BOARD OF ELECTIONS IN THE CITY OF NEW YORK

MEMORANDUM

To: Commissioners of Elections

From: Lucille Grimaldi, Manager, Electronic Voting Systems

Re: Report – Paper Canvass Feb 25, 2003 Special Election

Date: May 15, 2003

CC: John Ravitz, Executive Director
George Gonzalez, Deputy Executive Director
Pamela Perkins, Administrative Manager
Steven H. Richman, General Counsel
John Naudus, TeamWork Administrator
Anna Svizzero, Director of Election Operations,
New York State Board of Elections

Per your request, attached is the report on the scanning of paper ballots in the 43rd Council District in Brooklyn for the Special Election held on February 25, 2003.

For your convenience, I've placed the *Summary* at the beginning of the report. It includes the three steps that we presented to the Commissioners for consideration.

The rest of the report provides the details in sections titled: *Background, Research, Results.*

Thank you.

Attachment

REPORT on the SCANNING of PAPER BALLOTS

SPECIAL ELECTION for 43rd COUNCIL DISTRICT IN BROOKLYN

ELECTRONIC VOTING SYSTEMS DEPARTMENT (EVS)
APRIL 2003

SUMMARY

The EVS Department has researched the question raised at the canvass of paper ballots for the 43rd Council District in Brooklyn concerning a discrepancy noted between candidates' hand-tallies and results produced by the Board's ballot optical scanning system. The provider of the system (TeamWork OPSCAN System) is Sequoia Voting Systems, and the system consists of NCS Pearson's optical readers (OPSCAN 6 scanners), Sequoia Voting System's tabulation software, TeamWork, and ballots printed by Phoenix Graphics.

The research indicates that overall scanner performance and print quality is such that, coupled with the Board's criteria for conducting a manual re-canvass, and, adding the steps listed below, the integrity of election results using scanners for the paper ballots is maintained.

Based on the data and analysis to date, we found that the scanner used in the canvass was sensing some of the pre-printed voting ovals – which normally would not be the case. This caused the scanner to sense overvotes in nineteen instances where there were not overvotes. In accordance with New York State Election Law, whenever there is an overvote, TeamWork counts no vote for that contest – hence the discrepancy with the hand-tallies. The discrepancy did not affect the outcome of the election because the total (machine and paper) margin of victory fell within the Board's guidelines to conduct a manual re-canvass of the paper.

Our examination of all of the other Board scanners produced results that contrasted with the Brooklyn scanner in question. They showed some sensing of ovals at values greater than desired but most values were minimal and, for most scanners, occurred in less than 1% of the ovals. Three scanners gave values greater than preferred in 1 - 3% of the ovals. Note that the slightly higher values would not necessarily produce overvotes.

The other factor that plays a role in the sensing of ovals is the print on the ballots. The original ballots gave higher values more often than ballots produced for our research. The write-in oval was more likely to be sensed with a higher value than any other one oval.

To provide tighter control on scanner sensitivity and pre-printed ballot elements we are suggesting the following steps – the first two to be undertaken now, and the third one to be considered later:

> Starting now, require that preventive maintenance performed on each scanner prior to each election season include an evaluation of the scanner's sensitivity, and a re-calibration of each scanner to ensure that pre-printed ballot elements such as the oval are not being sensed with a value greater than two.
>
> Also starting now, add a segment of testing in which we scan folded, blank ballots, and ballots placed on the input trays only two or three at a time.
>
> If the two prior steps do not resolve all concerns, consider making the voting ovals slightly larger, or consider having them printed, at a higher cost, in red. The color red is not sensed by the scanners.

BACKGROUND

The Special Election for the 43rd Council District in Brooklyn was held on February 25, 2003. Five candidates were in contest and the results of the machine vote were close enough that the results of the paper vote would play a decisive role. Candidates and their representatives assembled at the Brooklyn Office to witness the canvass of the paper ballots commencing on March 5. The opening of the envelopes proceeded very slowly as each one was examined very closely. The optical scanning system used to scan the ballots is the TeamWork OPSCAN System provided by Sequoia Voting Systems. This system uses NCS Pearson OPSCAN 6 optical readers and Sequoia's software product TeamWork. Since the number of paper ballots was small, only one scanner, number 0601470, was used to read and tally the vote. A total of 421 ballots (absentee and standby) were scanned for the 43rd Council District. (Another scanner was used to tally the paper ballot votes from the Special Election for the 55th Assembly District, also held in Brooklyn on the same day.)

During the canvassing process, it was noticed that the accumulating number of votes reported by a preliminary TeamWork Summary Report of the scanning system did not match the number reported by individuals who were keeping a hand-tally of votes as the envelopes were opened. The EVS Department's TeamWork Administrator, John Naudus, who was present at the canvass, asked the scanner operators to produce a system report that shows blank votes and overvotes. [Note that when a voter overvotes a contest, the scanning system is designed (in accordance with New York State Election Law) to not count a vote for either candidate.] Fifteen overvotes and four blanks were reported.

John Naudus decided to re-run the test ballots to ascertain if the scanner was still operating properly. (The test ballots had scanned successfully during the usual testing of the scanning system prior to the election and canvass. The Pre-election Test had been held on February 21. It was repeated again for public observation on Feb. 24. It was repeated again for the Pre-canvass Test at 10 a.m. on March 5, the day of the commencement of the canvass. The results of all of the tests were verified and matched exactly against each other.) When the test was run again as per John's request on the afternoon of March 7 during the canvass, it ran successfully. The canvass of the ballots continued.

When the ballots of the last Election District were scanned, John Naudus examined the three ballots and saw that, although the ballots had votes correctly marked, the system had reported no votes for those three ballots. A TeamWork report to show blanks and overvotes for the three ballots was run, and it reported three overvotes for the three ballots. John again asked the scanner operators to run the test deck, and again it ran successfully. The final TeamWork Summary Report for the complete paper canvass for the 43rd Council District showed twenty-two overvotes and five blanks. The total results differed from the candidates' hand-tallies.

The difference between the hand-tallies and the scanner's tally did not affect either the winning candidate or the Board's requirement to conduct a manual re-canvass. The margin of victory in either case was under one-half of one percent.

As is required by the Board's standard operating procedures whenever the margin of victory for a contest is less than ten votes or one-half of one percent of the total votes cast, the paper ballots are re-canvassed manually. This manual re-canvass was conducted by the Board's Canvass Clerks on March 8.

The results of the election were certified after the judicial proceedings regarding the envelopes that had been set aside for court determination were concluded.

RESEARCH

We began our research immediately after the canvass by reviewing the summary reports from the Board's central computer system, ENCORE, looking at the results reported from both before and after the Board's manual re-canvass of paper. We identified the EDs where there was a mismatch. We then examined the TeamWork ED-level reports, and noted that for the EDs on the ENCORE reports that showed a mismatch, the TeamWork reports showed overvotes or a blank. We considered if there was any common characteristic of the identified EDs, such as language translations or ballot type that might lead us to a cause for the mismatches. We found none.

When the election was certified, and the ballots were available to us for examination, our first step was to scan the ballots from the relevant EDs on another scanner. We used the EVS Department's scanner in the General Office. We found no overvotes, except in one ED where there was an actual overvote on the ballot. We then scanned all of the ballots from the 43rd Council on the General Office scanner, and found four overvotes, three of which were actually on the ballot.

On April 1, we met with Sequoia Voting Systems, Phoenix Graphics, and with representatives from the operations department of the New York State Board of Elections. Sequoia brought a scanner diagnostic tool, SCANDR, that determines the degree of mark, in a range of zero to fifteen, that the scanner senses from each cell location on the ballot. It reports the numerical value (zero to fifteen) for all of the pre-printed ballot elements (such as the voting oval). The TeamWork system is set to interpret a mark as a vote whenever the scanner sends it a value of six or greater. To avoid TeamWork's receiving a value of six or more from anything other than an intended vote, Sequoia prefers that pre-printed elements on the ballot not send a value greater than two so that the cumulative affect remains below six except when intended.

Sequoia instructed John Naudus on how to use the product, and then some of the meeting attendees went to the Brooklyn Office to make observations. First the test deck was re-run on scanner 0601470, to be witnessed by the State Board representatives. It produced the same results as all prior runs. It ran successfully. Then two of the EDs that had originally shown overvotes (inappropriately) were also run on the original scanner, and they continued to show overvotes. Using SCANDR on scanner 0601470 for the two EDs revealed values greater than two for forty-three of the sixty-three voting oval positions. After re-calibrating the scanner, the number of voting ovals giving a value greater than two dropped to sixteen (25%). Examining the same two EDs on the other scanner in Brooklyn showed only nine of the ovals giving a value greater than two. A maintenance request was made for the original scanner.

The following week, April 9 and 10, John Naudus and Sequoia evaluated the scanners in the five borough offices. Sequoia had developed a test methodology and had had Phoenix Graphics produce ballots for the test. Some were 11" ballots that had one contest and some were 14" ballots of a full General Election. Each size ballot had some with the current voting oval and some with a voting oval slightly larger than the one currently used. The plan was to use these ballots and SCANDR on all of the Board's scanners to test the scanners' sensitivity. The process involved scanning on each scanner, a series of blank ballots (different lengths and different oval sizes), and receiving a report for each ballot that shows the degree of mark sensed from the pre-printed ballot elements.

Using SCANDR, the steps of the evaluation were as follows for each scanner:

1. Scan a calibration sheet.
2. Calibrate the machine.

3. Scan the same calibration sheet.
4. Scan three blank 11” ballots with the current size oval.
5. Scan three blank 11” ballots with a slightly larger oval.
6. Scan three blank 14” ballots with the current size oval.
7. Scan four blank 14” ballots with a slightly larger oval.
8. Scan three test ballots from the 43rd Council election.

Altogether, sixteen ballots were scanned fifteen times (fifteen machines) resulting in 240 ballot-scans.

After the scan of each calibration sheet or ballot, the system produced a report showing the value sensed for all the positions on the ballot.

John studied the 240 reports generated by this process and examined the values reported for each ballot position represented by a voting oval (that is, the pre-printed oval with no mark in it.) He then charted these values so that they could be analyzed, and we could determine if any pattern of excessively high values occurred. The results are summarized below and the 240 actual reports are also available for review.

RESULTS

Scanners

Scanners sense the degree of mark within a range of zero through fifteen for each cell location on a ballot. For each election, only the cell locations required for the given ballot are activated, that is, the voting ovals for each possible selection on the ballot. TeamWork will interpret a mark as a vote only if it receives a value of six or greater from the scanner. The scanners are calibrated to sense pre-printed ballot elements and voters' marks such that votes are tallied correctly. To avoid having a pre-printed ballot element (such as the line of an oval) contribute to the value received by TeamWork, the scanners should not sense the pre-printed ballot elements with a value greater than two. The diagnostic tool, SCANDR, determines how a particular scanner is sensing each cell location.

Our evaluation of the Board's scanners showed that only scanner 0601470 from Brooklyn was sensing numerous ovals at a value greater than two (25% before maintenance). Of the remaining scanners, eleven scanners sensed ovals with a value greater than two for 0.7% or less of the ovals. Three of the scanners sensed values greater than two for 1.5-2.9% of the ovals. One scanner sensed no ovals with a value greater than two.

The breakdown is as follows:

Each of the fifteen scanners scanned 686 voting ovals, for a total of 10,290 ovals. Altogether, eighty ovals were sensed with a value greater than two. The eighty ovals occurred on different machines.

Total voting oval positions	10,290
Ovals with a value of six or greater	0
Ovals with a value greater than two	80
Percent ovals with a value greater than two	0.78%

Scanner	Ovals with Value Greater than Two	
0600112	10	1.5%
0601816	3	.4%
0601287	3	.4%
0600675	4	.6%
0601820	3	.4%
0601821	5	.7%
0601822	0	0%
0601470*	5	.7%
0601817	3	.4%
0601818	2	.3%
0600735	12	1.8%
0600670	5	.7%
0600999	3	.4%
0600680	20	2.9%
0600679	2	.3%

* Performance after maintenance.

Ballots and Voting Ovals

The voting oval must be big enough to be outside the cell location activated for a possible vote, but small enough to guide the placement of the voter's mark so that it will fill the cell location with the sufficient degree of mark. If the ballot passes through the scanner in a skewed manner, the scanner will stop and we will scan the ballot again. However, to account for the event of only a slight movement of the ballot that is not detected, the ovals must be printed in such a manner that they will not send a value greater than two. In this way, the oval will not contribute to any other mark (such as an erasure) and possibly bring the value to six or greater (which TeamWork will interpret as a vote.) Our research showed that ballots printed with an oval slightly larger than the one currently used did not give any values greater than two. If preventive maintenance does not resolve the scanner sensitivity question, a decision to be made is whether we should move to a larger oval.

Our research also showed that 48% of ovals that were sensed with a value greater than two were write-in ovals. The ballots used in our research were the General Election form on which the write-in ovals are along the right side of the ballot. We may want to consider changing the size or weight of only the write-in ovals.

On the 240 ballot-scans, there were altogether 10,290 voting oval positions. [The short ballots (with only one contest) had seven ovals. The long ballots (a complete General Election ballot) had eighty-nine ovals.] There were no ovals with a value of six or greater. The number of ovals with a value greater than two, however, was eighty. Of the eighty ovals with a value greater than two, thirty-eight were write-in ovals. The remainder occurred across different positions.

Total voting oval positions	10,290
Ovals with a value of six or greater	0
Ovals with a value greater than two	80
Percent ovals with a value greater than two	0.78%
Write-in ovals with a value greater than two	38
Percent write-in ovals with a value greater than two (as a percentage of the eighty ovals with a value greater than two)	48.00%
Percent write-in ovals with a value greater than two (as a percentage of all 1,710 write-in ovals)	2.22%

Of the eighty ovals with a value greater than two, fifty-four were on the test ballots, eighteen were on the 14" ballot with current size oval and eight were on the 11" ballot with current size oval. No values greater than two occurred on either the 11" or 14" ballot with slightly larger ovals.

Total oval positions	10,290		
Oval positions with a value greater than two	80		
On test ballots (315 total ovals)		54	17.00%
On 14" ballots with current oval (4005 total ovals)		18	.44%
On 11" ballots with current oval (315 total ovals)		8	2.50%
On 14" ballots with larger oval		0	
On 11" ballots with larger oval		0	

Testing

The test ballots that are completed according to New York State Board of Elections regulations confirm that the contests and candidates for each lot are printed in the correct positions on the ballots. The testing also confirms that the TeamWork system has accurately stored the ballot definitions, and that the coding matches the ballots so that the votes will be tallied correctly.

Our research leads us to consider adding to the usual regimen some additional testing to focus on scanner sensitivity and print consistency. We can add batches of blank, folded ballots. We can also add scanning some test ballots in small groups of two and three.

We had already been working with Sequoia to require that NCS Pearson perform preventive maintenance on each scanner before each election season. We will now require that the maintenance also include a test of scanner sensitivity.