Election Review Committee Report

Committee Members
Richard N. Lyons, II (chair)
Tom Davidson (vice-chair)
Paul Tiger
Richard E. Harris
Linda L. Flack
Jay L. Harbour
Michael J. Taylor
Hillary Hall
David Leeds
Drew T. Durham (non-voting)

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INTRODUCTION

The term "hanging chad" forever took its place in American history when George W. Bush won the 2000 presidential election by a handful of votes in the pivotal state of Florida. The "Florida fiasco" spurred Congress into taking legislative action.

On October 29, 2002 the *Help America Vote Act*, ("H.A.V.A "), was signed into law in an effort to improve citizen access to the ballot, reduce election mistakes and fraud, and improve the punch card voting systems by forever eliminating hanging chads. Several important and far-reaching provisions of this federal legislation that impacted voting in Boulder County in 2004 include:

- establishing provisional voting to allow greater access to the ballot;

- requiring that, by 2006, all voting systems used in federal elections must provide the voter with the opportunity to review, change, or verify the ballot before it is finally cast; and

- establishing voting system requirements that effectively eliminate the use of punch-card systems by January 1, 2006

Colorado enacted certain election reform measures in an attempt to bring the state's election code into compliance with H.A.V.A .

The 2000 presidential election also resulted in heightened expectations of the American electorate---that every vote should "count" and "be counted." In addition to this generalized public concern for accuracy, public sentiment wavered between the often conflicting twin goals of obtaining prompt (if not instantaneous) election results, while maintaining the transparency and accuracy that had previously been provided by paper ballots and hand counts. After Florida, numerous advocacy groups and citizen organizations sprang into existence to lobby for election "reform." No one could agree, however, on exactly what such reform should entail.

In turn, these two independent factors—H.A.V.A. and heightened voter expectations---influenced the outcome of a series of public hearings conducted by Boulder County in 2004 regarding the selection of a new voting system to replace the punch-card system.

Although not required to be replaced until 2006, Boulder County's thirty-year old *Data Vote* punch card system was no longer technically supported and had experienced breakdowns in the 2002 election. At the direction of the Board of County Commissioners, and based upon public input that expressed a preference for a verifiable system utilizing paper ballots in lieu of higher-tech electronic voting, a new "H.A.V.A. compliant" voting system was selected.

Boulder County, acting through the Elections Division, purchased, installed, and activated *Ballot Now!* for the 2004 state primary in August and the presidential election in November.

The 2004 general election was held on Tuesday, November 2, 2004 after several legal challenges at the state and local level, last minute election rule changes issued by the Secretary of State, and zealous voter registration drives. Of the approximately 176,000 registered voters in the county, 89,886 cast their ballots on election day while 42,183 voted early, and 27,913 voted by absentee ballots. This represented a 90.8% voter turnout.

The polls closed at 7:00 P.M. on November 2 and each precinct delivered its ballots to the Elections Division in Boulder for central counting. As with the earlier *DataVote* punch card system, no counting was done at the precinct level because the additional required scanners and component hardware were not purchased to fully equip all 230 precincts. Despite a state-of-the-art system and scores of volunteers working at the counting center, Boulder County's election results were not finalized and released until Friday evening, November 5, nearly 72 hours after the polls were closed. Boulder County was one of the last counties in Colorado, and perhaps the nation, to report its final results. Even these "final" results were adjusted the following week after the provisional ballots were verified and counted.

As a result of this delay, and in response to public criticism, the Boulder County Clerk and Recorder and the Board of County Commissioners jointly named a ten-member Election Review Committee that was charged as follows:

A. *Do a review of the 2004 Boulder County General Election process in its entirety including early and absentee voting, voter registration, the vote counting system and the administration of the system, staffing, training, supervision, data processing and ballot development, printing and processing.*

B. *Identify those areas that worked well and those where improvement is needed.*

C. *Recommend a specific action or group of alternative actions involving Boulder County equipment and/or processes that could be improved to expedite future elections.*

The members named to the Committee were: Richard N. Lyons, II (chair), Tom Davidson (vice-chair), Paul Tiger, Richard E. Harris, Linda L. Flack, Jay L. Harbour, Michael J. Taylor, Hillary Hall, David Leeds, and Drew T. Durham (a non-voting member representing the Colorado Secretary of State). Joanna Macy served as the recording secretary to the Committee for its initial two meetings and Melba Shepard served as the recording secretary thereafter.

The Committee organized in December, first convened in January, and met on January 6th, 14th, 21st, and 28th; February 4th, 11th, and 18th; March 3rd, 10th, 18th, and 25th; April 1st, 8th, 15th, 22nd, 23rd, and 29th.

In accordance with the *Colorado Open Meetings Act*, all of the Committee's meetings were open to the public and minutes were taken and prepared weekly. All meetings were taped for minute preparation. The meetings typically lasted four hours.

Although lacking subpoena powers, the Committee heard testimony, examined documents, and accepted public comment. The meetings included both formal and informal presentations by a variety of groups including the Clerk and Recorder, representatives from the Elections Division of the Clerk's office, Hart InterCivic, Inc., Eagle Direct, the Secretary of State's office, the Boulder County Democratic Party, the Boulder County Republican Party, various advocacy and citizen groups including the Citizens for Verifiable Voting and representatives from the Boulder County Administrative Services Department.

In addition, the Committee conducted a public hearing in Boulder and one in Longmont, to receive additional input from concerned citizens, election workers, and others. The Committee also invited and received comments from the municipal Clerks of each municipality within Boulder County. The Committee received 43 documents that were marked and catalogued as exhibits and made part of the official record.

The following report constitutes the findings, conclusions and recommendations of the Election Review Committee. Except as noted, all recommendations reflect the unanimous decision of the Committee.

The Committee wishes to thank the numerous County staff members who assisted the Committee in its work. The Committee particularly wishes to thank Ms. Linda Salas and each of the members of her staff, particularly Patty Stahl and Tim Hansford, and Nancy Jo Wurl, Chief Deputy Clerk. Without their dedicated and courteous cooperation, the Committee would not have been able to effectively conduct its work. They promptly and professionally responded to every request for documents and explanations, and attentively met all of the Committee needs while understanding that their office and actions were being independently examined and analyzed.

Finally, the Committee wishes to recognize the vital and superior work of our recording secretary, Melba Shepard, who expertly maintained our minutes, records and exhibits and calmly met the needs of the Committee.

Dated: June 6, 2005

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SUMMARY

The Committee unanimously concludes that no single factor was the proximate cause of the delay in obtaining the election results in the 2004 general election. Instead of a single cause, the Committee has identified numerous independent factors that combined to create the delay. Some of those factors were within the control of the Election Division, some were beyond its control, and others were the result of acts and omissions of the County's outside vendors and service providers. In addition, some of these factors were so inter-related that it is difficult to separately identify them as causes whereas others set into motion a chain of events that, although traceable, were distanced enough from Election Day that it is difficult to identify them as causes.

The Committee resisted the temptation to review the decision of the County to select the Hart InterCivic voting system. Likewise, the Committee did not examine other voting systems, and does not recommend any particular alternative system.

The Committee also determined that it was not within its charge to determine fault or blame and cautions that its findings should not be used as the basis for any decisions other than those related to the conduct of future elections.

The Committee focused solely on what did and did not cause delays in counting the ballots on Election Day and on making recommendations regarding certain measures that, if taken, may avoid delays in the future.

Major Factors Causing Or Contributing To Delay

The Committee identified the following as being major factors causing or contributing to the delay:

- In its present configuration, the County's current voting system will not yield quick results. This system was designed for use in early voting and mail-ballot elections. Boulder is the only county that uses this system for precinct voting in a general election. Hart InterCivic Inc.'s representatives stated that, under *optimal* conditions, it would have taken 24-28 hours from the commencement of the count to obtain the final results utilizing its voting system in the configuration utilized by Boulder County. This would have yielded a result no earlier than late that Wednesday night, or in the early hours of Thursday morning, depending upon the time of delivery of the ballots from the precincts to the counting center.

- Prior to the close of precinct voting, state law permits the counting on Election Day of early voted and absentee ballots. The Elections Division had planned on counting these 70,096 ballots (representing nearly 40% of the total ballots cast) during the day while awaiting the precinct ballots that evening. However, state law prohibits the commencement of counting until a *Logic and Accuracy Test* (LAT) is conducted. The LAT requires submittal of test ballots by all major

political parties. The individual designated by the Republican Party for the LAT was uncooperative, obstructed the process, and prolonged the LAT until the Clerk and Recorder finally directed the LAT be conducted without his participation. As a result, the counting of the early votes and absentee ballots was delayed until late in the afternoon on Election Day. Although the Clerk and Recorder could have directed his removal from the LAT earlier in the day, she may have been deterred by the public criticism she received when she had him removed from previous LATs. Nevertheless, the inability to promptly conclude the LAT was a major cause of delay.

- State law requires that ballots be printed by a certain date prior to Election Day. The Elections Division obtained three bids for the printing of the ballots. One of the bidders was Hart InterCivic who prefers to print the ballots that are to be utilized with its voting system. However, Hart withdrew its bid because it was concerned that the statewide legal challenge regarding the exclusion/inclusion of Ralph Nader on the ballot, as well as other litigation, would not be resolved quickly enough to enable Hart to fulfill the printing order by the statutory deadline. Boulder County awarded the printing to Eagle Direct, Inc. by way of a waiver of the bidding requirements. No specifications were included by Boulder County in the printing contract because Hart had provided no specifications to Boulder County, presumably because Hart originally intended to be the printer of the ballots. When Hart printed the ballots for the primary in August, and again for the City of Boulder's election in early 2005, no problems were encountered with the ballots. However, in the general election of 2004, there were problems with the ballots that were printed by Eagle Direct and/or its subcontractors. Printing problems were a major cause of the delay as explained below.

- Approximately 13,000 ballots of the 89,886 ballots cast at the precincts were unable to be automatically scanned and counted, because they were identified by the software as containing "damaged races." All of these 13,000 ballots (involving approximately 27,000 contests or races) required "resolution" by teams examining the scanned image of each ballot on a computer screen to determine voter intent. Of these 13,000 ballots that required human resolution before being automatically tallied, approximately 1,000 were caused by obvious printing errors. The remainder appeared to be properly printed but could not be read by the software because the voting boxes were not located on the paper in the exact locations needed to be read automatically. Some ballots had just one or two races that had to be visually examined to determine the voter's intent, whereas other ballots had many damaged races that took additional time to resolve. These 13,000 ballots that required human resolution were a major cause of delay.

- The Hart's software specifications were not provided or explained to Eagle Direct. The software's tolerance for the location of the boxes on the printed ballots was small if standard 8.5 x 11 paper was used. However, problems resulted when the Elections Division decided to use larger 11 x 17 ballots due to the numerous races. The software's tolerances were not discussed with either the

County or Eagle Direct prior to Election Day. The failure by Hart to provide the defined specifications to both the County (which could have inserted them into the bid requirements or printing contract) and then to Eagle Direct was the root cause of the problem with 12,000 ballots.

- More than half of the three-day delay was due to the need for human resolution of these damaged ballots. The resolution teams required more intensive advance training rather than "on the job" training and there were insufficient number of scanners and computers for quick resolution of 13,000 ballots.

- Very successful voter-registration drives, conducted by numerous and diverse organizations, resulted in the submission of more names than the 34,000 actual newly registered voters. This caused valuable Election Division staff time to be diverted from election preparation, planning, and training.

- The Secretary of State changed the rules regarding emergency registration and provisional balloting in the weeks leading up to Election Day (with one change coming just 48 hours before Election Day) causing confusion and delays at polling places. In addition, the rule allowing provisional balloting at any precinct, but mandating that only the votes cast for president would be counted, came too late for any changes to the software, thus requiring human resolution of all of the approximate 3,400 provisional ballots which were determined to be valid. This was a contributing factor causing delay in obtaining results.

- The Houston Room used for the central counting was lacking in size and security. Because of the cramped quarters, there was a lack of a quiet, controlled and efficient working environment due to too many activities being performed by too many people in the same area. This environment indirectly contributed to the delay in counting.

- The Elections Division lacked a management plan that could quickly react to emergencies or unforeseen contingencies. When the damaged ballots started to appear on the resolution screens, there was evidently no backup plan to address and manage the problems and expedite the process. As a result, there was confusion among the workers- both with paid staff and volunteers. The lack of an emergency response plan greatly contributed to the delay in counting.

Summary of Major Recommendations

- As demonstrated by the Boulder City election in early 2005, the Hart system, utilizing hardware as currently configured by the County, is specifically designed and ideally suited for mail ballot elections. The election in November 2005 should be conducted as a mail ballot election.

- Abandon "central counting" for the 2006 election and purchase or rent additional scanners to be utilized at the precinct level or at vote centers if such vote centers are established. This would enable the voters to exercise their rights under H.A.V.A. to reconsider their votes before they are finally cast and would allow for each precinct (or vote center) to count and tally results.

- Utilize the established procurement/bidding system to obtain a printing contract for the printing of ballots. The RFP must contain detailed printing requirements and specifications. The ballots must be inspected and pre-tested by County staff for quality control purposes. Carefully consider the size of each page of the ballot as to whether ease of reading justifies the problems with handling larger pages. If larger paper is used, coordinate with Hart to insure it will not cause delays.

- Utilize advance planning to carefully select precinct locations to accommodate scanners or select bigger areas to be used for vote centers that will accommodate large numbers of voters as well as equipment.

- Establish a management plan that addresses critical paths, including contingency plans in the event of equipment or software failure, careful selection and training of supply judges who must be conversant in computer and scanner operations and trained to handle all last minute rule changes, and the training of Election Day workers.

- Enlist the assistance of all political parties, well in advance of the election, to develop rules, guidelines and purpose for conducting LATs to avoid misunderstandings and delays.

- Although not related to delays, the Committee recommends that the County develop and implement a legally permissible and statistically accurate manual audit process to be conducted immediately after the final results are certified by the canvass board, in conjunction with a citizen's Committee, to serve both as a "check and balance" of the software system to validate the machine count and to provide assurances to the public as to the integrity of the voting system.

1. FACTOR: HART INTERCIVIC ELECTION SYSTEM

In 2004, Boulder County purchased a new ballot counting system to replace its nearly thirty year-old *Data Vote* punch card system. While the old system had functioned well, two major considerations drove the decision to replace it. First, one of the card readers was broken and no vendors were available to repair it. Secondly, the State of Colorado had mandated that punched card systems would no longer be allowed after January, 2006.[1] While the new system offered great promise, counting the ballots in the November, 2004 election required three days, perhaps the slowest count in Colorado.

The choice of the new system was made to provide a paper trail to permit accurate recounts when necessary. It uses paper ballots counted by machine. The system, made by Hart InterCivic, scans each entire ballot to create a digital image, and uses software to determine which votes have been cast. This is a new approach; simpler, older technology, uses a limited number of optical sensors to determine whether votes have been cast. A claimed advantage of the Hart system is that where the machine is unable to automatically determine the voter's intent, election judges can manually resolve races using the image rather than the original paper ballot, avoiding the need to physically handle ballots after they have been scanned. However, incompatibilities between the ballots that were printed for the County's November, 2004, election and the Hart system, were the largest single factor in requiring the counting to take about three days.

The use of the Hart system to count ballots requires many sequential operations. Having a general understanding of them is necessary to understand the delays in counting in November 2004. Therefore the next few pages describe how the Hart system operates.

Creating the Ballots

First the ballot is designed using Hart's *Ballot Origination Software System*™ (BOSS). The operator must define the contests and the text to appear on the ballot, but the software lays out the ballot and encodes it in a *Mobile Ballot Box*™ (MBB), Hart's terminology for a solid-state memory card that is transferable between computers. In the 2004 election, Hart recommended the use of 11" x 17" ballots to reduce the number of sheets compared with 8.5" x 11" sheets. The software keeps track of election, precinct, and sequence numbers. An example ballot is shown in *Figure 1.* After the contests are entered and the ballot is laid out, the software writes a computer file, describing the image of each ballot to be created, using the Postscript language. These files can be shipped to a professional printer or used by the County staff to generate ballots as needed. Ballots must be generated as needed for early voting at locations where voters can appear

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[1] This ruling was a reaction to the failure of punched card systems in Florida in the 2000 presidential election. However, the Boulder County system used a completely different card punching mechanism that left none of the dangling Florida chads that shocked the Nation.

and request ballots for any County precinct. To have preprinted ballots already available for all 230 precincts would be very difficult. The system is especially convenient for early voting. An image of one side of one page of a ballot for the November 2004, election is shown in *Figure 1*. The notable features of the ballot are the three identifying numbers and corresponding barcodes identified on the ballot: the election number, the precinct number and the sequence number[2].

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[2] The presence of a sequence number was controversial among some citizens who feared that it could be used to trace a ballot to the voter. Boulder County never records a correlation between the voter's name and the sequence number. A court case was decided in favor of the use of sequence numbers. The sequence numbers have a major importance in performing a statistical analysis of the validity of the counting process.

Vote Both Sides

OFFICIAL GENERAL ELECTION BALLOT
Boulder County, Colorado
November 02, 2004

Precinct *2181307018-B23*

Linda N. Salas

Linda N. Salas
Boulder County Clerk & Recorder

200002221000

Instruction Note:

Please use a black or blue pen to mark your ballot. To vote for your choice in each contest, completely fill in the box provided to the left of your choice. IF YOU VOTE FOR MORE THAN THE MAXIMUM NUMBER OF ALLOWED CHOICES IN A RACE, YOUR VOTES IN THAT RACE WILL NOT BE COUNTED. TO VOTE FOR A WRITE-IN CANDIDATE, COMPLETELY FILL IN THE BOX PROVIDED TO THE LEFT OF THE WORDS "WRITE-IN" AND WRITE IN THE NAME OF THE CERTIFIED WRITE-IN CANDIDATE ON THE LINE PROVIDED. If you tear, deface, or wrongly mark any page of this ballot, return it and request a replacement packet, not exceeding three in all.

PRESIDENTIAL ELECTORS
(Vote for One Pair)
- [ ] George W. Bush / Dick Cheney — Republican
- [ ] John F. Kerry / John Edwards — Democratic
- [ ] Michael Badnarik / Richard V. Campagna — Libertarian
- [ ] David Cobb / Patricia LaMarche — Green
- [ ] Ralph Nader / Peter Miguel Camejo — Colorado Reform
- [ ] Michael Anthony Peroutka / Chuck Baldwin — American Constitution
- [ ] Gene Amondson / Leroy Pletten — Concerns of People
- [ ] Stanford E. Andress (Andy) / Irene M. Deasy — Unaffiliated
- [ ] Walter F. Brown / Mary Cal Hollis — Socialist
- [ ] Earl F. Dodge / Howard L. Lydick — Prohibition
- [ ] James E. Harris / Margaret Trowe — Socialist Workers
- [ ] Bill Van Auken / Jim Lawrence — Socialist Equality
- [ ] Write-In

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UNITED STATES SENATOR
(Vote for One)
- [ ] Pete Coors — Republican
- [ ] Ken Salazar — Democratic
- [ ] Victor Good — Colorado Reform
- [ ] Douglas "Dayhorse" Campbell — American Constitution
- [ ] Richard Randall — Libertarian
- [ ] John R. Harris — Independent
- [ ] Finn Gotaas — Unaffiliated
- [ ] Write-In

REPRESENTATIVE TO THE 109th UNITED STATES CONGRESS - DISTRICT 2
(Vote for One)
- [ ] Mark Udall — Democratic
- [ ] Stephen M. Hackman — Republican
- [ ] Norm Olsen — Libertarian

REGENT OF THE UNIVERSITY OF COLORADO - AT LARGE
(Vote for One)
- [ ] Jennifer Mello — Democratic
- [ ] Steve Bosley — Republican
- [ ] Daniel Ong — Libertarian

STATE SENATE - DISTRICT 18
(Vote for One)
- [ ] Ron Tupa — Democratic
- [ ] Krista Poch — Republican

STATE REPRESENTATIVE - DISTRICT 13
(Vote for One)
- [ ] Tom Plant — Democratic
- [ ] Rand Fanshier — Libertarian

DISTRICT ATTORNEY - 20th JUDICIAL DISTRICT
(Vote for One)
- [ ] Mary Keenan — Democratic
- [ ] Write-In

COURT OF APPEALS
Shall Judge James S. Casebolt of the Colorado Court of Appeals be retained in office?
(Vote Yes or No)
- [ ] YES
- [ ] NO

COURT OF APPEALS
Shall Judge Dennis A. Graham of the Colorado Court of Appeals be retained in office?
(Vote Yes or No)
- [ ] YES
- [ ] NO

COURT OF APPEALS
Shall Judge Arthur P. Roy of the Colorado Court of Appeals be retained in office?
(Vote Yes or No)
- [ ] YES
- [ ] NO

COURT OF APPEALS
Shall Judge Daniel Marc Taubman of the Colorado Court of Appeals be retained in office?
(Vote Yes or No)
- [ ] YES
- [ ] NO

COURT OF APPEALS
Shall Judge John R. Webb of the Colorado Court of Appeals be retained in office?
(Vote Yes or No)
- [ ] YES
- [ ] NO

DISTRICT JUDGE - 20th JUDICIAL DISTRICT
Shall Judge Morris W. Sandstead Jr. of the 20th Judicial District be retained in office?
(Vote Yes or No)
- [ ] YES
- [ ] NO

DISTRICT JUDGE - 20th JUDICIAL DISTRICT
Shall Judge Daniel C. Hale of the 20th Judicial District be retained in office?
(Vote Yes or No)
- [ ] YES
- [ ] NO

DISTRICT JUDGE - 20th JUDICIAL DISTRICT
Shall Judge Lael Montgomery of the 20th Judicial District be retained in office?
(Vote Yes or No)
- [ ] YES
- [ ] NO

COUNTY JUDGE, BOULDER
Shall Judge Thomas J.B. Reed of the Boulder County Court be retained in office?
(Vote Yes or No)
- [ ] YES
- [ ] NO

COUNTY JUDGE, BOULDER
Shall Judge John F. Stavely of the Boulder County Court be retained in office?
(Vote Yes or No)
- [ ] YES
- [ ] NO

COUNTY COMMISSIONER - DISTRICT 1
(Vote for One)
- [ ] Jeff Christen-Mitchell — Libertarian
- [ ] Will Toor — Democratic
- [ ] Write-In

COUNTY COMMISSIONER - DISTRICT 2
(Vote for One)
- [ ] Ben Pearlman — Democratic
- [ ] Roger Lange — Republican
- [ ] Paul Tiger — Libertarian

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Vote Both Sides

Election and page number

Voting box

Election number

Sequence number

Figure 1. Example of one page of an unused November, 2004, ballot. This image is about one-half the original size of 11" x 17". Ballots ranged in length from three to five pages.

Operation of the Counting System

The operation of the Hart counting system is illustrated in *Figure 2*. The most featured part of the Hart system is a high-speed scanner manufactured by Kodak. Controlled by a human operator who loads a batch of several hundred ballots, it scans both sides of each ballot at a rate exceeding 60 pages per minute. The master computer interprets each image of one side of a ballot to read the barcodes. In the election of November 2004, the computer was unable to interpret the barcodes on about 1,000 ballots, which had to be duplicated. Also the scanner occasionally jams and defective ballots must be removed and duplicated elsewhere. A batch log is automatically generated that shows the status of each ballot. It is printed and attached to the scanned ballots that are put in a temporary storage area.
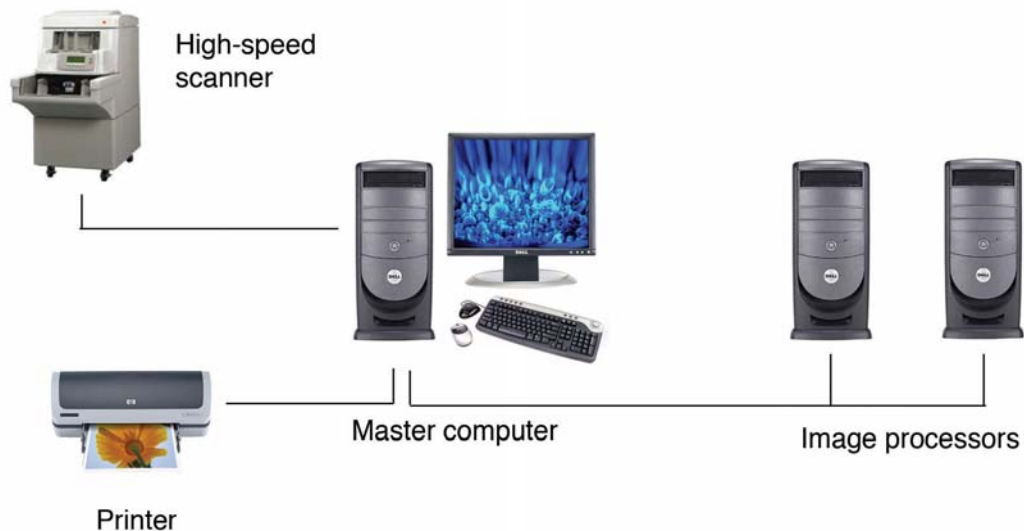

Figure 2. Block diagram of one scanning/resolution station in the Hart counting system. Boulder County owns and uses 8 such systems in parallel.

For the election of 2004, the most troubling ballot status was "rejected". This often meant that the computer was unable to read the barcodes on the ballot. Usually this resulted from poorly printed barcodes that were slightly smudged. In other cases, the ballot might have been wrinkled, severely folded, or damaged by food, especially in the case of absentee ballots. In a few cases, the voter deliberately defaced barcodes. For each rejected ballot, it was necessary to physically remove it from the batch of ballots and for a team of election judges to remark or duplicate the ballot onto another blank ballot. In the 2004 election about 1000 ballots needed to be duplicated. The great majority of duplicated ballots were associated with heavy printing that was not noticeable to a casual observer, but could sometimes be detected by a trained observer. The training was on-

the-job and in the middle of election night. Collecting and duplicating ballots was very time consuming, but that was not the primary cause of the slow counting.

Resolution

When scanning of the batch is complete, the operator instructs the system to resolve all the races on the ballot. Resolution is the term used to describe the conversion of the images of marks within voting boxes into a list of how the voter chose to vote; for example yes rather than no on the third contest or votes for Mary and John, but not Sam in another contest.

This operation is best completed automatically by the two image processing computers. However, the system allows manual resolution of races where that cannot be accomplished automatically. Examples are write-in contests and ballots where the computer cannot locate the voting boxes with sufficient accuracy. The latter was a problem with 13,000 ballots in the November 2004 election.

Once the automatic resolution process is complete the computer shows a list of the ballots for which automatic resolution was unsuccessful. The operator can display an image of each of these ballots one at a time highlighting those contests that require resolution.

If there are fewer than the maximum number of votes in a contest, that is considered an undervote. The Hart system was set to automatically resolve undervotes.

However, if the system detects more than the allowed number of votes, called an overvote, the Hart system was set to require manual resolution of the race. Because the Hart system stores the scanned image of the ballots, the operator can display an image of just the portion of the ballot representing the overvoted contest. In order for the two judges and the operator to simultaneously see the image, it is projected onto a wall using a digital projector. Then the election judges determine from the image what the voter intended and instruct the operator to enter that result into the computer. The response to the operator is visible to all so the operator and the two judges can be certain that the correct result has been entered.

When automatic resolution is successful, the county staff estimated that roughly 1,200 ballots can be interpreted per hour per scanner, giving a total of about 10,000 total interpreted ballots per hour using the County's eight scanners. The estimate includes all operator actions to complete the scanning.

An unfortunate limitation of the Hart counting system is that multiple page ballots must be scanned in sequence. When a voter puts ballots in the voting box, it is quite easy for multiple pages to be out of order or for them to become intermingled with other voters' ballots. While the sequence number permits precinct workers to manually reorder the ballots when the ballot boxes are opened, doing so is time consuming and error-prone. Hart's software should be revised so it can use the sequence numbers to resort images of improperly ordered pages that are already stored in the computer.

Logic and Accuracy Testing

The State of Colorado mandates that Logic and Accuracy Testing (LAT) for electronic counting systems be performed at most ten days before an election and again on election day before any voted ballots are counted. Representatives of the political parties are asked to fill out actual ballots as if they were voting and to manually keep track of their votes. Each party fills out about 25 ballots. Local jurisdictions and county staff also fill out additional test ballots. Then the approximately 200 test ballots are counted by the scanning and tallying system and compared with the votes cast by the parties. Any discrepancies are resolved by manually inspecting the ballots. Any problems identified with the system, must be resolved before any actual ballots can be counted. For further details please refer to a report submitted by Don Hayden as Exhibit 18.

In the November 2004 election, one representative demanded that the system be exposed to very unusual circumstances. Two examples were a crumpled ballot and one with only tiny dots placed in the voting boxes. The County Clerk, who is fully in charge of the LAT, attempted to accommodate the person's wishes without success. Finally she found it necessary to proceed without his consent. As a result the LAT was delayed almost until the polls closed. Had it been possible for the LAT to be completed 10 days before Election Day, as permitted by the State of Colorado, all absentee and early votes would have already been counted when the polls closed. These ballots represented about 44% of the total. Early counting could have significantly improved the speed of counting because about 70,000 more ballots (44% of the total) would have been counted before the polls closed. This is another of the major factors that caused the counting to take three days.

The delay to the final tally was at least 8 hours. If the absentee and mail-in ballots had already been counted before Election Day, 44% of the total votes could have been reported immediately after the polls closed. If election day precinct vote counting could have begun by 9:00 pm that night, the ballot problems could have been detected much earlier and adequate resources and staffing could have addressed the problems on election night instead of the following morning.

Ballot Incompatibility

After about 5 hours of counting in the November, 2004, election, the elections staff began to notice numerous avocado green highlighting of many races. This was a failure of the computer to recognize even the location of the voting boxes, called a "damaged" contest. The location was found sufficiently well, however, that the image of the damaged contest could be viewed and manually resolved. Over the three-day counting period, manual resolution was required for about 27,000 damaged races on about 13,000 ballots.

The Boulder County election staff had never seen such damaged races. Even more significantly, representatives from Hart testified they had never seen the problem before. It represented the most significant contribution to the slow counting. Fortunately the damaged races could be resolved by viewing the already-scanned images with the Hart

system, a far more efficient method than manipulating the paper ballots in a direct hand count. Nevertheless, one estimate was that manual resolution added at least an extra 21 hours to the total counting time.

In the Hart system, all contests within a batch of ballots must to be resolved before tallying. This delays the reporting of tallies and idles scanners. With so many damaged contests, the output of tallied votes became a trickle. Moreover, when the operator and judges were resolving contests no more scanning could be done because the same computer used for the scanning had to be used for resolution.

Tallying of the Votes

When a batch of ballots is finally fully resolved, the votes counted are written to a Mobile Ballot Box™ (MBB). The MBB is then carried to another computer running the Hart Tally™ software that records the contents of the MBB and adds the totals from the batch to the other batches already counted. The MBB is then returned to the scanner and scanning and resolution begins again with another batch of ballots. In principle, scanning and resolution could have been continued during the Tally process had more MBBs been available. They are however relatively expensive and the County staff had bought only enough for the normal counting process that they had reasonably projected.

The Tally system reports tallies for all the precincts. However, there is no automatic software for posting the latest tally on the County web site. As a result, data must be manually entered on the web site. Since the staff was so unexpectedly busy with counting and resolution, they concentrated on counting ballots and issued few counting updates even though they were concerned about the public reaction to the long counting time. They now believe this caused a public perception that the counting was effectively halted, even though it was actually continuing, albeit at a much slower pace than the public had grown accustomed to in previous elections. The staff now understands its responsibility to the electorate will be to make many more frequent reports, even at the cost of slowing the counting.

Qualitative Observations

The Election Review Committee was only able to qualitatively determine the causes of the delayed counting. The Committee's investigation was limited by several factors. Because of legal limitations on the Committee, witnesses could not be subpoenaed nor required to give sworn testimony. There was conflicting testimony. The printing company, EagleDirect, suggested the problem might be a coding error in the Postscript files used to print the ballots. Hart suggested the problem was poor temperature and humidity control of the ballot paper prior to printing. Hart was uncooperative in providing information about the internal workings of their system, claiming that it was proprietary on the one hand and that the Committee was too technical on the other. The County refused to allow the audit logs to be examined to attempt to trace ballots with damaged races to the printing machine used. Apparently, they feared a release of a ballot

serial number would be viewed as violating a voter's privacy, even though no name was associated with the number.

The Committee can only conclude that about 1,000 rejected ballots, by EagleDirect's testimony, were inadequately printed, that Hart should have provided detailed specifications for printing instead of refusing to explain the printing requirements to Hart, and that the County should not have ordered the ballot printing with no specifications. Unknown to any of the participants, the counting was doomed to be sluggish when the ballots were delivered to the County about one month before Election Day.

Problems That Can Be Fixed

The Committee wishes to point out a number of other problems with the Hart system that have not been mentioned above.

Ballot Size

- The County elections staff chose a ballot size of 11" x 17" with the support of Hart representatives.

- The large paper was chosen to reduce the number of sheets of papers compared with the larger number that would have been required if 8.5" x 11" paper had been used.

- The County staff rejected the use of smaller type since that might have been difficult for voters to read.

- The large paper was difficult to handle.

- The voters had difficulty putting their ballots into the ballot box without revealing them. Precinct workers had difficulty properly sequencing the ballots because of their large size.

- The election workers doing the counting had to manipulate piles of hundreds of ballots to locate those that had been rejected.

- A fundamental problem with large ballots may also be present. When the software locates the barcode fiducial marks and extrapolates across the page to find a voting box, the greater length on a large ballot increases the likelihood of an error. Perhaps larger ballots exacerbated the tendency of the system to find damaged contests. In a slightly different approach, the Committee recently learned that Orange County, California, has used 8.5" x 22" ballots with its Hart system. With all these factors now known, the County staff will likely reassess the ballot size issue when the next election with many contests occurs.

Hart Software

There are areas where the Hart software needs improvement. In discussions with the Committee Hart representatives were very non-committal about making changes.

- Had the ballot design included more fiducial marks than just the barcodes it would have been more robust in the face of printing variations in the locations of voting boxes because the marks would have been closer to the boxes.

- The Hart software should reorder multiple page ballots that are not in sequence, at least within a batch, saving substantial time that precinct and central counting workers spent doing that task.

- The user interfaces for the software need significant improvement for both user convenience and to eliminate the possibility of serious error. For example in the BOSS system for creating ballots on-demand, failure to close a computer window resulted in creating multiple ballots having the same serial number. While there was no fraud involved, it required duplicating ballots during the counting process. The labels on windows that opened were sometimes poorly designed. For example, a window might open automatically at a small size leaving its label only partly visible. At as result operators were often misled about the function of the window. While the window could be expanded manually, in some cases that may not have been done and an error was possibly made. In other situations, excessive mouse motions and clicks were required. This is not a serious problem, but in a large election with tired workers, it is not acceptable.

Committee members noted that in previous elections, utilizing different counting equipment, the write-in contests had been resolved at the precinct polling places. If that were possible with the Hart system, it would speed-up the counting.

Strategies to Improve Counting Speed Using the Hart System

1. Ultimately the counting speed would be best with scanners at each polling place. After the voter finishes marking his ballot, he would feed it into a relative inexpensive scanner. In just a few seconds the scanner would display on a screen how it interpreted the ballot. The voter could verify the machine interpretation. If the voter accepted it, the ballot would drop into a ballot box and the vote would be counted in the precinct level computer. If the voter found the interpretation incorrect, the ballot would be returned for corrections, or the voter could ask for a new ballot and remark it. Counting and resolution would effectively be carried out during the entire day with all polling places working in parallel. This form of precinct level scanning is very attractive to the Committee. It would speed the counting and give voters more confidence. The Committee did not assess the cost

of purchasing the scanners and screens and installing them in each of the 230 precincts.

2. An option to improve the counting time of the present system is to add more scanners similar to those already part of the County facility. From a simplistic point-of-view, doubling the number of scanner/resolution stations ought to halve the counting time in the following calculation to 13 hours.

3. Hart representatives submitted the information shown in the first column of Table 1 to estimate the counting time in an election with size of that in November 2004. Assuming counting and resolution at a preferred pace and using the present Hart equipment and software configuration, the counting time would be about 9 hours for scanning plus an additional 13 hours for resolution. Note that Hart's calculations allow only 15 seconds per resolution, a pace that would be difficult to achieve, much less sustain over a 22-hour counting time. Hart's estimate apparently does not account for inefficiencies in moving, storing, and staging of ballots. Hart estimated only half of the number of ballots to be counted because they excluded absentee and mail-in ballots that were not counted before election night, only half of the number of write-in votes, and only half the number of damaged contests. Hart's estimate is clearly too conservative.
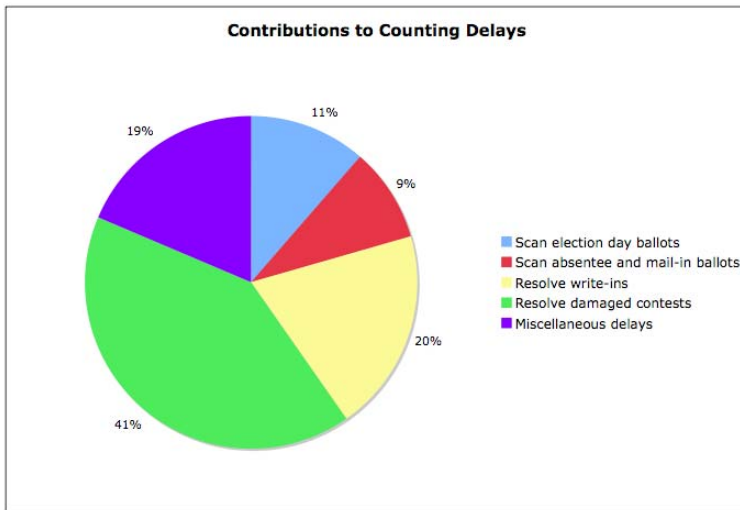
Table 1. Calculation of Counting Times Using Two Assumptions

Hart InterCivic Nov. 2, 2004		Hart InterCivic (adjusted) Nov. 2, 2004	
	55% of all ballots cast on Election Day		*All ballots counted on Election Day*
88000	Total voters casting ballot Election Day	160,011	Total ballots counted on Election Day
202,400	Number of sheets (2.3 sheets per ballot)	320,022	Number of sheets at 2 (3 sides) per ballot
70.3	Hours for one station	111.1	Hours for one station
8.8	Hours for 8 stations	13.9	Hours for 8 stations
4,696	**Est. accepted write-in votes**	8575	**Write-in votes**
7,044	Total write-in votes (est. at 1.5 times accepted)	12862	Total write-in votes (est. at 1.5 times accepted
15	Est. avg. seconds to resolve one write-in	30	Est. avg. seconds to resolve one write-in
29.4	Hours to resolve with one station	107.2	Hours to resolve with one station
3.7	Hours to resolve with 8 stations	13.4	Hours to resolve with 8 stations
14,973	**Estimated Damaged Contests**	27,000	**Estimated Damaged Contests**
15	Estimated time to resolve one race (seconds)	30	Estimated time to resolve one race (seconds)
63.4	Hours to resolve with one station	225.0	Hours to resolve with one station
7.8	Hours to resolve with 8 stations	28.1	Hours to resolve with 8 stations
22.4	**Total hours to count election with 8 stations**	**55.4**	**Total hours to count election with 8 stations**

In later verbal testimony, a Hart representative estimated that, in a good situation, the counting would have taken between 24 and 28 hours. No calculation was given to justify this time but it is similar to that resulting from the above correction to Hart's calculations.

The Hart calculation was corrected for the errors mentioned. In addition the resolution time was raised to 30 seconds per contest. This calculation shows a counting time of 55 hours, still less than that actual counting time of about 68 hours (from 7 pm Tuesday until 3 pm Friday) after the polls closed. Nevertheless, this calculation is similar to the actual time required suggesting the methodology is reasonable.

Contributions to Counting Delays

- 11% Scan election day ballots
- 9% Scan absentee and mail-in ballots
- 20% Resolve write-ins
- 41% Resolve damaged contests
- 19% Miscellaneous delays

The calculation was also applied to a hypothetical future election in which the major causes of delay are expected and not allowed to happen. These results are not shown in the table. It is assumed that the ballots are printed to be compatible with the Hart system, the LAT is completed about 10 days before Election Day which permits all absentee and mail-in ballots to be counted before election day, leaving only half of the total ballots to be counted on Election Day. It is also assumed that there are only 1,000 damaged contests. The calculation suggests an election the same size as November 2004, could be counted in 8 to 12 hours if the election workers were highly trained and organized for efficiency. The Committee is aware that this result is only a calculation. The potential speed is the basis for a recommended test of the Hart system in the next election in November 2005.

This calculation suggests the resolution time for the November 2004 election was about twice as long as the scanning time. The first task in avoiding the long counting time is to have ballots that work with the Hart system and do not produce unreadable ballots or damaged contests. There were no damaged races on any ballot printed on the County's in-house printers.

Yet another approach to improving the counting time would be to network the scanning/resolution stations together. This would permit resolution teams to work in a nearby quiet environment without the noise of the scanners. Conceivably, all of the resolution teams could be working on a batch of ballots from one scanner while the other

scanners ran at optimal speed. When an MBB was taken from a scanning system to the Tally system, resolution teams could be resolving other batches from any of the other seven scanners. County staff are now exploring whether this is possible using existing equipment. Networking of this sort could dramatically reduce the counting time for an election like November 2004. In the election, scanners sat idle while resolution teams reviewed scanned images to determine and enter voter intent. Of course, future elections will hopefully not have 27,000 races to resolve. Networking is inexpensive and it will certainly allow a more comfortable work environment for the people doing the counting and resolution.

Logic and Accuracy Test Delays

In November, 2004, because of the major delays in performing the LAT, 27,942 absentee and 42,183 early voting ballots were not counted until after the polls closed. This must not happen again. This improvement alone, that will cost nothing, will reduce the counting time by one-third. <u>This was a major issue that the Committee strongly believes is in need of resolution.</u>

Learning Curve

The use of any system is a very complex interplay between equipment and people. In future elections, the counting time is certain to be reduced. Much of that reduction will hopefully come from learning how to specify and print ballots that are compatible with the Hart system. But other major improvements will come from the familiarity of the nearly 2,000 workers that are required to carry out an election like that in November 2004.

Hand Counting

A significant amount of public testimony was heard supporting hand (manual) counting of paper ballots. Specific examples were given of systems in Switzerland and Canada. It was beyond the scope of the Committee to evaluate alternative methods of counting votes. Hand counts of contests nevertheless represent a benchmark for features and performance that would provide a point of comparison for a future system selection.

In the November 2004 election, all of the ballots that could not be automatically scanned and tallied had to be manually read, interpreted and added to the count. This amounts to approximately a thousand full ballots that could not be recognized and about 27,000 contests that could not be read by the Hart system. Manual count is the fallback position when the system is unable to perform as designed.

Example Ballots.

These partial images of a ballot were selected by the Boulder County staff, based on their experience, to show a ballot that has a high likelihood of producing a rejected ballot or damaged races.
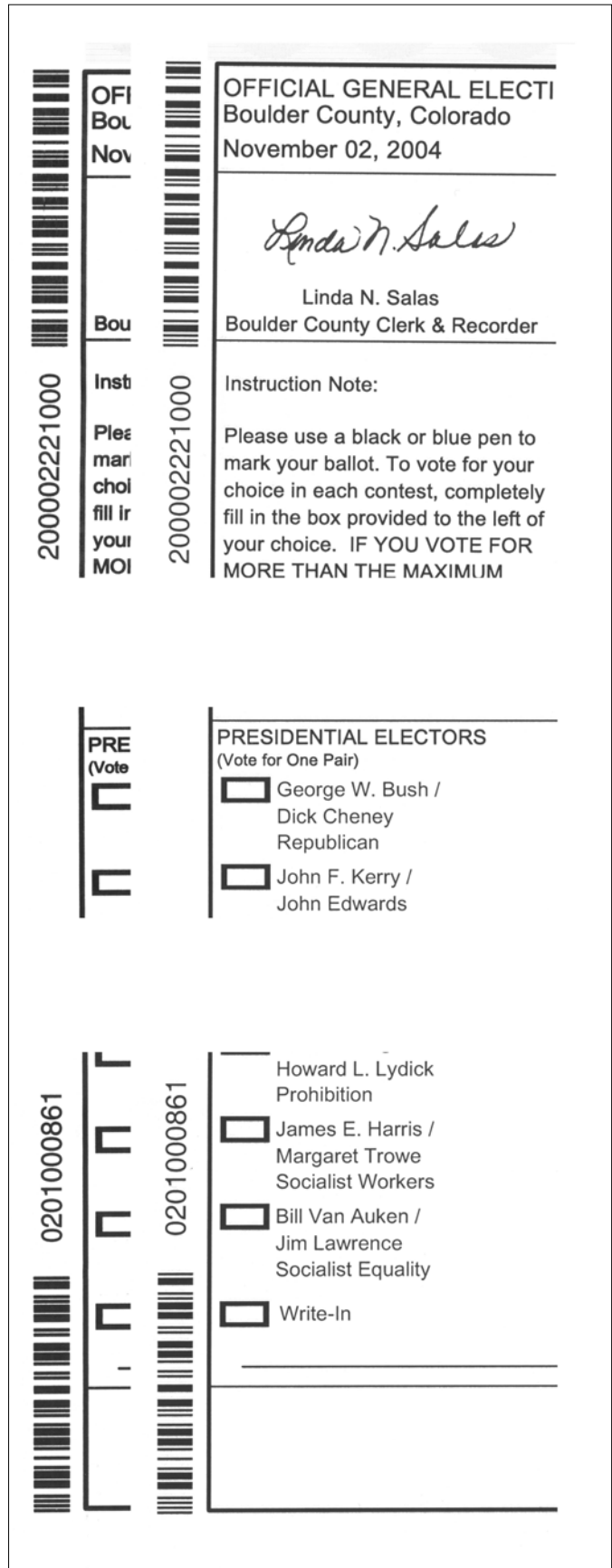
This image shows a ballot on the left printed by EagleDirect using a high-speed xerographic printer. It is overlaid on the right by one printed from the same Postscript file using Boulder County's 11" x 17" office-quality printer. No ballots printed using this model of printer were ever found to be rejected or to be associated with damaged races.

Note the heavier printing in the professionally printed ballot. Also, note that lines in the barcodes are in some cases nearly blurred together. Moreover, the barcodes and their numbers are at slightly different positions.

The voting boxes at the middle of the page are at slightly different vertical positions, something that might cause a damaged contest.

Note that in most cases, if an untrained voter were to examine these ballots, she would not notice the differences. Only when compared side-by-side are the differences apparent.

This image was prepared for illustration. It may degrade if multiple copies are made of this report.

RECOMMENDATIONS WITH RESPECT TO HART SYSTEM

The following is the majority recommendation of the Election Review Committee to the Board of County Commissioners and the Clerk and Recorder of Boulder County regarding Boulder County's current election system:

1. Because the November 1, 2005 election will probably be a mail ballot election, utilize the current voting system for that election. As demonstrated by the City of Boulder's recent election, the Hart system is specifically designed and ideally suited for early voting/mail ballot elections. This election provides an opportunity to optimally utilize the system and determine exactly how fast the system can count ballots. Based upon this information, the election staff can make a reasonably accurate estimate of the expected counting time for the 2006 gubernatorial election.

2. In sufficient time to adequately prepare for the 2006 gubernatorial/mid-term election, rent or purchase precinct scanners that comply with H.A.V.A and that count and allow for voter review and resolution of a ballot before it is finally cast at the precinct. These could be Hart Ballot Now scanners, which Hart indicates will be on the market later in 2005, or they could be optical scanners from another company. The existing Ballot Now system can be used in its current configuration for absentee voting and works well for early voting. The use of precinct scanners, at early vote centers will make it even more efficient. One voting station per site must allow disabled voters to cast ballots unaided pursuant to H.A.V.A .

The minority opinion of the Committee believes that the expenditure for additional scanners should not be made until, and unless, a test of the system at the 2006 gubernatorial election demonstrates such a need.

The Committee learned late in its proceedings that the state would soon disburse approximately $800,000 to Boulder County to lessen the financial impact of the conversion from the old punch card system. These funds could be utilized for this purpose.

3. Experiment in 2006 and 2007 with additional early voting centers and with election day vote centers in lieu of precinct voting, in preparation for the 2008 presidential election.

Other options considered, but not recommended, by the Committee:

A. Abandon the Hart system and purchase, for immediate implementation, another voting system that would comply with federal and state requirements.

B. Purchase additional supportive software, hardware, and equipment, including scanners and computers, to fully implement the Hart system for use at a

general election. Such implementation would allow for voter review and resolution of a ballot before it is finally cast, such resolution occurring both during early-voting and at a precinct or voting center for election-day voting;

C. Continue to use the current system, monitor its future performance, continuously ranking it with other technologies as they become available. Planning to implement an improved system in time for the 2008 primary.

D. Hand count paper ballots at precincts.

E. Purchase many more scanners and move central counting to the Boulder County Fairgrounds where there is sufficient space for additional equipment to more quickly resolve, count, and tally the votes**.**

2. FACTOR: PRINTING ISSUES

Printing was suspected as a significant source of tally delay from the inception of the Election Review Committee for Boulder County. The task of printing was accomplished by the Boulder County Clerk's facilities and by Eagle Direct and its contractor.

Issue: Printing Quality

In testimony, representatives of Eagle Direct accepted responsibility for those misprinted ballots suffering from overtone, undertone, and mis-registration to the page. This contributed to less than 1000 ballots cast where the bar codes could not be read. Damaged ballots of this nature were "duplicated" by county personnel with on-demand ballots printed by the county on county equipment.

Eagle Direct did not accept responsibility for approximately 27,000 races on ballots that had readable bar codes but could not be resolved by the Hart System and caused delays. Manual resolutions of the 27,000 races were the most significant source of the delay of the tally. County staff testimony stated that the resolutions added 21 hours to the count. The Election Review Committee could not definitively identify the root cause – printing or scanning/optical recognition by the Hart System. Eagle Direct offered correspondence with the paper supplier that suggested that environmental factors could move previously correctly printed images out of the Hart System's sensitive zone and that this could result in irresolvable races. This effect is exaggerated as the paper gets larger and is different in each direction on the paper.

It seems clear that some of the printing delivered by Eagle Direct stressed the scan, resolution, and tally capabilities of the County/Hart InterCivic System and made weaknesses in other parts of the whole election process more evident.

Issue: Paper Size

The large paper used in the November general election had several disadvantages:

- Affects paper movement during printing and scanning

- Increases the difficulty of automatically locating the voting box on ballot

- Delays Voters at polling location

- Increases time handling ballots during scanning and resolving

On-Demand Printing differs from traditional printing in many aspects, one of which is paper transport. Printers of this type change direction of the paper during printing and rely on rollers to convey the media through the machine. Each contact and change in direction is an opportunity for the paper to become less square paper edge to image. As a

result, the specification for image position is not as tight on On-Demand printing as lithograph and many other traditional printing techniques. With larger paper, the farther the reference point is from a box on the image, the farther from nominal it may be with all other machine variables constant. Smaller paper is better. A similar situation occurs when the ballot is fed into the scanner.

Testimony suggested that the larger ballots were more difficult for voters to handle. Specifically, larger areas to vote are required, managing multiple sheets was difficult going from station to station, and the use of the privacy sleeve was compromised when placing the ballot in the ballot box.

Sorting, stacking, loading and unloading scanners was more tedious for election workers with the larger ballots and contributed to delays in processing each ballot.

Issue: Paper Conditioning

In testimony, Hart InterCivic suggested that the printing and scanning problems could be explained if the paper was improperly conditioned by Eagle Direct before it was printed. Eagle Direct testified that they used industry best practices and cited applications support by the paper supplier that changes in the paper after, as well as before, could account for significant movement of the image from internal reference points. The Committee feels the conditioning had a minimal effect.

Issue: Procurement

There was a disconnect between what was needed and what was communicated between Hart InterCivic, Boulder County and Eagle Direct. Unlike lithography, where bad images can be culled out and isolated from shipment, On-Demand Printing results in unique images that have to be 100% correct. Rework may cause duplicate ballots (serial number) if the poorly printed ballots are not quarantined. Unfortunately, poor ballots were not quarantined when remade at the printer and there were duplicates delivered to the county.

The county did not use a formalized procurement process. Historically this was a common practice. Speed to meet state deadlines sacrificed quality of the printed image. Ballots require more quality and process control to meet requirements than typical printing jobs yet neither the county nor Hart InterCivic provided documented specifications to highlight critical characteristics. Eagle Direct was inexperienced in printing ballots and did not have the expertise to anticipate the more stringent requirements. Hart withdrew its bid to print at the last minute leaving only Eagle Direct willing to meet the County deadline. Inadequate lead-time for the printer may have created an atmosphere that implied a best effort, particularly since the expectation and penalties for non-compliance were never specified or documented on the purchase order. No contract was issued to support a purchase order.

Eagle Direct also subcontracted some of the work to John Phillips (company) to meet deadlines. While they described the relationship as an extension of their shop with their quality and process control, some testimony by Eagle Direct suggested that the known damaged ballots all came from the subcontracted equipment. In the future, specifications and certifications may prevent subcontracting from being a variable.

Issue: Barcodes

Industry practice on bar codes allows them to change size and still be readable by standard scanners. Since the Hart Software used the bar codes as locators, "fiducials," having them change shape and location may have contributed to the optical recognition to not find races. Our investigation was unable to get a clear agreement on how the bar codes were represented in the postscript files provided to the printer, nor how the bar code was used as a fiducial in the optical recognition algorithm used in the Hart system. Depending on how they may have been represented, transformations (Raster Image Processing, or "RIP") accomplished at the printing machine may have contributed to the Hart's systems inability to locate the voting box for 27,000 races.

Issue: Labeling

Some packages of ballots delivered by Eagle Direct were mislabeled as to the number of ballots contained and the serial numbers represented in the package. While it may have been inconsequential, it does suggest a systematic problem with security and quality control checks at Eagle Direct.

RECOMMENDATIONS REGARDING PRINTING ISSUES

The following is the unanimous recommendation of the Election Review Committee:

Ballots must be procured using Boulder County's formal procurement process, including, but not limited to: 1) written request for proposal or quotation; 2) detailed printing requirements and specifications; and, 3) formal written bids from vendors. The ballots should also be inspected by a qualified county inspector, either at the vendor's facility or upon the ballots being received by the County.

Ballots should be inspected using a random sampling inspection methodology. This methodology should use the actual ballots printed by vendor. Ballots should then be processed by the same machines used to scan and tabulate on Election Day. In addition, at the voting location, an election worker must visually inspect each page of a ballot for appearance prior to giving that ballot to a voter. This is to ensure that each ballot given to a voter contain no obvious error (i.e., blurred images or not completely printed pages)

A printing vendor must be selected from a pre-qualified vendor list (Boulder County could itself be a qualified vendor) with ballot quality overriding price and schedule, as long as the County would receive the ballots in time for the election. Vendor pre-qualification must include as a minimum; 1) vendor has demonstrated its ability to produce ballots without error and of good quality from the Postscript files created by the HART *Ballot Now* system or other computer generated file: 2) vendor has a written quality assurance system in place that is capable of detecting ballots that do not meet specification requirements; and, 3) vendor is capable of verifying the electronic files prior to printing as to the origins of the *x-y* coordinates and any other possible errors or anomalies.

The County must produce a ballot printing specification for use in the procurement process. It is recommended that a digital printing specialist be used to produce the specification, or review a specification produced by HART or other future vendor. The printing specification must as minimum contain centering location and voting box location together with allowed tolerances. It is further recommended that ballots be 8 ½ by 11 inches until the County or Hart can demonstrate that the printing specification can be achieved without great difficulty on larger sized ballots.

3. FACTORS: PLANNING, STAFFING & EDUCATION ISSUES

OFFICE STAFFING, TRAINING AND MANAGEMENT

The 2004 Presidential Election was forecast to have one of the highest turnouts in years. The early surge in voter registrations certainly confirmed this prediction. These indicators called for careful planning and significant increases in staffing over previous years. The use of a new voting system made the need for careful planning even more essential. Unfortunately, both political parties criticized the Elections Division for its apparent lack of understanding the manpower needed, or the hours required, to complete all of the required tasks. As a result, the parties attempted to manage their own staffing but were unable to advise their volunteers about work hours due to lack of information from the Elections Division management.

Registration Records

Testimony indicated that planning was inadequate for staffing and processes for handling the record number of new registrations, changes to existing records, increase in turnout and in early voting, to name only a few areas. The Committee was told that voter registrations were still being entered into the system on election night and in the days following the election. Workers from previous elections volunteered to work again and in some cases were never called.

Early Voting

Early voting sites were inadequately staffed and often located in cramped space. There was only one printer at each voting site and these often jammed or stopped printing causing delays in moving voters through the process. Waits of several hours were reported.

Judges

Some election judges were not informed until the weekend before the election, or even later, of their polling place location. A few experienced judges indicated they were willing to serve and yet were never contacted. Some of these judges attended training anyway and were still not called. Neither party was able to get lists of judges appointed prior to the election to determine if further recruitment was needed. At one point, the Elections Division reported the judges' database had been lost and was being reconstructed.

Although precinct supply pickup had been scheduled for Saturday, judges were informed at the last minute that they could not pick up their supplies until Sunday afternoon. At the pick up sites some judges were left waiting in their cars for more than an hour before

distribution began. Many discovered that supplies were missing or were for the wrong precinct.

In at least one precinct, the poll book was not the correct one for the precinct. The judges discovered this election morning. While waiting for the correct poll book to be delivered, voters were given provisional ballots to vote. There were reports of people leaving the precinct without voting because of this problem.

Judges report forms were incorrectly filled out and, in some cases, not turned in. Judges were confused about complying with provisional ballot requirements, directed voters to incorrect precincts, were inconsistent in providing voters with information about write-in voting, inconsistent in handling poll watchers and were confused about handling spoiled ballots. While many judges and voters reported confusion at their precincts, there were precincts that ran efficiently.

Telephone communication with the Elections Division both prior to and on Election Day was quite poor, although some judges reported no problems getting through. Others reported they were not able to speak with the office staff from Friday, 10/29 through Election Day. Many were unable to get through at all on Election Day.

Election Night

Staff on election night worked around the clock verifying absentee ballots. Many had no experience and reported that training was spotty and sometimes not available.

Hart InterCivic Ballot Now software required the ballots to be scanned in sequential order. This need was apparently not anticipated and workers spent days manually sorting and checking ballots of absentee and early voters (and again on election night) when judges were unable or unaware of this requirement.

Both parties testified that the Elections Division failed to advise them in a timely manner as to the number of party-affiliated voters needed to serve on the resolution, duplication and canvass boards. There was no work plan for these boards, their progress was not monitored and no set schedules were defined. This meant that workers showed up only to be sent home because the office could not put them to work. When they were put to work there were inadequate or no written instructions or guidelines. When verbal instructions were given, they were later changed or found to be incorrect. Overall training was haphazard, informal and not uniform.

Hart's original estimates of time needed to count the ballots using this system proved to be inaccurate. This was demonstrated during the County's experience in the primary, which took until after midnight to obtain results despite a generally light turnout. Despite this experience, neither Hart nor the County revised these estimates for the general election and failed to revise staffing and processing plans.

Once the precinct ballots began to be counted, it became apparent these ballots were not counting as easily as the absentee and early ballots with many contests identified as damaged contests. Subsequently, it has been determined that some precinct ballots were incompatible with the Hart system. However, since no formal contract or ballot specifications existed, it is difficult to find fault with the printer who did what he had verbally agreed to do, print ballots.

The problems with ballot printing and inadequate training were especially worrisome as it relates to the resolution board. Without adequate instructions and documented procedures, it seems that no attempt was made to insure uniformity in decision-making as to when a vote was being counted or rejected. Since the Elections Division had implemented a procedure for resolution teams to work in conjunction with the scanning process, there were lengthy periods of time when the resolution teams had no work to do since the scanners were often not being used. The Committee was told these two operations could have been separated with additional equipment and different configuration. Workers also complained that the display of contests to be resolved was at such a height and position that it caused neck discomfort and pain.

There was a great deal of confusion over write-in votes, especially when voters misspelled the name of the certified write-in candidate. Eventually the Clerk directed the teams to count the vote if the last name was reasonably close, but many votes were not counted prior to that decision. There was confusion over whether the box next to the write-in name had to be darkened. Many workers counting write-in votes were unaware that the scanners had been programmed to require that the oval box next to the write-in name had to be filled in.

Beginning election night until the end of the count on Friday, there was no time when all of the scanners were operated simultaneously. Most of the time there were no more than two or three scanners being used. There were not enough machine operators and the training of these operators was minimal. Although there were written guidelines at each scanning station, some workers were not aware of their existence. This was particularly evident when the count exceeded the estimated time to complete the election. According to testimony, it appeared that only three people, in addition to the vendor, knew how every station in the ballot counting process worked and could train other workers.

Operators were to confirm that the number of ballots scanned matched the number of ballots the election judges reported should be in the ballot box. However, many of these reports were missing. When this happened, operators just wrote down their own numbers because they had no other numbers with which they could compare results. Operators had to write out summary sheets when the software should have been capable of generating and printing these sheets. The Elections Division had not planned a process for this problem.

In all areas, workers were unable to get answers to questions from election office staff. Indeed, there were hours when management was not present at all in the ballot-counting room, or management was involved in performing clerical tasks such as sorting

envelopes, checking registration databases, etc. The Elections Office Manager was not willing to stop what he was doing to train anyone, according to testimony. Temporary staff should have been assigned routine tasks to free up managers to manage.

Because of the breakdown in the orderly processing of the ballots, absentee ballots lay in unsecured piles for hours in the ballot absentee processing room at the Clerk's office and were carried back and forth between various rooms without any tracking or security measures. There was also minimal security in the ballot counting room during the counting of precinct ballots, with people walking in and out at all hours. There was no one assigned to check people in and hand out badges. Required oaths were not always administered. Ballot boxes were stacked, unattended by the doors and could have been tampered with or removed.

Current Staffing

The Clerk's office presented information about permanent staffing size of election offices in other front-range counties. Adams County with 183,241 voters has 8 permanent staff members. Larimer County with 182,791 also has 8. Boulder County with 198,951 voters has only 5.5 permanent staff members.

HELP AMERICA VOTE ACT (H.A.V.A)

Beginning January 2006, every voting site must have a voting device in place that will allow disabled voters to cast their ballots unaided. Most of the systems currently on the market to comply with this requirement are DRE (direct recording electronic) systems, computer-based voting with no paper involved. However, this requirement in no way requires all other voters to use the same system. These H.A.V.A -compliant systems must provide unaided voting to a universe of visual and mobile impaired voters so they are generally more expensive than other systems.

INTERACTION WITH POLITICAL PARTIES

The problems with recruitment, appointment and notification of election judges and with members of various boards have been noted above. Meetings with all parties prior to the election to sort out issues, interpretations of Secretary of State rules, etc. could have eliminated many slow-downs throughout the process.

Running the Logic and Accuracy Tests (LATs)

Colorado statutes require that LATs be run prior to any ballot count. This may be done ten days prior to Election Day. Running of this test was delayed by disagreement on the purpose and methods of such testing. There was no procedure in place to resolve any dispute. This in turn delayed counting early and absentee votes until after the polls closed. This nearly doubled the number of ballots to be counted after 7 pm election day.

Canvass Board

After the count was finally completed, there was confusion as to the duties of the canvass board. Again, there was limited training and no written instructions. To help with the canvass, the Clerk's Office generated a precinct-by-precinct report showing ballots cast vs. ballots counted. This report indicated that 54 precincts counted more ballots than were cast in the precinct. These precinct discrepancies have not been resolved. However, on a countywide basis, the number of ballots counted was equal to or less than the number of ballots cast.

The canvass board was directed to disassemble and file many of the contents of the precinct black bags, unused ballots, sign-in sheets, election judge's reports and poll books prior to the commencement of the canvass. This took more than a day. However, once the canvass began, all these materials had to be located and reassembled by precinct, again taking many hours and workers.

The canvassing process was not as complete as it has been in the past. It does not appear that the canvass processing had adapted to the new Hart system. The official canvass board canvassed only Election Day precinct votes. Neither political party was informed or involved in the canvass of early, absentee or provisional votes.

VOTER EDUCATION

Voters registering with various volunteer organizations were often given incorrect information or did not fill out the forms legibly or completely. The Clerk's office had no control over the registrars for these groups since the law is silent on poorly filled out forms, forms turned into the wrong county, etc. This definitely added to the workload in the Clerk's office.

Voters were unsure of registration requirements and the new requirement concerning identification at the polls.

Sixty thousand dollars in the Hart contract was set aside for a voter education program. To our knowledge there was only a limited effort, with an expenditure of approximately $17,000. As a result, voters were unfamiliar with the system and its requirements. Written instructions to voters in absentee instructions and at the top of the first ballot page were unclear especially where it related to write-in votes. There was confusion about filling in the voting boxes, what kind of pen to use, whether to fill in boxes in completely, etc. Voters were told a felt tip pen could not be used. After the election, the Committee learned felt tip pens would have worked fine.

Voters and some judges did not use the sign in slips correctly. Sign in slips should contain one column "print your name", another column "sign your name", another for "type of voter id required" and a final column noting provisional ballot, directed to another precinct etc.

VOTE CENTERS

Larimer County successfully used vote centers in the 2004 election, combining over 200 precincts into 40 vote centers that allowed voters to cast their vote on Election Day in any one of these centers. Testimony indicates that use of these centers requires fewer judges so that the judges who are used can be more carefully screened and trained. However, there may be a problem finding an adequate number of sites with the necessary space and wiring available. Many voters want to continue voting in their neighborhood. Our Committee did not have time to adequately evaluate these centers but feel that the concept needs to be carefully studied for possible adoption in Boulder County.

RECOMMENDATIONS – PLANNING, STAFFING & EDUCATION ISSUES

It is the unanimous recommendation of the Committee that the county hire an Integrated Quality Management Analyst and other such consultants that may be required to analyze all tasks to be performed during the election cycle. This analysis should include but is not limited to registration and record changes, absentee processes, early voting processes polling place selection and supplies, judge recruitment, training and certification/testing (give authority to supply judge, perhaps as head judge, or lead judge), staffing of Clerk's office in weeks leading up to the election (including election day phone crews for voters and judges), provisional ballot processing, ballot counting (including adoption of standards and procedures for consistent resolution of overvoted ballots), and canvass.

Planning

An analyst must develop, document and implement processes, procedures and training materials. In addition the analyst must define and plan efficient Logic and Accuracy Test procedures, as well as develop back-up plans in possible problem areas. He or she must also implement best practice contract review and monitoring, procurement, and process controls such as certified operators.

He or she must also determine whether current space is adequate.

Staffing

Assess current staffing levels and capabilities. Does the County need more staff? Does the current staff have the necessary skills?

Education

He or she must also define training needs for both permanent staff and for temporary employees, including election judges.

Implement Help America Vote Act

The County must work more closely with political parties to determine implementation of Secretary of State rules prior to election, determine partisan staffing needs, set procedures and guidelines for running the LATs in advance of each election, set procedures and guidelines for the work of the Canvass Board in advance of each election, plan and implement a program to actively recruit and train temporary workers who will help with all tasks during the months prior to each election, appoint a Committee to investigate the use of Vote Centers (similar to early voting locations) and/or super precinct polling locations (with 5-6 precincts voting in one location) and make recommendation to Board of County Commissioners. In addition, the County must plan and implement voter education with particular attention to registration issues, how to mark and cast a ballot, and provisional ballots.

4. FACTOR: PHYSICAL FACILITIES

From testimony and investigation, the Election Review Committee discovered that many of the physical sites used by Boulder County for the November 2004 elections were inadequate. Lack of adequate facilities (space and environment) indirectly contributed to the delay of the final count.

Issue: Space for Counting

The Houston Room where the count process was conducted for the November, 2004 election was woefully lacking in size and security. Because of the cramped quarters it did not afford a quiet and controlled working environment. There were too many activities taking place in this one small area creating confusion and reducing the efficiency of work. Due to the number of election volunteers, observers and media going in and out of the room placed the security of the ballots in question. A much larger, more controlled and secure site is necessary for efficient ballot processing and security. Resolution teams require a quiet and distraction-free environment in order to concentrate on their task.

Formalized procedures for I.D. and checking-in of election volunteers and observers must be created and maintained until all ballots have been processed and secured. Making the processing of ballots more transparent by using signs will enable workers and observers to tell where ballots are and what stage of processing the ballots are in.

Issue: Precinct Polling Locations

Boulder County had 237 Precinct Polling Locations for the November 2004 Election. Many of these locations were too small in physical space and layout to accommodate the increase in voter turn-out. Parking was also an issue. The increase of voters, the new voting system and H.A.V.A requirements over burdened not only the Election Judges, but also the physical facilities at many locations creating delays and long lines.

Many of the traditional sites where the *Data Vote* punch system was used in the past no longer have adequate space. The reason they are inadequate is because additional voting stations are required to process voters in a timely fashion. A voter turnout history by polling place location can be assessed to determine which locations will require larger sites. All sites should be sufficiently large to accommodate the required number of voter privacy shields/booths, ballot scanners and etc. for the expected voter turnout. Stations must be oriented to assure voter privacy and traffic flow. The current privacy screens were designed for use with the former punch-card system and, unless carefully configured, they do not adequately shield the ballot markings from those waiting in line or from the judges. Security of the unused ballots and ballot box is essential. The polling site should also be situated in such a manner that the Federal and State Laws governing polling places may be easily accomplished.

Issue: Early Voting Locations

The Early Voting Locations used for the November 2004 election were too small and too few, which created long lines and discouraged voters. For some voters, early voting took up to 3 hours in some locations. Reports of voters becoming frustrated and leaving before voting were presented to the Committee. This could lead to charges of voter disenfranchisement. To avoid the possibility of this reoccurring, these early voting sites must be larger, more numerous, and more efficient.

Physical Facilities Conclusion

- Lack of large enough space for counting and polling places
- Lack of privacy shields in polling places
- Insufficiently quiet space for counting
- Lack of control of entry into counting space
- Inadequate control of ballot security during processing
- Lack of separate facilities for resolution
- Need for additional early voting locations

RECOMMENDATIONS REGARDING PHYSICAL FACILITIES

The following is the unanimous recommendation of the Election Review Committee regarding Boulder County's election facilities.

2005 Election Clerk's Office

Assuming a mail ballot, no polling locations will be needed. Using 8 scanners, operating full time, the county has adequate but not ideal space for the 2005 election. Scanning must be started as early as state statute will allow. This will require that the LAT be completed when scheduled.

2006 Election Clerk's office

Provided the County adopts a precinct/vote center scanning and counting system, the current space is adequate to count absentee and early voting ballots, provided the scanning begins ten days before the election as the current law allows.

For all locations, creating a secure and quiet environment must be a high priority. This is especially important at the County Clerks office. Ballots must be secure at all times and the security must be obvious. Making the processing of ballot status more obvious, with signs, is also necessary. This will enable workers and observers from the campaigns to tell where ballots are and what stage of processing the ballots are in. If empty ballot boxes are left in the hallway, it must be obvious that they are empty.

If the county continues with a central count system, this current space is in no way adequate. Either additional space could be acquired or the counting could be moved to a larger off-site location.

A more formalized procedure for checking in election workers and observers must be created and maintained until all ballots have been processed.

Precinct locations

Precinct locations will need to be large enough to have additional scanning equipment, and additional privacy screens. Space will also be needed to have a separate processing area for irregularities, provisional ballots, DRE users, etc. Precinct turn-out should be factored in when choosing locations and allocating resources.

A physical site inspection of all polling locations should be conducted between now and the 2006 primary election to insure adequate space, voter privacy and proper flow of

traffic. The locations should take into account the 100-foot campaigning restriction/limit to avoid distractions to those who are waiting in lines.

Early Voting Locations

Additional early locations are recommended due to the increasingly large number of voters who take advantage of early voting. Sufficient space should be available within the early voting centers for observers/poll watchers. Although the voting is deemed to be "early," such voting is still subject to all Election Day rules and regulations such as campaigning within 100 feet of the voting and security should be applied and enforced.

Privacy Screens

Additional privacy screens are needed at all voting places. Additionally, they must be located to truly provide screened privacy for voters, regardless of the size of the ballots.

5. EXTERNAL FACTORS BEYOND CONTROL OF COUNTY CLERK THAT CAUSED OR CONTRIBUTED TO DELAY IN COUNTING

- Constantly changing rules from Colorado Secretary of State.
- Antiquated state statutes not adapted to new technology (e.g., lack of legal authority to conduct statistical audits absent authorization).
- Some new ballot counting system required to be purchased because previous (DataVote) system needed expensive repair.
- Addition of barcodes to ballots for Hart scanners, one of two counties in which this was done.
- Pre-election litigation filed in Boulder County regarding use of barcodes.
- Activist interference in elections procedures.
- Activist interference in Logic and Accuracy Tests.
- Activist interference at the precinct polling locations.
- Issues with power air conditioning in early voting locations.
- Issues with power failures in central tally location.
- Polling location access issues.

H.A.V.A requires all counties in Colorado to replace all punch card balloting systems by January, 2006. Since Boulder's *Data Vote* system needed comprehensive repairs, the Clerk and Commissioners empanelled an advisory Committee in 2003 to find a new system.

After a good deal of research and public input, the Hart/InterCivic system was chosen in February of 2004. The contract was written in April, and the first equipment began to arrive in May. This gave the Clerk less than three months to prepare to train personnel and work with a system that they had never used.

With the new systems and technology, many activists and the Clerk would have liked to have conducted audits to make sure that the new voting system functioned as expected. State laws in place at the time prevented such audits. The Secretary of State gave the Clerk a waiver for the March 2005 election to perform an audit, but no such waiver was given in the August or November 2004 elections.

At the time of the election many new voters discovered that they were not registered. This was the result of politically motivated registration drives and, in at least one instance, only the registration cards of the party organizing the drive were turned in. Thus citizens who believed that they were registered to vote discovered at the polls they were not registered. In response to this issue, these voters had to vote by provisional ballot. This confusion angered voters and often interrupted precinct operations.

Prior to the election, various interest-group activists harried the Clerk and her staff. Their purpose was to discredit the opto-sense system and promote hand counting of ballots. These activities started in late 2003 when the County chose to purchase the

Hart/InterCivic system that it now uses. These activities continued throughout the primary and general election. They included, but were not limited to: purposely damaging and duplicating test ballots; launching disinformation campaigns in the local press; in activist 'chat rooms' on the internet; continually harassing the Clerk and her staff with multiple open records demands, then not paying the required fees for the labor to research the records.

Five days before the General election, members of a local activist group filed for an injunction in Boulder District Court to prevent the Clerk from holding the general election using ballots that had serial numbers and barcodes on them; while simultaneously delaying the Logic and Accuracy Tests. At least one member of the group, the Republican appointed LAT representative, was scheduled to testify at the hearing. Both of these events were happening concurrently. The timing of the application of the LATs is controlled by state statute and Secretary of State's rules. Pre-election LATs had been scheduled for this time. Ballot counting of early cast ballots and absentee ballots could not commence until all LATs were completed. The activists were well aware of this and forced the Clerk into court at the time that the pre-election LATs were to take place. Such activities stretched the limited labor force and the management in the Clerks office. Resources were drawn away from the Clerk's office to address court issues. The probability of future litigation over the serial numbers and barcodes remains unclear but is possible.

Some of the activists attempted to interfere with elections procedures. Perhaps they were unaware of the procedures in place and wanted to draw attention to what they felt was a lack of ballot security or they wanted to test these procedures by overburdening the protocols. For example, some activists scratched out barcodes on their ballots in an effort to force the hand tallying of their ballots. At some precinct polling locations there were a myriad of election activists interfering with precinct polling judges. In addition to these activists, partisan activities took place inside of the 100-foot limit. At some precincts poll watchers engaged in partisan activities within a few feet of voters. This was stressful to the precinct judges and in turn diverted staff time within the Clerk's office when judges attempted to call for help.

In the months leading up to the election, and partly because legal challenges were not resolved until near the election, the Secretary of State issued multiple rule changes. There was no mechanism in place to efficiently and quickly distribute these changes to the county Clerks. Particularly challenging, the issue of whether to include Ralph Nader's name on the ballot in Colorado raised the possibility that the counties would not be able to meet the statutory deadlines to have their ballots printed in advance of the election. Based on the delayed time line, Hart declined to print the Boulder County ballots and the county only had one option left, EagleDirect. It is unclear if the County Clerk could have contracted with other printers.

During the week leading up to the November election the Secretary of State was dealing with the courts and issues that directly affected the rules for the use of provisional ballots. These court actions and those of the Secretary of State had a direct impact on the precinct

polling place judge's rulebooks and training: provisional ballots, emergency voter registration, absentee ruling for the use of provisional ballot at precinct, student ID rule to allow a letter from registrars to be used. Rule changes and court decisions had been happening weekly and made it difficult for the Elections Division to train judges on all of the rule changes in adequate time.

Issues that needed resolution from the Secretary of State's office were left to her staff. This put an increased burden on the Clerk of Boulder County and on the Secretary of State's staff. There was inadequate and conflicting guidance from the Secretary of State's office.

The burden of voter intent had to be determined by resolution teams when the ballots were scanned. Voters appeared to have difficulty understanding how to mark the ballots (e.g., whether to fill in the entire box or just put a check mark or an "X"). In addition, rather than returning to the judges to obtain a new ballot if one was spoiled, some voters scratched out whole areas, others scribbled instructions to the resolution team, some added circles and lines, and others made alterations to the ballot because they didn't understand how to proceed. This caused these ballots to be hand resolved, taking up a good deal of time.

The Louisville early voting location had serious electrical power problems. The power to the computer equipment was lost on several occasions. Additionally, the un-interruptible power supplies were running even when the power from the wall sockets should have been sufficient. Poll workers in that location had laid their coats over the tops of the UPS units causing them to overheat and fail. Louisville and Longmont both experienced repeated power problems. The Boulder central count location in the Clerk's office also had experienced power fluctuations in the August primary that appear to have been resolved before the November election. Power problems elsewhere continued to plague the systems.

A number of the precinct polling locations had logistical problems that were unanticipated. For example, in Table Mesa area of Boulder, the National Guard Armory denied voters access to the parking lot and only would allow voters access through a specific door due to "security" reasons. The National Guard officials should have anticipated this when an inquiry was first made to use the Armory as a voting place. Also, in a mountain precinct that used a fire station, voting was interrupted by the fire department's need for the use of their building while running an emergency call. These logistical issues frustrated voters and precinct judges.

RECOMMENDATIONS IN RESPONSE TO EXTERNAL FACTORS BEYOND THE CONTROL OF THE COUNTY CLERK

The following is the unanimous recommendation of the Election Review Committee.

Boulder County experienced a variety of problems that were beyond the Clerk's control at the time of the election. In respect to these issues the following responses are suggested.

Request that the County's representatives in the state legislature call for legislation that will alter the state elections calendar so that:

    A.   No changes to the ballot may be made after a date that is one month before an election. This coincides with CRS 1-5-402 for Primary elections; CRS 1-5-403 for partisan General elections; and CRS 1-5-406 for non-partisan general elections.

    B.   No changes to Clerks' procedures in counting ballots electronically may be made after a date that is fifteen days before an election date. (This coincides with the Secretary of State's rules.)

    C.   The Secretary of State is disallowed from changing or amending to elections rules after a date that is sixty days after the adjournment of the general assembly (approximately the second week of July).

Ask our state legislature to amend the state elections laws so that random hand counted audits of counted paper ballots can be compared to electronically counted paper ballots. At present this requires a specific and individual waiver of elections rules by the Secretary of State. There may be legislation in this state legislative session that will permit such audits without such a waiver.