is adopted).

Step # 14 – The team should then start the process over for the next office or issue to be counted.

Step # 15 – The moderator should designate some election officer who routinely works with numbers, often the clerk, to tally the team totals. Ideally a second election officer will assist and act as observer for this tallying process. Usually these individuals do not work on a counting team. As each team completes its totals, the tally sheets should be turned in.

Step # 16 - When the last pile(s) have been counted and turned into the clerk or whoever is tallying the team totals, the moderator should ensure that these officials have peace and quiet to finish the tallies. The tallying must occur in public, however, when all the election officers and counters gather at the tallying table and watch the final calculations it puts pressure on those making the final calculations and makes errors more likely. The tallying team should tally the results for all elections. The use of a printing calculator or a laptop with a spreadsheet program such as Excel allows the team or the moderator to check the printed tape or the computer file as a means of ensuring the accuracy of the tally. The final tallies should be written down and presented to the moderator.

Step # 17 – The moderator should stop before announcing the results and check the final tallies. If a count was done of the total number of persons checked off as having voted on the checklist, the tallies for each office and question should be verified against that count. The number of ballots used at the election must be determined. The total votes for all candidates, including write-ins, plus the skipped/abstention ballots plus the defective or overvote ballots should equal the total number of ballots used. The total votes for all candidates should never exceed the total number of ballots used or the total number of voters checked off as having voted at the election.

In towns or wards with 1000s of ballots and 1000s of voters checked off on the checklist, the moderator should be looking for any significant discrepancies between the totals.   It is difficult to get a perfect count from the checklist. Therefore, it is not essential that the total count for each office or question exactly match the vote totals. Provided the write-in, skipped and defective votes were tallied, however, the totals from one office to the next should be the same.   If any discrepancies are found, the moderator should investigate and attempt to resolve the discrepancy before declaring the results.   Every effort should be made to correct any error that leads to the total votes for all candidates exceeding the total number of voters voting or the total number of ballots used. Other discrepancies, provided the discrepancy is smaller than the margin of victory in the closest race, do not leave the will of the voters in doubt.

ELECTION NIGHT RECONCILIATION

Moderators are obligated to ensure that votes are counted accurately. RSA 659:60. Moderators are strongly encouraged to adopt an election night reconciliation procedure that checks the apparent results of the ballot counting against other known election statistics to ensure that the results are accurate.

It is inherent in the nature of an election night count, particularly at polling places that hand count ballots, that even the most careful election officials can make mistakes. Most of the officials conducting the counting will have been working for 12 or more hours before the counting process starts. Often the counting is done under the pressure of the candidates, the public and the press watching and anxiously waiting for the results. Therefore, taking the steps described below to ensure that the count is accurate is necessary.

Each election, a small number of polling places report results which are conspicuously inaccurate. The results report votes for the candidates in a given race that when added together total more than the reported number of ballots used, or more than the total number of voters reported as voting. In most cases, an inquiry by the Secretary of State or a recount disclose a counting or tabulation error. Either mistakes are made when tallying up the counts done by individual teams doing hand counts or errors are made in the manner in which ballots which were machine counted but contain write-in votes are counted.

When election night results are invalid on their face, this diminishes the public's trust in our election system. It often results in a call for a recount. Finding and correcting easily identifiable errors on election night is less work and less expensive than a recount.

A great deal of effort is taken to afford every qualified voter the opportunity to vote quickly and easily. That effort is ineffective unless every vote is accurately counted. Voters deserve the extra effort that is required to conduct a reconciliation of election night results with other election statistics.

BALLOT INVENTORY

The inventory of ballots is the starting point for the election night reconciliation of ballot counts. The ballot inventory establishes a baseline of how many ballots were used at the election. The moderator and clerk are required to keep track of the ballots made available for use at the election and those actually used. The Return of Votes that must be filed with the Secretary of State requires a report of the number of ballots used.

The Ballot inventory should start with determining the number of ballots received from the Secretary of State ("SOS"). During the counting process, determine the number of ballots produced by the Accessible Voting System ("AVS") the telephone – fax voting system that must be available for use by voters with disabilities.

The number of absentee ballots must be determined. This can be done during the hand count by segregating the ballots or this can be kept track of during the processing of absentee ballots. At elections where federal office only ballots are used, these will always be absentee ballots, the number of these ballots should be kept track of separately. When reconciling the votes cast for federal offices, these federal office only ballots should be included in the calculation of the total number of ballots used at the election. When reconciling the votes cast for state and county offices the number of federal office only absentee ballots must be subtracted from the total number of ballots used.

BALLOTS USED

Determine the total number of ballots used at an election as follows:

Election Day Ballots received from SOS = _____

+ Ballots from IVS	_____
+ State Absentee Ballots Cast	_____
+ Federal Office only	
Absentee Ballots Cast	_____
+ Absentee Ballots/Photocopy ballots	
used for election day ballots	_____
- Spoiled Ballots	_____

- Election Day Ballots not used   _____
= Total Ballots Cast at the Election   _____

COUNTING NUMBER OF VOTERS VOTING

The Return of Votes form requires that the number of voters checked off on the checklist as having voted must be counted and reported.

HAND COUNT POLLING PLACES. In a hand count town the check-in checklist should be counted and compared to the check-out checklist to establish the number of voters who voted.

MACHINE COUNT POLLING PLACES. In a machine count town the number of voters checked off on the check-in checklist should be compared to the results tape from the ballot counting machine. The total ballots counted reported on the end of the election results tape must be added to the number of ballots that had to be hand counted. Typically a small number of ballots are rejected as not readable by the Accuvote optical scanning machine. These should be put in the side pocket during polling hours and hand counted after the polls closed. These ballots, which are entirely hand counted, are not included by the machine in its report stating the total number of ballots counted. Other ballots which contain write-in votes or which were read by the Accuvote machine as entirely blank will be found in the write-in bin beneath the machine. These ballots are included in the total ballots counted reported by the machine. Do not add them in twice.

The total from the tape plus the number of completely hand counted ballots is a statistic that serves the same function in a machine count town that the check-out checklist serves in a hand count town. This total of ballots should be compared to the number of voters checked off as having voted on the check-in list to determine the total number of voters who voted.

TOTAL VOTES COUNTED

The next step in reconciliation is to determine the total votes counted for each contested office or question. To effectively reconcile the election night results it is necessary to count not only votes for candidates in a race but also the number of voters who skip the race, that is abstain (submit a ballot with no candidate marked for that race). A ballot in which the voter overvoted, that is marked two or more candidates for a race where the instruction is to vote for no more than one, should for this purpose be treated as a skipped or abstention. The same applies in a multi-seat office where the voter votes for more than the permissible number of candidates. Because the voter may only vote for the permitted number and it is impossible to determine which candidates the voter preferred most, the ballot is treated as if the voter did not vote for anyone for that office.

RACES BLANK, SKIPPED, OVERVOTED AND ABSTENTIONS. In a hand count polling place the counting teams should be instructed to record the number of ballots where the voter skipped or abstained from voting in the race and the number where the voter overvoted. These numbers must be reported along with the total number of votes for each candidate and write-in.

The ballot counting machine automatically records as a "blank" each ballot where the voter skipped the race or abstained or where the voter overvoted. It is necessary to count the abstentions and overvotes only on the ballots that are entirely hand counted. If entirely blank ballots are found in the write-in bin which were improperly marked and can be hand counted, it will be necessary to subtract that ballot from the total blanks reported on the machine tape for every race where a vote is counted for a candidate.

VOTES CAST FOR AN OFFICE

To determine the total votes cast for an office:

For each office (vote for no more than one):
    All votes for first candidate   ____
+ All votes for second candidate   ____
+ All voters for each additional candidate   ____
+ All write in votes   ____
+ All blank/skipped/abstention/
overvote ballots   ____
= **Total votes counted for the office**   ____

Reconciliation. The election night results are reconciled if each of these statistics are equal for each contested race or question.

Ballots used =   _____
Voters Voting =   _____
Total Votes Counted for the
Office/Question   _____

Small differences in the number of ballots used, number of voters voting and the total number of votes counted for an office or question sometimes occur even when counts are accurate due to human error in marking the checklist. Under no circumstances should the total votes counted for an office or question exceed the total number of ballots used or the total number of voters voting. Every effort should be made to resolve any discrepancies of this character. Errors in the other direction, where there are fewer total votes counted than ballots used or voters voting are problematic, but do not create conspicuously invalid results.

If you are certain there is no counting error, declare the final results even if a small difference exits. Occasional human error in checking the checklist as voters check in or in counting large numbers of blank ballots when determining the number of ballots used are unavoidable. Make the existence of that difference part of the record of the results. The difference usually will not be an issue, unless the margin of victory is less than the difference. In that case, a candidate will often request a recount.

EXPECTED UNDERVOTE

A second approach to reconciling election night results is to compare the total votes counted for each candidate and write in the total number of voters voting/total number of ballots used and access whether the undervote makes sense. At every election a certain number of voters will abstain in certain races, i.e. they will not vote for any candidate. Alternately, they will purposefully or by error vote for too many candidates, an overvote, thereby casting a ballot with the same effect as an abstention.

The rate of such undervoting is reasonably stable for the races at the top of the ballot. At elections where voters are voting for President of the United States, an undervote of ½ of one percent (.005) is common. Therefore, when reconciling the apparent results at an election where President is being voted for, if your results suggest that more than 3% (.03) of the voters did not vote for President, this is a warning sign. This result is possible, but should prompt the moderator to recheck the results before announcing them.

At an election where the Governor is the top candidate on the ballot, the undervoting rate is less constant, but generally should be less than 5% (.05).   The same is true for candidates for United

States Senate. If the apparent election night results indicate that more than 5% of the voters did not vote for Governor or United States Senator, the moderator should re-check the numbers before announcing the results.

The undervote rate for Representative to Congress can average around 4 – 5%. Therefore, results indicating that more than 7% of the voters did not vote in that race should prompt a review of the numbers. The undervote rate for offices below these on the ballot is too unpredictable to be helpful in reconciliation. However, it is sometimes the case that if an error is found regarding a top-of-the-ballot race, for example that the results from a hand count team were omitted from the tally, that error will have affected all the races and questions on the ballot. Checking the undervote for the top of the ballot races is another effective way to identify problems with the tallying.

NATIONWIDE COSTS FOR REPLACING DRES WITH AUDITABLE VOTING SYSTEMS

Following are realistic numbers for replacing DRE systems with paper ballot systems – optical scanner and hand count, including transitional costs such as training, configuration and integration.

Replacing the Nation's DREs with Optical Scanners

According to Election Data Services in 2006 there were **69,382** precincts (1,142 counties) using DRE voting systems.

Optical scan device $5,000/ea

Programming $500/election

1) Assuming 100% replacement for one device per precinct:

69,382 precincts X $5,500 = $381,601,000.

To allow for back up devices, add an additional device for every 4 precincts (shared backup):

$381,601,000 x 1.25 = $477,001,250

2) Adding Replacement of DREs for Disability Compliance

Ballot Marking Device $6,000/ each

69,382 precincts X $6,000 = $416,292,000.

3) Integration, training and recruitment costs to be determined in conjunction with the Congressional Budget Office, but rough estimate is $4,000 per precinct:

69,382 X $4,000 = $277,528,000

TOTAL COST FOR DRE REPLACEMENT WITH PAPER BALLOT OPTICAL SCAN EQUIPMENT: $477,001,250 + $416,292,000. + $277,528,000 = $1,170,821,250

Replacing the Nation's DREs with HCPB Elections

In New Hampshire, we have collected information on hand count costs through many years' experience of manual state wide recounts, and through limited surveys of NH hand count towns. Generally, hand count towns estimate their election costs at around $700 / election, with some of our NH hand count towns counting up to 3,600 ballots per polling place.

New Hampshire hand count towns count up to 3-4 times the national average of ballots processed in any given polling place (the national average is 1000 ballot / polling place) - but we have not found the cost to vary much. This is largely due to the level of volunteerism among hand counters, who come to count because it is considered an honor within their community, rather than to get paid.

Using proper management and efficient processes, hand counting requires 5 teams of 4 people (2 counter/tallyers and 2 observers) to count 1000 ballots in about 2-3 hours. This is accounting for a typical general election ballot, consisting of 12-15 races.

The State of New Hampshire, which conducts 20-30 manual recounts every election, estimates costs for hand counting at around **7 cents per race on the ballot.** This is for a 4-person team, each getting paid $10/hr.

For a general election ballot of **15 races; this comes to $1.05 / ballot**.

NOTE: New Hampshire ballots are among the most complex in the nation, because of our large legislature, consisting of 400 state reps. This means New Hampshire has many multi-member districts. These races are more complex and time consuming to count than a typical one seat/district race with only a handful of candidates running for that single seat. For instance, a single district in New Hampshire might have as many as 26 candidates running for 13 seats. This means that hand counters are counting the votes for each of those 26 names. Obviously, this takes more time than counting a 2-3 person race running for one seat.

For a typical average precinct by national standards (1000 ballots per precinct), a hand count election would cost **1,000 ballot X $1.05cents = $1050.**

For our **69,382 DRE precincts**, Election Data Services gives us the number of **65,959,464 registered voters**. If every registered voter cast a ballot:

65,959,464 / 1000 = 65,959 X $1050 = $69,256,950

For hand counting voting systems to replace DREs, you would need to incorporate sufficient management staffing, training and recruitment funds.

Management, training and recruitment rough estimate is $2,000 per precinct:

69,382 X $2,000 = $138,764,000

TOTAL COST FOR DRE REPLACEMENT WITH PAPER BALLOT HAND COUNT SYSTEM PLUS REPLACEMENT DISABILITY UNITS: $69,256,950 + $138,764,000 = $208,020,950

DATA FROM STUDIES ON DRES

NIST Study 2006

I. Requiring Software Independence in VVSG 2007: STS Recommendations for the TGDC
2.1 DRE Systems and Security

DRE machines are essentially notebook computers programmed to display ballot images, record voter choices, and store the electronic CVRs on removable memory cards. They are comparatively easy to use, particularly by those with impaired vision; they can also produce an audio ballot for blind voters. They typically produce a start-of-day zero report and an end of- day summary printout of the ballots cast on the machine, but they do not require or produce paper ballots, and it is this aspect that has helped to make them popular with election officials who have had to deal with logistical and accuracy problems and historical fraud in handling and counting paper ballots.

But many people, especially in the computer engineering and security community, assert that DREs are vulnerable to undetectable errors as well as malicious software attacks because there is no audit mechanism other than what the DRE can report on: how many records it has stored, ballot styles, etc. Potentially, a single programmer could "rig" a major election. *The computer security community rejects the notion that DREs can be made secure, arguing that their design is inadequate to meet the requirements of voting and that they are vulnerable to large-scale errors and election fraud.*

One conclusion drawn by NIST is that the lack of an independent audit capability in DRE voting systems is one of the main reasons behind continued questions about voting system security and diminished public confidence in elections. NIST does not know how to write testable requirements to make DREs secure, and NIST's recommendation to the STS is that the DRE in practical terms cannot be made secure. Consequently, NIST and the STS recommend that VVSG 2007 should require voting systems to be of the SI [software independent] "class," whose readily available (albeit not always optimal) examples include op scan and DRE-VVPAT.

The widespread adoption of voting systems incorporating paper did not seem to cause any widespread problems in the November 2006 elections. But, the use of paper in elections places more stress on (1) the capabilities of voting system technology, (2) of voters to verify their accuracy, and (3) of election workers to securely handle the ballots and accurately count them. Clearly, the needs of voters and election officials need to be addressed with improved and new technology. The STS believes that current paper-based approaches can be improved to be significantly more usable to voters and election officials, and that other kinds of all electronic IV (software IV) and E2E cryptographic systems may possibly achieve the goal of secure paperless elections. *However, for VVSG 2007, the STS judges that designs for these new systems are still immature and that developing testable requirements for these approaches is not yet feasible. Industry has not yet responded in a significant way with new designs, and some method for jumpstarting industry to design and market these approaches may be beneficial.*

These systems may be dependent on software to an extent, however not nearly to the extent that today's DREs rely on software correctness. How this software would be

specified and tested remains a matter of debate. ***Currently, the STS is divided on whether software IV [independent verification] systems are possible to secure at this point without further research.***

Election Science Institute Study 2006

II. The Election Science Institute Study of DRE VVPAT for Cuyahoga County showed a ten percent error rate for VVPAT printouts, rendering these votes unreadable and unusable for hand counts in an audit or recount situation.

Following the 2004 General Election in Ohio, Cuyahoga County adopted a new voting system using the Diebold touch-screen voting system. The new system complies with both the new federal election technology standards established under the Help America Vote Act of 2002 (HAVA) and with recently enacted Ohio legislation that requires voting systems to produce a paper ballot that can be verified by the voter. Under Ohio law, this paper ballot (Voter Verified Paper Audit Trail (VVPAT) serves as the official ballot in the event of recount or contested election. The May 2006 Primary, the first major election using the new system, presented an opportunity to assess the new system's benefits and weaknesses. The Cuyahoga County Board of Commissioners decided that an independent scientific analysis of the Primary election would give elections officials objective feedback on the accuracy, reliability and usability of the new voting system.

In April 2006, the Cuyahoga County Commissioners engaged Election Science Institute (ESI) to study all aspects of the new system during the Primary Election. Voting devices are only a small part of an election system: any thorough assessment of a voting system must include an evaluation of the administrative procedures, pre-election programming and testing of the machines, voter and booth worker interaction, and counting and auditing procedures. Although the touch screen systems are vastly different from optical scan and punch card, it still holds true that an election will be only as successful and reliable as the human administration of all system components.

Summary of Key Findings
Key Finding: After three months of exhaustive research, empirical evidence supports the key definitive finding: ***The machines' four sources of vote totals – VVPAT individual ballots, VVPAT summary, election archive, and memory cards – did not agree with one another.*** The current election system appears to provide some of its promised benefits at potentially great cost; namely, that the election system, in its entirety, exhibits shortcomings with extremely serious consequences, especially in the event of a close election. These shortcomings merit urgent attention. ***Relying on this system in its present state should be viewed as a calculated risk in which the outcome may be an acceptable election, but there is a heightened risk of unacceptable cost.***

Manual Count of Paper Ballots
Key Finding: VVPAT's were missing, missing information and the tally of the individual ballots did not always match the VVPAT summary printed at the end of Election Day. In order to validate the accuracy of Election Day vote tabulations by the Cuyahoga County BOE Diebold voting system, ESI conducted a manual count of the VVPAT paper ballots. Using a recount fixture that allowed for viewing the tapes without handling them, a team of election officials, booth workers and students tallied the votes for governor on each tape. The paper ballot tallies were initially compared to the results report printed on the VVPAT tapes. When the count did not match the count provided by the results report, the paper ballots were recounted.

• ***85% of the VVPAT Ballots and VVPAT Summaries reconciled after the primary manual count, where approximately 15% required a secondary count***

• 1.4% of the VVPAT cartridges exhibited missing ballots.
• 16.9 % of VVPAT tapes showed a discrepancy of 1 - 5 votes between the tally of ballots and the results report; 2.1 % showed a discrepancy of over 25 votes.
• During the manual recount, team members discovered 40 VVPAT tapes (9.66%) that were either destroyed, blank, illegible, missing, taped together or otherwise compromised.
• Identifying information on the VVPAT tape such as precinct information and machine identification was inconsistent, as were the summary reports printed at the end of the day. 2.8% of the VVPATs were missing machine ID numbers; 5.4% did not identify the precinct, increasing the difficulty of a meaningful audit and raising questions about the integrity of the vote count.
• VVAPTs showed evidence of booth workers using trial and error to print reports and start up or close down the machines; workers apparently attempted to overcome printer problems by shutting down machines, removing and replacing cards, and restarting machines.
• 72% of the labels identifying canisters containing the VVPAT tapes were missing information. 46% of the canister labels were blank.
• Booth workers frequently failed to sign the tapes. Such failures in chain of custody also increase the risk of a legal challenge.

SOURCES

1) Election Data Services 2006 Voting Equipment Report
http://www.edssurvey.com/images/File/ve2006_nrpt.pdf
2) NH Department of State
3) Requiring Software Independence in VVSG 2007: STS Recommendations for the TGDC, William Burr, John Kelsey, Rene Peralta, John Wack, National Institute of Standards and Technology, November 2006 (see relevant portions quoted below)
4) ESI Study of DRE VVPAT for Cuyahoga County
http://www.votingindustry.com/TabulationVendors/1stTier/Diebold/esi_cuyahoga_final.pdf