

MEMORANDUM

December 17, 2002

To: Members of the Alexandria Board of Elections
From: Thad Hall, The Century Foundation¹
Subject: Evaluation of the Hart Intercivic Voting System Test, November 2002

SUMMARY

During the 2002 general election, the Alexandria Board of Elections tested the Hart Intercivic *eSlate* voting system as a first step in determining how well an electronic voting system would work in the City of Alexandria.² There are three key findings from the evaluation of this system.

1. Alexandria voters are comfortable and satisfied with the current voting system that they have. Voters like the optical scan system and use it quite adeptly.
2. When voters at the Lee Center precinct were exposed to the Hart Intercivic voting system for the first time, they generally had a high level of satisfaction with the system.
3. There is a certain level of non-voting that occurs in Alexandria that will likely occur regardless of the type of voting system the City adopts.

The Hart Equipment Test

The City tested the Hart equipment in two settings. First, the system was used for absentee voting. In the General Election, voters were allowed to cast ballots on Hart voting equipment set up at the absentee voting precinct, which was located in the Board of Election offices in downtown Alexandria. Three machines were set up for this purpose. A different piece of Hart equipment – *Ballot Now* – was used to scan and count traditional absentee ballots.

Second, the Hart equipment was used in one polling precinct – Lee Center – on Election Day. There, eight machines were set up for voting. Before the election, the Hart system was configured for the Alexandria Board of Elections by professional staff from Hart. Hart conducted the ballot loading, and two Hart technical support individuals were in Alexandria on Election Day. However, at the poll site, regular election

¹ This evaluation and the report were prepared in close consultation with R. Michael Alvarez, Professor, California Institute of Technology. I am grateful for his assistance; however, any errors contained in the report are attributable to me. I would also like to thank Tom Parkins and Eric Spicer for their assistance with collecting the data used in the report.

² The decision to conduct this test was made at the June 3, 2002, Alexandria Election Board Meeting.

personnel set up and operated the system, as is required under Virginia law. City election officials also set up and operated the absentee voting system and absentee ballot counting systems.

Residual Voting

One of the first methods of evaluating the voting system is to determine whether the Hart system helped to reduce the residual vote rate in the City of Alexandria. Both the existing optical-scan system and the Hart system either inform voters if there is an overvote or do not allow for overvoting. However, the optical scan system does not remind voters at the end of the voting process that they have undervoted, a feature that does exist on the Hart system.

Figure 1 shows poll site residual voting for the 2002 general election at Lee Center precinct, the Fire Department precinct, and the entire City, excluding early voters. The Figure shows that the lack of an opponent from the Democratic Party for incumbent Senator John Warner resulted in a very high residual vote rate for that race. However, for the more high-profile races – the House race and the northern Virginia transportation tax – the residual vote rate was comparatively low.

Figure 1: Residual Voting, 2002 General Election

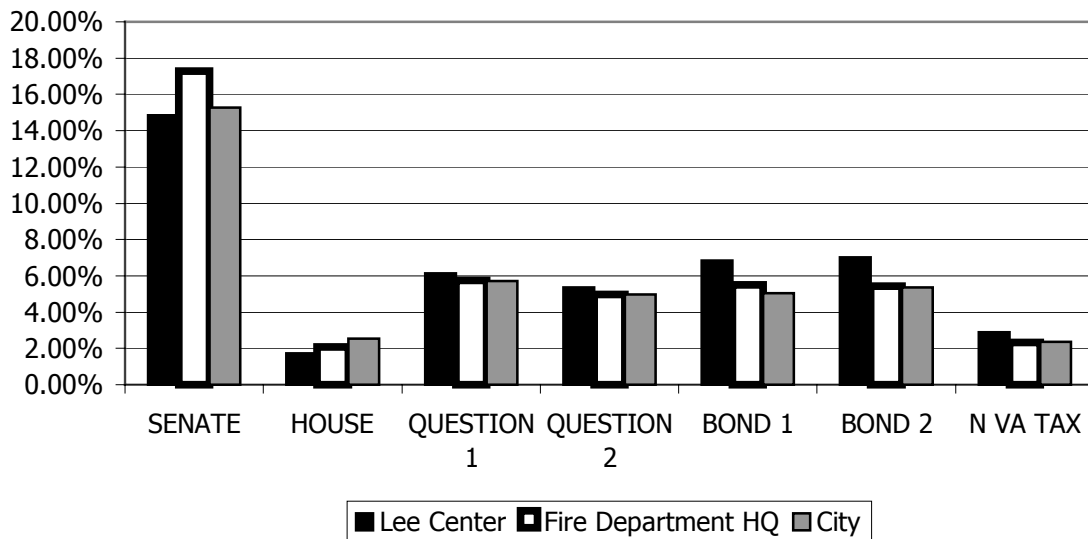


Table 1 compares poll site residual vote rates at the Lee Center precinct with both the Fire Department precinct and the entire City. One trend the data show is that the residual vote rate on the Hart system tended to be lower in the Senate race and the House race compared to the optical scan system precincts. Once voters moved down the ballot to the constitutional amendments, bond issues, and the Northern Virginia tax question, the residual vote rate was slightly higher on the Hart system compared to the existing optical-scan system.

Table 1: Residual Voting, 2002 Election

| | SENATE | HOUSE | Q 1 | Q 2 | BOND 1 | BOND 2 | N VA TAX |
|-----------------------------------|---------------|--------------|------------|------------|---------------|---------------|-----------------|
| Lee Center – Fire Dept Difference | -2.42% | -0.35% | 0.39% | 0.38% | 1.35% | 1.59% | 0.56% |
| Lee Center – City Difference | -0.68% | -0.91% | 0.39% | 0.32% | 1.81% | 1.64% | 0.48% |

NOTE: A negative value means that there were fewer residual votes at Lee Center on the Hart Equipment than on the optical-scan equipment to which it is being compared. A positive value means that there were more residual votes on the Hart equipment.

Knowing that there was a slightly higher residual vote rate on down-ballot races is interesting but not meaningful until we can put this information in context. Specifically, we need to compare this residual vote rate with the rate in past elections, ideally in comparable past elections. Because of changes in precinct boundaries after the 2000 Census, it is not possible to compare the 2002 results with those in 1998 or 1994. Instead, it is necessary to compare the 2002 data with the closest available proxy data, which are the results in the 2001 gubernatorial election. The 2001 and 2002 elections did have similar turnout rates, and the City used identical voting precincts in each election. Figure 2 shows the poll site residual voting for the 2001 general election for the Lee Center precinct, the Fire Department precinct, and the City of Alexandria. The Figure shows that the competitive nature of the three statewide races led to a very low residual vote rate across all three areas. It also shows that down-ballot roll-off was higher in 2001 for local races than in 2002 for the referenda, although this in part resulted from a lack of competition in these contests.

Figure 2: Residual Votes, 2001 State Elections

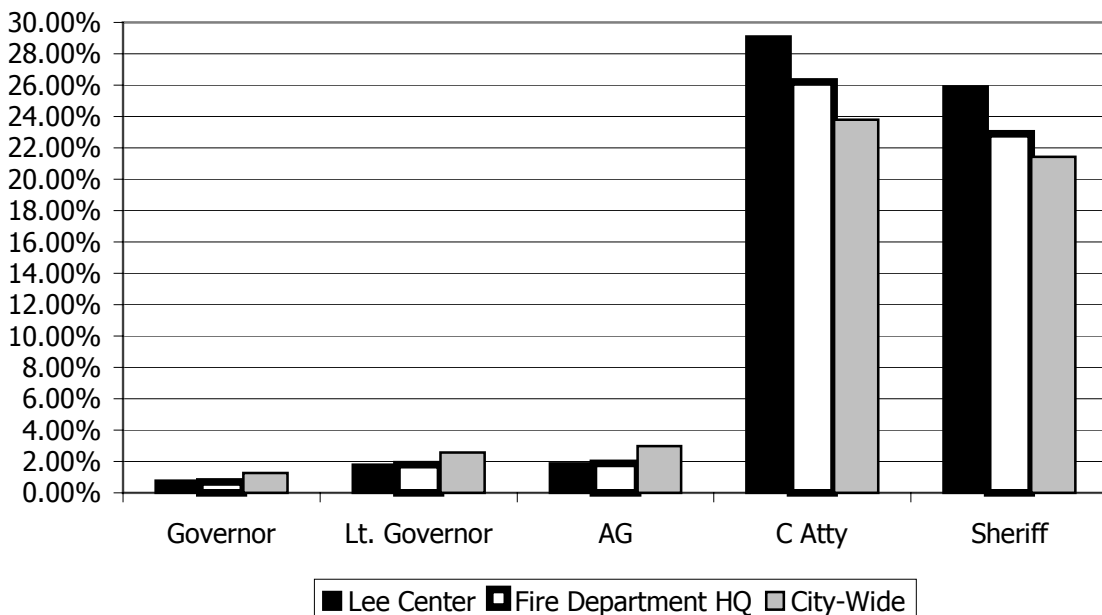


Table 2 examines the residual vote rate in 2001. Here, there are several things of note to consider. First, the Lee Center precinct residual vote rate was higher in the 2001 election compared to the Fire Department precinct, although the gap was quite low for the first three races on the ballot. Second, the Lee Center precinct had a lower residual vote rate than the City average for the first three races on the ballot in 2001. Third, on down-ballot races, the residual vote rate in the Lee Center precinct was much higher than in either the Fire Department precinct or the City at-large.

Table 2: Residual Voting, 2001 Elections

| | Governor | Lt. Governor | Attorney General | Commonwealth Attorney | Sheriff |
|-----------------------------------|----------|--------------|------------------|-----------------------|---------|
| Lee Center - Fire Dept Difference | 0.10% | 0.00% | 0.00% | 2.89% | 3.02% |
| Lee Center - City Difference | -0.47% | -0.77% | -1.11% | 5.32% | 4.49% |

NOTE: A negative value means that there were fewer residual votes at Lee Center than in the precinct to which it is being compared.

Comparing the two elections, it is possible to gain a general sense that Lee Center voters *may* be more likely to avoid voting on down-ballot races, although it not possible to state this statistically given the data available. Clearly, the Hart system did not exacerbate residual in the Lee Center precinct, as the residual vote rate was lower compared to the Fire Department precinct across all races from 2001 to 2002.

Public Perceptions of the Voting Equipment

The City of Alexandria conducted an exit survey at the Lee Center, Fire Department, and absentee voting precincts. The City implemented this survey, with volunteer surveyors interviewing individuals outside the poll sites. The poll site surveys were administered in the first hours when the polls opened and in the last hours before the polls closed. Three questions were asked of voters about their views on the voting equipment used in the general election:

1. Did you find the voting machine easy to use?
2. Were you satisfied with the voting equipment you used today?
3. Do you feel confident that the voting machine that you used today recorded all of your votes correctly?

Voters were also asked to provide demographic information so that it would be possible to determine if there were differences in how various subsections of the population viewed the voting systems. Also, the testing of the Hart system at the absentee voting

precinct provides a unique source of data, since early voters tend to be more partisan and more informed than traditional Election Day voters.

A total of 203 voters (15.8 percent) from Lee Center and 142 voters (12.21 percent) from Fire Department completed the survey. Additionally, 85 absentee voters (8.71 percent) completed the survey. When reading the tables that follow, it is important to read both the percentages and the number of respondents – noted in parentheses below the percentage – for that subpopulation. For several of the subpopulations noted in the Tables, the response rate is low – below 5 – which is a rather small number on which to base an evaluation of the system for that population of voters.

**Table 3: Did you find the voting machine easy to use?
(Percentage of Respondents Answering “Yes”)**

| | Optical Scan | Hart Intercivic <i>eSlate</i> | |
|--|---------------------|--------------------------------------|-----------------|
| Demographics | Fire Department | Lee Center | Absentee Voting |
| Male | 93.6% (44) | 92.6% (87) | 82.6% (38) |
| Female | 97.8 (91) | 89.9 (98) | 86.8 (33) |
| White | 96.6 (113) | 92.9 (157) | 84.0 (63) |
| Black | 100.0 (15) | 84.4 (27) | 100.0 (3) |
| 18-24 | 100.0 (4) | 100.0 (2) | 100.0 (4) |
| 25-34 | 95.7 (44) | 95.2 (40) | 75.0 (12) |
| 35-44 | 100.0 (42) | 90.0 (36) | 87.5 (14) |
| 45-54 | 88.0 (22) | 88.2 (45) | 94.1 (16) |
| 55-64 | 100.0 (17) | 90.0 (45) | 77.3 (17) |
| 64 and older | 100.0 (6) | 94.1 (16) | 88.9 (8) |
| Voted in 2000 Presidential Election | 96.3 (129) | 91.1 (174) | 84.1 (69) |
| New User | 95.5 (63) | | |

Table 3 shows the percentage of voters who found each voting system easy to use. For most subpopulations of voters, at least 90 percent of respondents found the voting

system that they used to cast their ballot easy to use. There were two findings of note, however.

- Between the Lee Center and Fire Department precincts, there is an almost eight-percentage point gap between the views of women regarding the Hart system compared to the optical scan system. Although men liked both systems at the same level, almost 98 percent of women at the Fire Department precinct had a positive assessment of the optical scan system compared to only 90 percent of women respondents at the Lee Center precinct.
- There was a 8.5 percentage point gap between the views of Black and White respondents to the Hart system, with Black respondents having a less favorable view of the system compared to Whites.

Table 4: Were you satisfied with the voting equipment you used today? (Percentage of Respondents Answering “Yes”)

| Demographics | Optical Scan | Hart Intercivic <i>eSlate</i> | |
|--|-----------------|-------------------------------|-----------------|
| | Fire Department | Lee Center | Absentee Voting |
| Male | 97.8% (45) | 94.7% (89) | 82.2% (37) |
| Female | 98.9 (92) | 87.2 (95) | 92.1 (35) |
| White | 98.3 (114) | 92.3 (156) | 87.8 (65) |
| Black | 100.0 (15) | 84.4 (27) | 66.7 (2) |
| 18-24 | 100.0 (4) | 100.0 (2) | 100.0 (4) |
| 25-34 | 97.8 (44) | 95.2 (40) | 87.5 (14) |
| 35-44 | 100.0 (42) | 85.0 (34) | 75.0 (12) |
| 45-54 | 100.0 (25) | 88.2 (45) | 87.5 (14) |
| 55-64 | 100.0 (17) | 92.0 (46) | 95.5 (21) |
| 64 and older | 83.3 (5) | 94.1 (16) | 77.8 (7) |
| Voted in 2000 Presidential Election | 98.5 (131) | 90.6 (173) | 86.4 (70) |
| New User | 98.5 | | |

Table 4 presents the percentage of voters who were satisfied with the voting system that they used to cast their ballot. As was the case above, at least 90 percent of the respondents in most subcategories of voters found the voting system that they used to cast their ballot easy to use. There was also a similar gap between how satisfied women were with the Hart system compared to the optical scan system, and between how Black and White respondents viewed the Hart system.

One point of note is that while respondents aged 65 and older may find optical scan voting easy to use, fewer of these respondents were satisfied with optical scan as a voting system. In fact, there was more satisfaction with the Hart system at Lee Center precinct among respondents 65 and older than there was for the optical scan system used at the Fire Department precinct.

Table 5: Do you feel confident that the voting machine that you used today recorded all of your votes correctly? (Percentage of Respondents Answering "Yes")

| Demographics | Optical Scan | Hart Intercivic <i>eSlate</i> | |
|--|-----------------|-------------------------------|-----------------|
| | Fire Department | Lee Center | Absentee Voting |
| Male | 91.5% (43) | 85.9% (79) | 86.7% (39) |
| Female | 94.6 (88) | 91.7 (99) | 84.2 (32) |
| White | 93.2 (109) | 88.0 (147) | 86.5 (64) |
| Black | 100.0 (15) | 93.5 (29) | 100.0 (3) |
| 18-24 | 100.0 (4) | 100.0 (2) | 75.0 (3) |
| 25-34 | 93.5 (43) | 95.1 (39) | 87.5 (14) |
| 35-44 | 92.9 (39) | 79.5 (31) | 87.5 (14) |
| 45-54 | 88.0 (22) | 96.1 (49) | 82.4 (14) |
| 55-64 | 100.0 (17) | 81.6 (40) | 81.8 (18) |
| 64 and older | 100.0 (6) | 100.0 (17) | 100.0 (8) |
| Voted in 2000 Presidential Election | 94.0 (126) | 89.4 (168) | 85.2 (69) |
| New User | 93.9 (62) | | |

The final question – Do you feel confident that the voting machine that you used today recorded all of your votes correctly? – is designed to examine how well people trust the voting technology they use to accurately capture their vote. Some Americans have concerns about the reliability and accuracy of various forms of technology. For example, some individuals will not allow their paycheck to be direct deposited into the bank; they want a physical check. Similarly, in light of the 2000 election, some individuals may question whether optical scan balloting is an effective form of voting, while other voters may wonder if the computer terminal on which they vote is actually capturing their vote accurately.

Table 5 shows that there is some concern about whether electronic voting records votes correctly. Here, however, there is an interesting reversal, with women and Black respondents at the Lee Center precinct more likely to think that the Hart system accurately recorded their vote choices. The concern was also greatest among voters in the 35-44 and 55-64 age brackets; older voters and younger voters both trusted the Hart system at a very high rate.

Next Steps

The City of Alexandria is in a unique position to move forward from this point in their effort to select a new voting system. Next year, there will be two citywide elections – elections for city office in the spring and elections for state offices in the fall. These two elections provide the Board of Elections with two opportunities to test new voting systems, and an opportunity to conduct a second test of how effectively the Hart system performs at the Lee Center precinct. Consider that:

- The City now has baseline data for the performance of the Hart system; testing the system again will provide for a more robust analysis of the system.
- It would be possible to test a new system at the Fire Department precinct – where there is baseline data on the optical scan system – and gain insight into the effectiveness of the new system.
- Testing the Hart system at the Lee Center did not prove disruptive to voters. Additional testing at other precincts is likely to be more of an issue of administration for the City, not a concern for the ability of voters to use the system.

In additional tests of the system, the City may also want to make strides to encourage voters with disabilities to turn out to vote and to use either absentee voting (on new voting equipment) or vote in their precinct (if their precinct has a new technology). Ensuring that voting systems are truly accessible to the disabled in real-world settings is important.

Appendix A: Voting Technology in Alexandria

Currently, the City uses the Diebold *AccuVote* voting technology. As configured by the City, this system allows voters to know if they have over-voted before the ballot is placed in the ballot box. The City also utilizes the system's precinct count technology, where ballots are counted in the precinct as the votes are cast. These results are then relayed via modem to the City Board of Elections once the polls close.

As described on the Diebold website [<http://www.diebold.com/>], the AccuVote-OS system is a precinct count and central accumulation optical-scan voting system. The AccuVote-OS system's integrated components are:

- The AccuVote-OS Tabulator: This is a multi-functional terminal that counts and tabulates the ballots at precincts on election day and communicates with the host computer at Election Central.
- Global Election Management System (GEMS) Application Software: GEMS is a multi-user Windows NT/2000-based software that concurrently and automatically generates, appropriate ballot styles for each precinct, postscript ballot files for postal ballots, precinct-specific media for tabulation, and vote tally files.
- The Host Computer: The PC-based computer system is configured to perform all of the necessary integrated functions of the application software.

The Hart Intercivic is somewhat unique in that it is not a touch-screen voting system. Instead, voters see the ballot on a screen -- as is the case with a touch-screen system -- but manipulate the ballot using a wheel that moves a cursor on the screen. The Hart equipment does not allow for over-voting. Additionally, the voter is provided a summary screen when voting has been completed informing her of the votes she cast in each race and notes if no vote was cast in a given race. The voter is then provided with an opportunity to vote in the races in which she did not vote before casting the ballot. The vote totals from the voting machines can be sent to the Board of Elections via modem, although they were not transmitted this way in the 2002 test.

As described on the Hart website [<http://www.internetvoting.com/>], the eSlate is a Direct Record Electronic (DRE) system that has the following components:

- The eSlate 3000 voting machine is a flexible ballot presentation, durable polycarbonate screen, integrated selector and is secure and affordable.
- The Judge's Booth Controller manages the election process in the precinct. It issues an access code and manages modem transmission to election central headquarters and can control up to 12 eSlate 3000, informing the election judge which booths are in use at any given time.
- The eSlate system is ADA accessible by design and can be upgraded to accommodate various devices that support voting by the disabled.
- Ballot Origination Software System™ (BOSS) enables users to define and create ballot styles for all precincts.

- Tally™ accepts results from and tabulates all Absentee Voting tabulation, Absentee tabulation, Election Day tabulation and Election Canvass information.
- Ballot Now Digital Ballot Imaging services allow ballots to be produced as needed by the customer. Returned mailed ballots are processed using commercially available scanners providing a fully scalable solution.

Appendix B: Methodological Issues

Evaluating the effectiveness of public policy decisions is often difficult because of a lack of data. For example, evaluating the effectiveness of the *eSlate* system is a case in point. It would seem simple to evaluate the system by comparing it to the current optical scan voting system that is used throughout the City. A pure scientific experiment would randomly partition subjects into two groups: an experimental group using the Hart equipment and a control group using the traditional system. By randomly assigning people to either the experimental or control group, subjects with idiosyncratic differences are assigned to each group with equal probability; subjects with one idiosyncratic attribute that are assigned to the experimental group will be counterbalanced by a subject with the same idiosyncratic attribute being assigned to the control group.

A pure experiment would then proceed by taking pre-test measurements of the subjects in both the control and experimental groups. Both groups would then vote, and post-test measurements would be taken. Differences in measurements between control and experimental groups after treatment could then be attributed to the treatment. Strong causal claims about the effect of the treatment on the measured post-treatment difference between the control and experimental groups could then be made, as long as subjects were assigned to the experimental or control group correctly.

It is difficult to evaluate voting systems in this manner. Such an experiment in Alexandria would have required – among other things – having both the Hart system and the Diebold optical scan system in the same precincts, and then randomly assigning voters to either the Diebold system (the control system) or the Hart system (the experimental system). This type of experiment would control for environmental factors at the precinct as well as demographic differences among voters. It would also require having certain data about the views that both types of voters had about voting technology prior to participating in the experiment.

In this evaluation, there are not complete comparable data for effectively evaluating the Hart voting system. For example, there are not pre-test data to know the attitudes of voters about voting equipment before they used the Hart system. (The sample of survey respondents is also lower than would be ideal). Similarly, the voting precincts in Alexandria have been modified since the last mid-term election, making it difficult to compare residual votes (residual votes = overvotes plus undervotes plus uncounted ballots) across precincts and over time. This lack of certain data means that it is not possible to determine if the performance of the Hart system in Lee Center – and the voters' reaction to the system – would hold true across the City. It is also not possible to determine whether the performance of the system was affected in any way by the composition of the voters who used it or the way in which the polling station was configured affected voters' interaction with the system. Finally, because the survey data involve the human responses of an uncontrolled sample of the voters, it is important not to make definitive conclusions based solely on the survey data.