Cobb County, Georgia

Pilot Project

Voter Verifiable Paper Audit Trail

November 7, 2006

Sharon Dunn, Director of Elections
December 13, 2006

Report of the VVPAT Pilot in Cobb County

I. Introduction

During the 2006 legislative session, the Georgia legislature passed SB 500, the "2006 Georgia Accuracy in Elections Act." This bill required the Secretary of State's office to implement a pilot program in one precinct each in the counties of Cobb, Bibb and Camden in the 2006 November general election and any runoff from such election. In the selected precincts, the voting equipment was required to produce an elector verified, permanent paper record of the votes cast by the elector. The elector must have the opportunity to review such record, but not to be able to possess it, and to make any necessary changes before finally casting his ballot.

The bill requires that a public hearing be held, and that a summary of the findings as well as the comments received shall be submitted to the General Assembly and made available to the public.

II. The Pilot Precinct

The precinct chosen for the pilot was Macland 01, which votes at McEachern Memorial United Methodist Church, 4075 Macland Rd., Powder Springs, GA 30127.

Voter Registration Statistics as of November 1, 2006

	Black	White	Asia-PI	Hisp-Lt	Other	Total
Active	866	1209	19	45	88	2,227
Inactive	115	169	0	3	12	299
TOTAL	981	1378	19	48	100	2,526
%	38.8%	54.6%	0.8%	1.9%	4.0%	100%
County Total %	21.6%	72.0%	1.5%	1.6%	3.4%	100%

The precinct was chosen based on voter registration statistics, the capabilities of the poll workers, the location's suitability for the pilot equipment, and the location's suitability and availability for conducting the public hearing. (See maps, Appendix A.)

There were lines of 1 ½ to 2 hours constantly during Election Day in this precinct, whereas in other precincts there were occasional lines, usually not more than 20 minutes, but sometimes as long as 50 minutes. The last voter at Macland 01 finished at 8:30PM. Among our other precincts, the latest that any voter finished was 7:55PM. If the pilot equipment were to be implemented countywide, we would have to reconsider how many touch screen units to send to each precinct.

III. The Canisters

The voter verifiable paper audit trail (VVPAT) is created by attaching a special printer module (AVPM) over the existing printer unit on a Diebold TSX machine. When a voter completes the last race on his ballot and touches "Next", the screen then displays a summary of all the races on that ballot. The summary screen displays all the choices made by the voter. Before he can cast his ballot, the voter must touch the "Print Ballot" button in the lower right hand corner of the screen. The printer prints a record of the voter's choices which the voter verifies as being correct. For the General Election ballot in this precinct,

the voter had to press "Print Ballot", and then "Print Next Page" 4 times. When the voter presses "Cast Ballot", the paper trail is rolled up into the secure canister and blank paper is displayed for the next voter.

We originally sent 8 TSX - AVPM units to the pilot precinct. Based on lines building up during the morning, we sent an additional unit to them at 3:00pm. Each of the original 8 units used 2 canisters, and the 9th unit used 1 canister for a total of 17 canisters. Attaching the AVPM unit to the TSX machine required an additional 20 steps for the poll workers before the polls could open on Election Day. Because of the difficulty of those procedures, a technician from Diebold was present with them all day at the poll. When the paper ran out in a canister during the day, the canister had to be removed and secured and a new canister installed in that printer. That took time away from voters being able to vote on each unit, and increased the lines at this precinct.
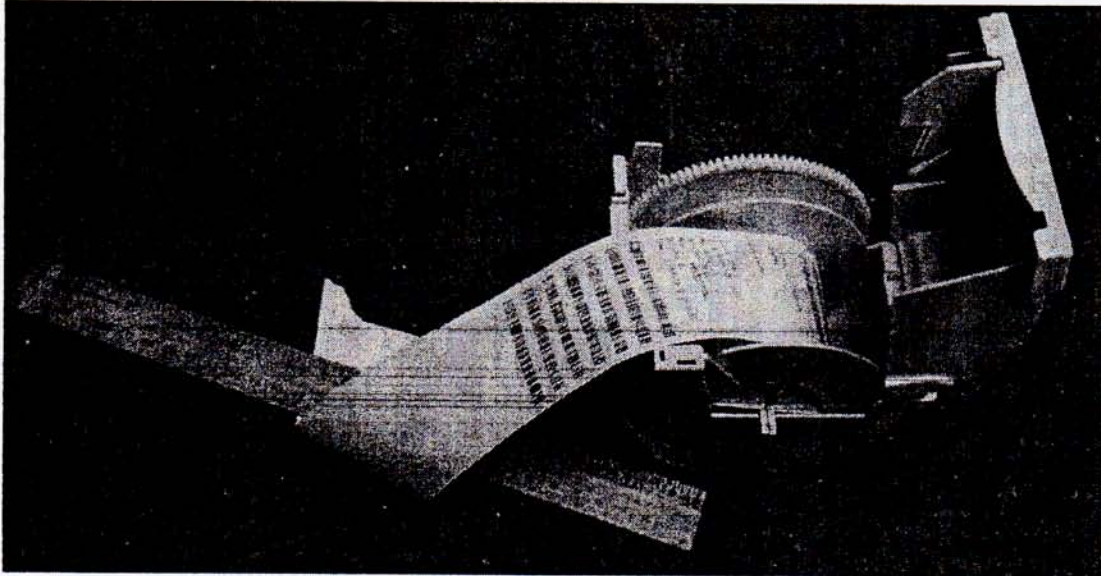
An open canister with paper tape

Each canister had a label on the outside to allow us to prove the chain of custody and to track which TSX machine the canister was used in. (See sample below.) The canisters were each numbered, but there is no relationship between the numbers on the canisters and the order in which they were used.

COBB COUNTY

Nov 7, 2006   Vote Center # 033122

TSX Serial # 0287215

Canister # 10 of 17

Signatures:

Theresa Harris

Eleanor Rainey

Mattie J Carey

Seal # 11182

Report of the VVPAT Pilot in Cobb County

Canister #	# of Ballots
1	20
2	52
3	39
4	31
5	41
6	53
7	30
8	18
9	13
10	84
11	88
12	86
13	65
14	90
15	67
16	104
17	95

The length of the paper roll inside each canister varied greatly. The same paper rolls were used for testing, training, and then on Election Day; some had been used up more in testing and were therefore smaller than others by Election Day. The chart (above) lists each canister and how many ballots it contained.

The ballot in the pilot precinct contained 42 races. The first 14 were partisan races for candidates, the next 18 were nonpartisan races for candidates, and the final 10 were questions. On the VVPAT the race is identified by the first 30 characters of its title. (See next page for picture of one ballot as printed on the VVPAT.)

(See Sample left, which is 80% scale.)

It took approximately 10 inches of paper tape to print each voter's ballot. There is approximately 8 inches of blank space between the end of one ballot and the beginning of the next. The paper tape therefore contains 1 ½ feet of tape per voter. There were 976 voters, so there are approximately 1464 feet of paper tape for the printing of all of the ballots cast at this precinct. There is also a results tape at the beginning of the first canister for each TSX machine and the end of the last canister for each TSX machine. This adds several more feet to the length of the tapes. The total length of paper tapes if stretched out end to end would run through more than 5 football fields. (see picture page 7.)

These tapes were very unwieldy to handle, and a lot of time was spent unwinding and untwisting them as the manual count work progressed. (See pictures page 8.) As they were completed they were folded rather than rewound.

Ballot tape sample (left, 80% scale):

```
GENERAL Cobb County
Macland 01
    11
For Governor
[X]  SONNY PERDUE  <NP>

For Lieutenant Governor
[X]  CASEY CAGLE Republica  <NP>

For Secretary of State
[X]  KAREN HANDEL Republic  <NP>

For Attorney General
[X]  PERRY MCGUIRE Republi  <NP>

For Commissioner of Agricultu...
[X]  GARY BLACK Republican  <NP>

For Commissioner of Insurance
[X]  JOHN W. OXENDINE  <NP>

For State School Superintende...
[X]  KATHY COX  <NP>

For Commissioner of Labor
[X]  BRENT BROWN Republica  <NP>

For Public Service Commission...
[X]  CHUCK EATON Republica  <NP>

For Public Service Commission...
[X]  STAN WISE  <NP>

For U.S. Representative in th...
[X]  DEBORAH TRAVIS HONEYC  <NP>

For State Senator From the 33...
[X]  MARK T. GRANT Republi  <NP>

For State Representative in t...
[X]  DON WIX  <NP>

For Solicitor-General
[X]  BARRY E. MORGAN  <NP>

For Justice, Supreme Court of...
[X]  GEORGE H. CARLEY  <NP>

For Justice, Supreme Court of...
[X]  CAROL W. HUNSTEIN  <NP>

For Justice, Supreme Court of...
[X]  HAROLD D. MELTON  <NP>

For Justice, Supreme Court of...
[X]  HUGH P. THOMPSON  <NP>

For Judge, Court of Appeals o...
[X]  JOHN ELLINGTON  <NP>

For Judge, Court of Appeals o...
[X]  M. YVETTE MILLER  <NP>

For Judge, Court of Appeals o...
[X]  HERBERT E. PHIPPS  <NP>
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For Judge, Court of Appeals o...
[X]  J. D. SMITH  <NP>

For Judge, Superior Court of ...
[X]  JIM BODIFORD  <NP>

For Judge, Superior Court of
[X]  ROBERT E. FLOURNOY  <NP>

For Judge, Superior Court of ...
[X]  JOAN P. DAVIS  <NP>

For Judge of State Court of C...
[X]  DAVID P. DARDEN  <NP>

For Judge of State Court of C...
[X]  BEVERLY COLLINS  <NP>

For Judge of State Court of C...
[X]  NANCY M. CAMPBELL  <NP>

For Judge of State Court of C...
[X]  MARIA GOLICK  <NP>

For Judge of State Court of C...
[X]  BRIDGETTE CAMPBELL  <NP>

For Judge of State Court of C...
[X]  CARL W. BOVERS  <NP>

For Cobb County Soil and Wate...
[X]  DONALD AYRES  <NP>
[X]  ALICE CHAMPAGNE  <NP>
[X]  FRED WOOD SHELL, III  <NP>

-1- TO RESTRICT THE USE OF EM...
[X]  YES  <NP>

-2- TO PROTECT THE TRADITIONS,...
[X]  YES  <NP>

-3- TO AUTHORIZE THE GENERAL ...
[X]  YES  <NP>

-A- TO EXPAND THE AD VALOREM ...
[X]  YES  <NP>

-B- TO EXPAND THE AD VALOREM ...
[X]  YES  <NP>

-C- TO EXPAND THE AD VALOREM ...
[X]  YES  <NP>

-D- TO PROVIDE A HOMESTEAD EX,...
[X]  YES  <NP>

-E- TO PROVIDE A HOMESTEAD EX...
[X]  YES  <NP>

-F- TO PROVIDE THAT A SURVIVI...
[X]  YES  <NP>

PARKS BOND REFERENDUM
[X]  YES  <NP>
```
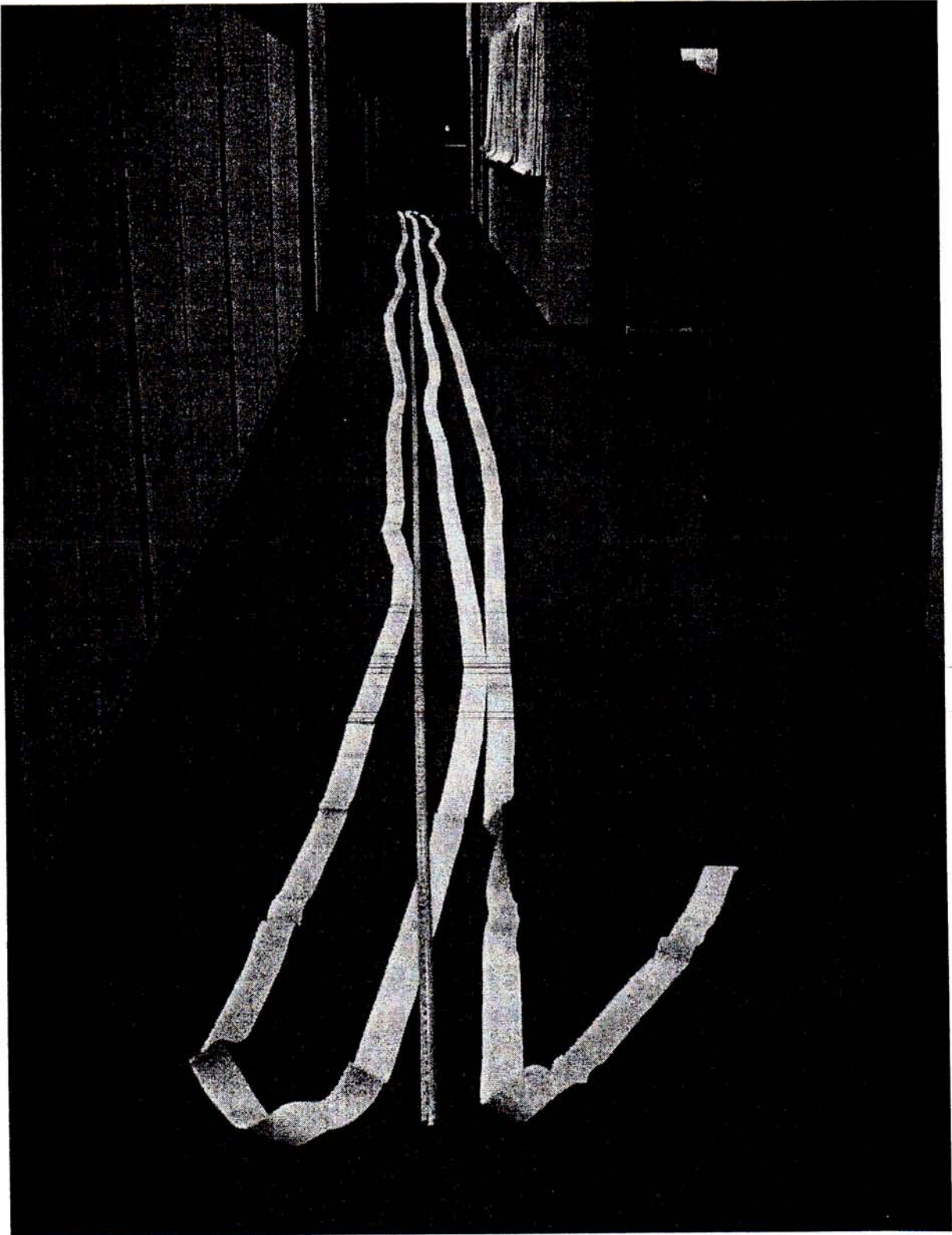
One tape laid out in our office—total approximately 194 feet long (95 ballots)

An Unwound Tape

A Tape In Progress—Being Folded As It Is Completed

IV. The Teams

A. *How we chose them*

The first decision we made was to invite the Poll Manager to be part of the counting teams. If any questions were to arise about what occurred at the poll during the Election Day, she would be available to provide the information. The Diebold technician was also present for much of the counting, although he did not serve on a team. Besides the poll manager, we used workers who were already on our payroll, were capable of doing the work, were available on the days needed, and were not doing other work that was deadline oriented.

B. *First Day*

We decided to begin with 4 teams of three people each at 9:30am on November 16th. Present on the first day were 12 employees, 3 managers, and the Diebold technician.

C. *Subsequent Days*

At the end of the first day, we did not feel that sufficient progress had been made to complete the task in the allotted 5 days, so we formed 2 additional teams for the second day. However, needing 18 people each day, we were not able to get all of the same people for complete days, so while each team always had three members, the membership of the teams changed considerably on days 2 through 5.

V. The Space

The main auditing room is approximately 400 sq. ft. On the first day, there were four audit team tables measuring 2 x 4 feet, each with three chairs. A fifth table, used to hold supplies, was placed in one corner of the room. An observation area was set up along one wall with approximately 7 - 8 chairs.

(Not to Scale)
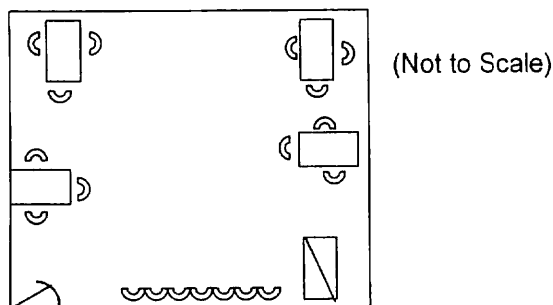
Report of the VVPAT Pilot in Cobb County

Each Audit Team consisted of a Caller and two Recorders. The Caller sat at the short end of the table and the Recorders sat on the long sides of the table opposite each other.

After the first day, two additional audit team tables were added and dividers were moved in to separate the teams. The dividers were used to block the sound carrying from team to team and consisted of various racks of equipment and supplies. The noise was a definite problem as several callers would call out the same candidates' names in succession. The supply table was moved to the center of the room. The observation area was dismantled.

(Not to Scale)
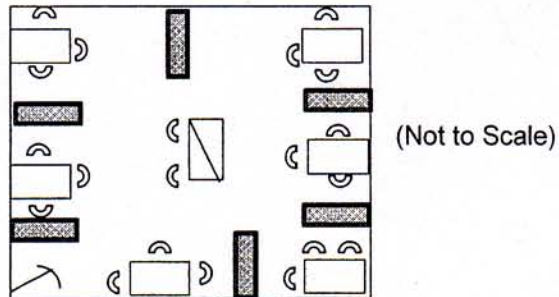
A second room of approximately 155 sq. ft. was used to reconcile the audit tally counts to the Touch Screen tapes. Two people worked across a single table in this room. Any tallies that were found not to match the tape were sent back to the primary room for recounting.
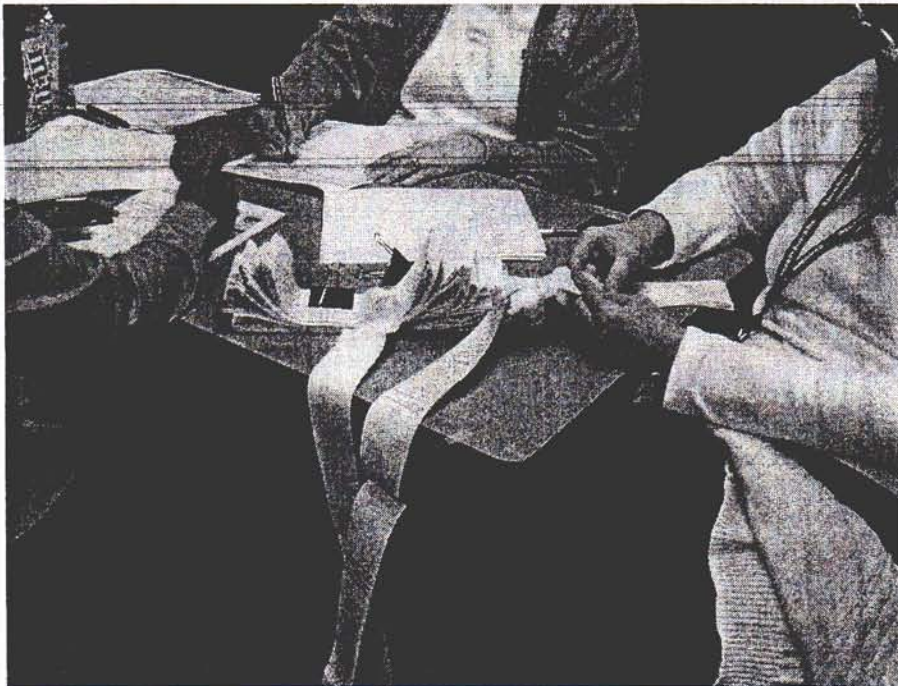
A Team Working

VI. The Process

A. One Caller, 2 Recorders

Cobb County has prior experience with manual counts of ballots. Until recently, some of our municipalities used paper ballots that had to be counted by hand. Also, the Soil and Water Conservation District Supervisors Election has been a paper ballot until 2006. In addition, many years ago, when the voting method in Cobb County was still punch cards, we used to do a manual audit of selected races in selected precincts.

We began the manual audit of the VVPAT with procedures that were similar to the ones we used to use for those various manual counts. The procedure is to have teams of 3 people, in which one person calls out the results on the ballot, and two people independently record the results in a style called "tallying". Each time the caller says the name of a candidate, each of the two recorders makes a vertical mark on the page. When they get to the fifth time that a particular candidate's name is called, they draw a diagonal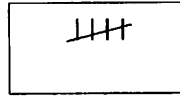 line through the 4 vertical lines, and say the word "tally" out loud. If they do not reach "tally" together, then an error has been made and they must go back to correct it before going on. There is not any way to know exactly where the error has been made so that entire race must be started over from the first ballot on the canister.

B. Directions

The following are the instructions given to the employees for the Manual Count:

Manual Audit Procedures for the VVPAT Pilot Program
General Election, November 7, 2006
Cobb County

There are Teams of three people; one person will read from the VVPAT paper roll and the other two will tally separate Tally Sheets.

Manual Audit Event Log

For every activity, including breaks and lunch, each Team will record their beginning and ending time on the Manual Audit Event Log. All Team members must take breaks and lunch at the same time.

Step 1 - Record the Team member names on the Manual Audit Event Log.

Step 2 - Unseal the first canister; record event on the Log.

Step 3 - Unroll the paper to get to the beginning of the tape; record event on the Log.

Step 4 - Record the time at which you start to tally ballots on the Log.

Tally Ballots

Step 5 – Check to see if the ballot is VALID or REJECTED. Record a tally in the Valid or Rejected box on the Tally Sheet.

Step 6 - If the ballot was REJECTED, draw a line through the rejected ballot from beginning to end.

Step 7 - If the ballot was VALID, the caller will begin reading the votes. First, read the office, then read the candidate for which the vote was cast.

Step 8 - As the caller reads the office and the candidate, the recorders will mark a tally for that candidate in the correct place on the Tally Sheet.
- If the tally mark is the fifth mark on the diagonal, the recorder will call out "tally".

                      JHHt

- Both recorders should say "tally" on the same call. If one recorder says "tally" and the other does not, stop and research the error. Both tally sheets should end up identical.

Repeat steps 5, 6, 7 and 8 for each ballot. When finished tallying ballots, record the ending time on the Log.

If all ballots have been tallied for a canister:
- Verify that all candidate totals are the same on both tally sheets.
- Return the tape, canister and completed tally sheets to Sharon Dunn.
- Record the event on the Log.

Leaving the Audit Room

When Team members leave the Audit for any reason (break, lunch, end of day), record the event on the Log. Write on the Audit Tape, in the white space after the last ballot tallied, the time the Team is leaving the Audit. Upon return, record the time and continue to tally ballots.

C. Samples of Forms Used

TALLY SHEET
Manual Audit of VVPAT Pilot
Macland 01, Cobb County, GA

Manual Audit Event Log
Macland 01

Team Member _____

Team Member _____

Team Member _____

Event	Date	Beginning Time	TSX Machine ID #	TSX Serial #	Canister Number	Canister Seal #	Ending Time	Initials
Unseal canister	11/16/2006	10:00am	0	12345	1	721435	10:02am	BCK
Unroll tape to get to beginning		10:02am	0	12345	1		10:05am	BCK
Tally ballots		10:06am	0	12345	1		11:00am	BCK
Break		11:00am					11:15am	BCK
Tally ballots		11:17am	0	12345	1		12:30pm	BCK
Lunch		12:30pm					1:00pm	BCK
Tally ballots		1:02pm	0	12345	1		2:12pm	BCK
Turn completed tapes over to Sharon Dunn		2:12pm			1		2:15pm	BCK
Unseal canister		2:16pm	0	12345	9	721551	2:18pm	BCK
Unroll tape to get to beginning		2:19pm	0	12345	9		2:21pm	BCK
Tally ballots		2:21pm	0	12345	9		3:00pm	BCK
Break		3:00pm					3:15pm	BCK

D.   The Role of the Managers

There were 3 managers present at most times during the manual audit and they had several critical functions to perform. First, the managers kept logs detailing the handling of the canisters and tapes. The canisters had been sealed on Election Day and were held under tight security until the manual audit was complete. The logs allow us to prove chain of custody of the canisters and tapes.

Manual Audit Return Log
Macland 01

add bag #

Returned by	Date	Time	TSX Machine ID #	TSX Serial #	Canister Number	Tape	Tally Sheets	Open Seal	Close Seal
Opened the solid canister	11-16-06	10:13am							142 3331
Sandi Faith	11-16-06	3:40	6	299529	13	1	2		1423301
Margaret Bruce	11-17-06	9:26a	1	297255	17	1	2	1423301	1423302
Sandy Faith	11-17-06	10:19a	6	299529	2	1	2	1423302	1423303

Return Log (Small Sample)

We filled up more than one of the bags that we were using to store the completed tapes, and decided that in the future, the bag number should be on the log as well. Second, at least one manager was always helping at least one of the teams to untwist and fold the
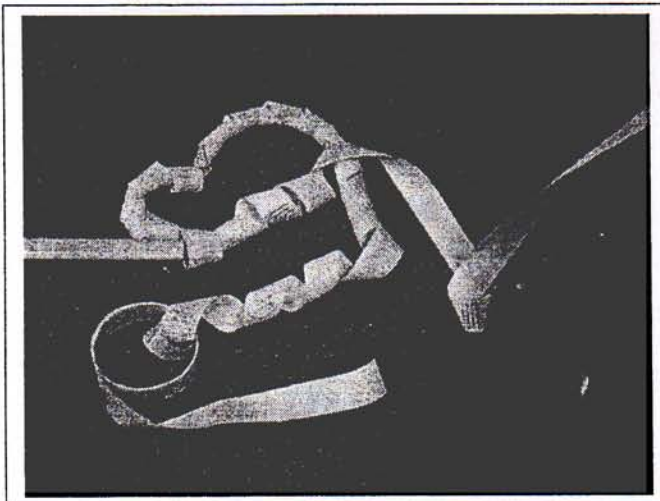
tapes because they were hard to handle. (See picture, left.) Third, the managers enforced the use of the Event Logs so that team members recorded each activity for later analysis and reporting. Fourth, the managers checked the tally sheets and compared the results to the machine results tapes from each TSX unit in the pilot precinct. The employees did not know the results of the machine counts so there was no

way for them to try to "get it right" or to make their counts match the machine counts. But they did know that the two recorders were supposed to stay together; therefore, there was some incentive for them to have the same numbers. In at least one case, when their tally sheets were checked, even though their total numbers matched, the actual tally marks did not support the numbers written. This tape was given to another team to recount that race. There was also a great deal of adding up required before we got the numbers to be compared with the machine totals. This is partly because there were 2 canisters each for most of the machines, and the results from both canisters have to be added together. Also, the design of our tally sheets did not allow for the teams to add up their own totals.

E.   Errors

Because the "tallying" method is so methodical and careful to begin with, we did not anticipate the number of errors that occurred. We believed that the process would work to keep the 2 recorders together, but it did not. It was impossible for any of the employees to get all the way through one canister without making some errors in tallying some races. It takes only a fraction of a second's lapse of concentration to make an error. Therefore, there were multiple "Restarts" by each team when they had to go back and redo one race that they did not agree on. A higher number of ballots per tape tended to make it harder to tally correctly the first time, but the biggest determinant turned out to be the capability of the individual employees. Some team members had to be swapped out to other teams or replaced altogether before we could get a correct tally.

VII. Results

All manual tallies matched the machine counts, thus proving that the machine counts were correct. However, the cost, as measured in both time and money, was high.

A.   Total employee hours and cost

A total of 24 different employees, 3 managers, and the Diebold technician were used during the course of the 5 days. The total cost was $2,937.45 not including the three managers or the Diebold technician (whose salary was paid by Diebold.) The following shows the number of teams and hours worked each day. (For totals by employee see Appendix C.)

Employee Hours

Team # (Table #)	Thurs. 11/16	Fri. 11/17	Mon. 11/20	Tues. 11/21	Wed. 11/22	Total Hours per Team
1	6.50	7.00	2.00			15.50
2	7.25	7.50	7.75			22.50
3	6.50	7.00	3.25			16.75
4	7.25	7.50	3.75	0.50		19.00
5		7.25	1.25	8.00	0.25	16.75
6		7.00	1.75			8.75
Daily Totals of Teams	27.50	43.25	19.75	8.50	0.25	
x 3 people per team	82.50	129.75	59.25	25.50	0.75	
Plus 1 employee checking and verifying			7.50	7.00		
TOTAL	82.50	129.75	66.75	32.50	0.75	312.25
Number of Managers	3	3	3	2	1	

B.   Time per Ballot

In analyzing the counting time per canister, the time required to count one ballot varied from 3 minutes to 11 minutes, with an overall average of 5 minutes per ballot. (See the chart on the next page.) The time required per ballot seems to be determined by a variety of factors working together; therefore, it is not predictable. There does not seem to be a "learning curve" where the first canister done by a team took longer than subsequent canisters.

For example, the canisters with fewer ballots seemed to be easier to count, however, in the 7 canisters that contained less than 50 ballots, the per-ballot time ranged from 3 minutes to 9 minutes. In the 6 canisters that contained over 80 ballots each, the time per ballot ranged from 4 minutes to 11 minutes. The largest canister contained 104 ballots and it took 5 minutes per ballot to count.

The capability of the teams seems to be a slightly better predictor of success. For example, the "fastest" team had an average of 2 minutes per ballot. On the other hand, the "slowest" team had an average of 10 minutes per ballot. They seemed to be having trouble from the start, so we changed the personnel several times. It is not clear if changing the personnel was a cause or an effect; perhaps changing the personnel made it even harder for the group to get into a routine of working well together.

Within each team there was a large range of minutes per ballot. For example, Team # 4 varied from less than a minute per ballot to 4 minutes per ballot. The lower average time per ballot did not result from working faster, but from being careful, so that fewer mistakes were made, and the ones that were made were caught earlier. (See Appendix B.)

In the original counts, where the teams were counting all 42 races on each ballot, the time ranges from 2 to 11 minutes per ballot. When the teams were doing recounts, which were usually only a few races per tape, the time ranges from less than a minute per ballot to 3 minutes per ballot.

Report of the VVPAT Pilot in Cobb County

Time Required to Perform Manual Count

Event	Canister #	Elapsed Time	Number of Ballots per Canister	Minutes per Ballot per Canister	TSX Machine ID#	Number of Ballots per TSX	Minutes per Ballot per TSX
Original Count Canister	9	1:46					
Recounts Canister	9	0:10					
Total Canister	9	1:56	13	9			
Original Count Canister	10	5:57					
Recounts Canister	10	2:43					
Total Canister	10	8:40	84	6			
Total TSX Machine ID		10:36			0	97	7
Original Count Canister	8	1:20					
Recounts Canister	8	0:01					
Total Canister	8	1:21	18	5			
Original Count Canister	17	6:16					
Recounts Canister	17	0:16					
Total Canister	17	6:32	95	4			
Total TSX Machine ID		7:53			1	113	4
Original Count Canister	5	1:53					
Total Canister	5	1:53	41	3			
Total TSX Machine ID		1:53			2	41	3
Original Count Canister	7	1:14					
Recounts Canister	7	0:43					
Total Canister	7	1:57	30	4			
Original Count Canister	11	13:06					
Recounts Canister	11	3:33					
Total Canister	11	16:39	68	11			
Total TSX Machine ID		18:36			3	118	9
Original Count Canister	6	2:46					
Recounts Canister	6	:10					
Total Canister	6	2:56	53	3			
Original Count Canister	15	3:54					
Recounts Canister	15	0:53					
Total Canister	15	4:47	67	4			
Total TSX Machine ID		7:43			4	120	4
Original Count Canister	1	1:27					
Total Canister	1	1:27	20	4			
Original Count Canister	16	8:15					
Recounts Canister	16	1:05					
Total Canister	16	9:20	104	6			
Total TSX Machine ID		10:47			5	124	5
Original Count Canister	2	3:41					
Total Canister	2	3:41	52	3			
Original Count Canister	13	4:01					
Recount Canister	13	0:33					
Total Canister	13	4:34	65	4			
Total TSX Machine ID		7:15			6	117	4
Original Count Canister	4	1:35					
Recounts Canister	4	0:05					
Total Canister	4	1:40	31	3			
Original Count Canister	14	7:34					
Recounts Canister	14	0:10					
Total Canister	14	7:44	90	5			
Total TSX Machine ID		9:24			7	121	5
Original Count Canister	3	2:35					
Total Canister	3	2:35	39	4			
Original Count Canister	12	4:58					
Recounts Canister	12	0:38					
Total Canister	12	5:36	86	4			
Total TSX Machine ID		6:11			8	125	4
TOTALS		82:18	976			976	5

C. Restarts vs. Recounts

When a team realized that the two recorders were not agreeing with each other, they had to immediately count that race over from the beginning of the tape. We termed this event a "Restart". At the beginning, we did not ask the teams to keep track of these Restarts. Once we asked them to start keeping track, only 1 team, Team #4, did a good job of recording their Restarts. Below is a sample Event Log of one canister that they worked on. The canister contained 39 ballots and took them 2 hours and 35 minutes total, during 2 different work days. They made 5 restarts during that time period.

MANUAL AUDIT EVENT LOG - MACLAND 01
GENERAL ELECTION - NOVEMBER 7, 2006
Working Time Only

Table #	Sheet #	Event	Date	Begin Time	TSX Machine ID #	TSX Serial #	Canister #	Canister Serial #	End Time	Elapsed Time	Initials
4	c	Unseal canister	11/17/06	4:05 PM	8	297333	3	22054	4:10 PM	0:05	SF
4	c	Unroll tape to get to beginning	11/17/06	4:10 PM	8	297333	3	22054	4:15 PM	0:05	SF
4	c	Tally Ballots	11/17/06	4:15 PM	8	297333	3	22054	4:50 PM	0:35	SF
4	c	Restart	11/17/06	4:50 PM	8	297333	3	22054	4:55 PM	0:05	SF
4	c	Tally Ballots	11/17/06	4:55 PM	8	297333	3	22054	5:00 PM	0:05	SF
4	c	Tally Ballots	11/20/06	9:00 AM	8	297333	3	22054	9:20 AM	0:20	SF
4	c	Restart	11/20/06	9:20 AM	8	297333	3	22054	9:30 AM	0:10	SF
4	d	Tally Ballots	11/20/06	9:30 AM	8	297333	3	22054	9:40 AM	0:10	SF
4	d	Restart	11/20/06	9:40 AM	8	297333	3	22054	9:45 AM	0:05	SF
4	d	Restart	11/20/06	9:45 AM	8	297333	3	22054	9:50 AM	0:05	SF
4	d	Tally Ballots	11/20/06	9:50 AM	8	297333	3	22054	10:00 AM	0:10	SF
4	d	Tally Ballots	11/20/06	10:05 AM	8	297333	3	22054	10:30 AM	0:25	SF
4	d	Restart	11/20/06	10:30 AM	8	297333	3	22054	10:35 AM	0:05	SF
4	d	Turn in completed Tape	11/20/06	10:35 AM	8	297333	3	22054	10:45 AM	0:10	SF

After completion by the team, each set of tally sheets was checked by a manager. If it was determined not to be in balance, or not to match the results tape, it was given to another team to be recounted. The recounts are correctly recorded for all teams and canisters. (See Chart Page 16.) A total of 9 hours and 50 minutes was spent on "Recounts".

VIII. What We Learned

A. Diebold—the tape

Because of the way the races displayed on the tapes, the employees got incredibly confused when calling and tallying the nonpartisan judges' races. Several races in a row all have the same title except for "To succeed.....". Because the tape is displaying only the first 30 characters, the part that differentiates one race from the next is not displayed. If employees were working on a ballot where the voter had made a selection, it was easy to tell which race was which by the candidate selected. But when employees were working

on a ballot where the voter had not selected a candidate, every race would display "No Vote Cast"; therefore, there were several races in a row that appeared to be exactly the same and there was no way for the caller and recorders to know if they were talking about the same race.

The jurisdiction needs to have some control over how the race displays on the VVPAT tape. Rather than printing the first 30 characters of the race, the VVPAT tape could display the "Label" of the race, which is a shorter version that appears on the optical scan tapes and reports. For example, the "Labels" of the four judges' races displayed in the sample above would have been "Appeals - Ellington", "Appeals - Miller", "Appeals - Phipps", and "Appeals - Smith", thus easily allowing the employees to differentiate between them.
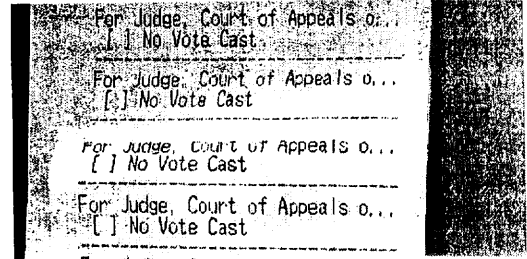
B. Our Tally Sheets

The tally sheets were designed with enough spaces to tally all the votes on an entire canister. This did not work for 2 reasons. First, there were more ballots in some of the canisters than we had realized prior to opening them, so that even with our design, there was not enough room and more than 1 set had to be used to complete a canister. Second, having multiple rows for some candidates caused confusion for the Recorders, and may have led to some errors. In the future, our tally sheets will contain space for 25 ballots. When 25 ballots have been counted, that tally sheet will be totaled and a new one begun. At the end, there will be a totaling sheet to help add up the results of all the tally sheets. This will also make it easier when doing a "Restart" because the maximum that a team would have to redo would be 25 ballots.

C. Our Event Logs

Overall, we were happy with our Event Logs, but we do want to make several changes in any future audits. The current logs have space for the three team member's names at the top. When one employee left a team and was replaced, we added the new name. However, at the end of the audit it was hard to reconstruct exactly what time the swap had been made. In the future, we will have a team start a new event log if any of the personnel change.

It requires extreme vigilance on the part of the managers to be sure that every event is recorded on the event logs. For example, when it is time for a break, the employees want to just leave the room. We may want to consider the next time that a manager also has to see and initial the event log before anyone can leave the room. In addition, we must make it clearer to the employees that the "Restarts" have to be recorded on the event logs. As discussed in Section VII.C the "Restarts" are a frequent part of the process, and most of the teams considered that they were still tallying ballots and didn't record "Restarts" separately.

D. The Process

We had a desire at the beginning to get all of the canisters with large numbers of ballots started to be sure that we could complete the task in the allotted time. However, we could

not actually compare the counts to the results tapes until we had done all the canisters that belong to one machine. In retrospect, instead of using 4 teams to start 4 large tapes, we should have started the first and second tape for two machines.

One big problem with the audit in the current form was having to tally all of the races on every ballot. Although the ballot in the pilot precinct contained 27 races with opposition, there were also 15 races with unopposed candidates. Many times when a team made a mistake and had to restart, or when the tally sheets were found to not match machine totals and had to be recounted, the error was in a race for an unopposed candidate. For example, on day 4, one team spent 20 minutes recounting one of the unopposed races.

On several canisters, an error was made involving not counting the right number of ballots. (See the next section about Cancelled Ballots.) The votes can never total correctly if the auditors have skipped a ballot. For this reason, in the future we will number each ballot on the tape, and a manager will verify that the number of ballots to be counted matches the number of ballots cast on the machines before the employees proceed to tally the votes.

As soon as the General Election was over, we found out that we would be having a Runoff on December 5th. Many staff members had duties relating to preparing for the Runoff. In Cobb County there was only one race, and the turnouts for Absentee, Advance Voting and Election Day turned out to be low. However, if we were preparing for a large Runoff, such as we experienced on August 8, 2006, having to also conduct a manual audit of the previous election would have been a huge burden.

E. Cancelled vs. Rejected Ballots

We were familiar with the situation of a "Rejected" ballot where the voter had decided he was not happy with the results and went back to change some selections before casting the ballot. As in the sample on the next page, the ballot has printed on the tape, but then seeing the "Rejected" notation, the auditors must cross out the preceding ballot and not count it. (See next page, left.)

Prior to beginning the audit we were not familiar with the possibility of the notation "Ballot Cancelled". (See next page, right.) When it appeared on one of the first canisters to be audited, we assumed that it was similar to "Rejected" and directed the teams to cross out the preceding ballot and not count it. This turned out to be wrong. The totals from the tapes containing that notation did not match the machine totals on the first check because we had not counted the ballot prior to the "Ballot Cancelled" notation. We then did some testing on the extra TSX unit in our office and discovered that the reference "Ballot Cancelled" is printed on the tape when a ballot is cancelled prior to anything being printed. We should not have crossed out the ballots prior to the "Ballot Cancelled" notations, so we had to go back and count them.

14 ✓

```
*******************************
GENERAL Cobb County
Macland 01
    11
*******************************
For Governor
  [X]  MARK TAYLOR Democrat <NP>

For Lieutenant Governor
  [X]  JIM MARTIN Democrat <NP>

For Secretary of State
  [X]  GAIL BUCKNER Democrat <NP>

For Attorney General
  [X]  THURBERT BAKER  <NP>

For Commissioner of Agricultu...
  [X]  TOMMY IRVIN  <NP>

For Commissi      For ...
  [X] GUY DR'      [X]  NANCY M  Un

For State S       For Judge of State Court of C...
  [X] DENIS        [X]  MARIA GOLICK  <NP>

For Commi         For Judge of State Court of C...
  [X] MIC          [X]  BRIDGETTE CAMPBELL  <NP>

For Publ          For Judge of State Court of C...
  [X] D/           [X]  CARL W. BOWERS  <NP>

For Pul           For Cobb County Soil and Wate...
  [X]              [X]  ALICE CHAMPAGNE  <NP>
                   [ ]  No Vote Cast
For L              [ ]  No Vote Cast
  [X]
                   -1- TO RESTRICT THE USE OF EM...
For                  [X]  YES <NP>
   D
                   -2- TO PROTECT THE TRADITIONS...
Fc                   [X]  YES <NP>

                   -3- TO AUTHORIZE THE GENERAL ...
r                    [X]  YES <NP>

                   -A- TO EXPAND THE AD VALOREM ...
                     [X]  NO <NP>

                   -B- TO EXPAND THE AD VALOREM ...
                     [X]  YES <NP>

                   -C- TO EXPAND THE AD VALOREM ...
                     [X]  YES <NP>

                   -D- TO PROVIDE A HOMESTEAD EX...
                     [X]  YES <NP>




                   *******************
                   ***  REJECTED  ***
                   *******************
```

```
*****************************
***  BALLOT CANCELLED  ***
*****************************
```

F. The Canisters and Tapes

Unwinding the tapes to get to the beginning is a challenge, and the resulting amount of tape is very difficult to work with throughout the process. None of the folding methods that we tried works well for conveniently handling or storing the completed tapes. You have to touch nearly every tape to find the one you are looking for because there is no convenient way to label them. Also, if there were ever three canisters for any given TSX machine, only the human labeling would enable us to know which machine that middle tape belonged to. The current header that prints on the tapes does not contain that information.
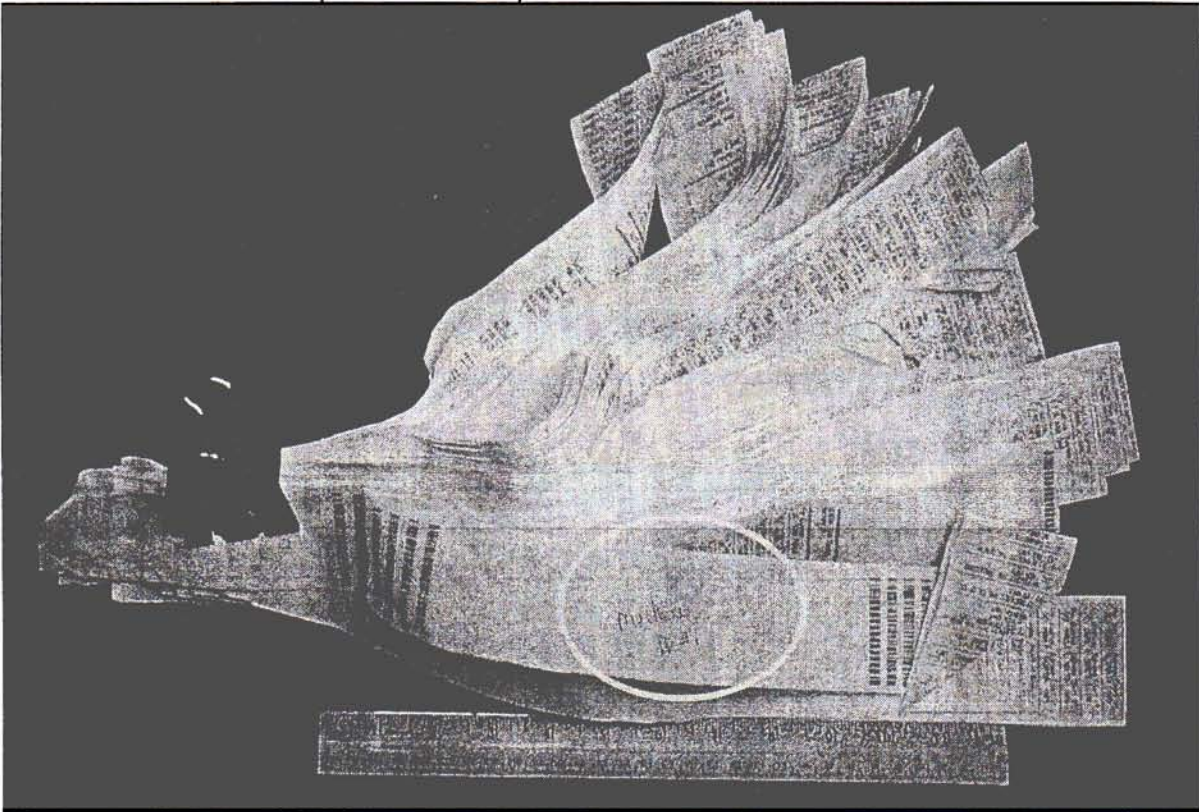
The Problem of Labeling the Tapes

If this process were to be implemented county wide, we would have a massive handling and storage problem for these tapes. A method of unwinding would need to be worked out, and devices for storage designed. The paper that the tapes are printed on is "thermal paper"; therefore, it has to be stored in climate controlled conditions. Storage of tapes from the entire county would create a problem because with our current facilities there is no available space for storage of these tapes for 22 months. (See picture, next page.)
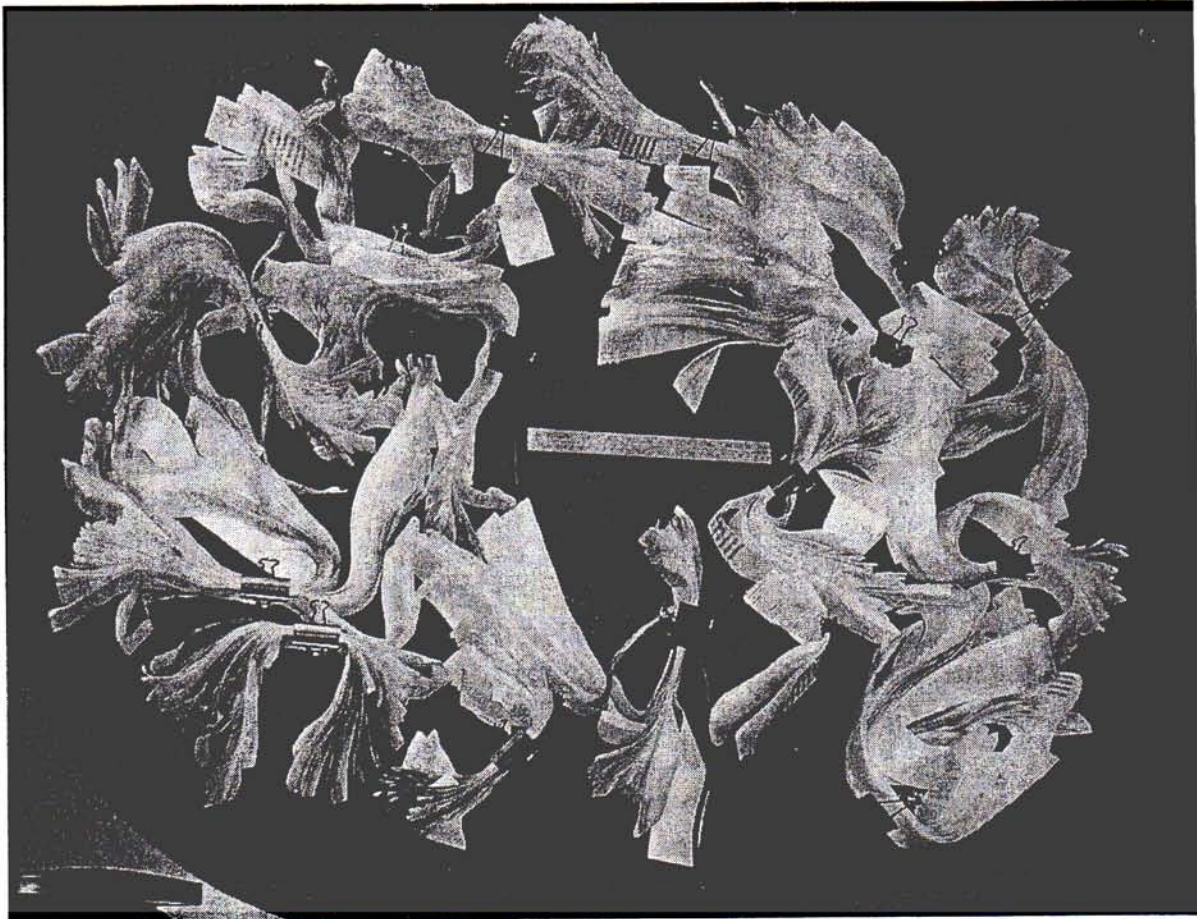
Folded Tapes from 1 Precinct

G. Unexpected Problem

Based on our testing, we were expecting each machine to give a "Low Paper" message when it sensed that the paper on the roll was running out. In all of our testing, no matter how small the paper tape was, the machine always completed a voter's ballot before giving the "Low Paper" message.
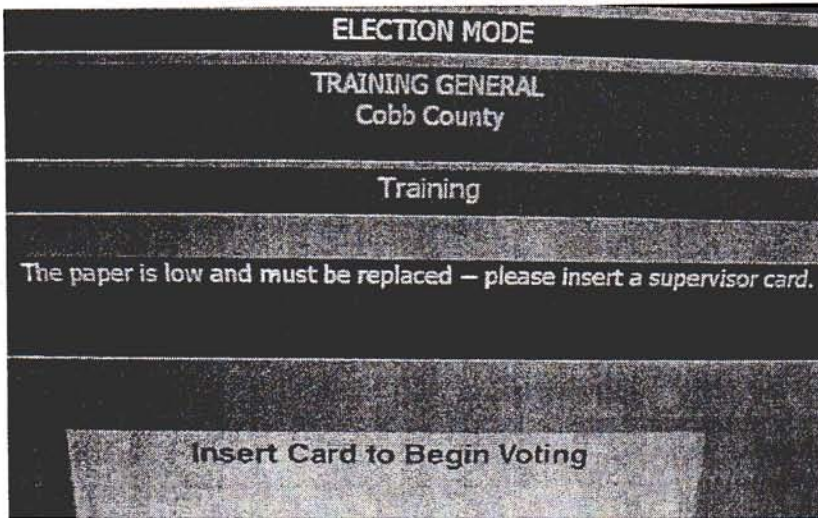
However, on Election Day, canister 15 ran out of paper right in the middle of printing the ballot for a voter. It printed some of the races onto the tape, but then the voter access card popped out of the machine, and the machine displayed the "Insert Voter Access Card" screen with a red error message "Your

ballot has been cancelled" and an additional pop-up message about a printer error. The poll manager issued another voter access card to the voter and allowed her to continue on a different machine. The first machine was then turned off to clear the error messages, the tape was replaced and other voters were allowed to use it. No further problems occurred.

IX. Conclusions

The manual audit has proven that the Touch Screens did count the votes accurately. However, it has also proven that having humans count by hand is not an efficient method of counting. Humans make lots of errors and have to go through the steps many times in order to get the right answers. Humans take a very long time to do what machines can do instantaneously.

If the manual audit process were to be mandated for the future, it should be for selected races only and selected precincts only. Otherwise, the time required would prevent us from ever being able to conduct the next election. For example, in the General Election in 2004, there were 229,231 ballots cast at the polls in Cobb County. If we extrapolate our experience of 5 minutes per ballot, it would have taken 19,102 hours to do a complete manual audit of that election. If we had fielded 20 teams working 40 hour weeks, it would have taken them 24 weeks to audit the General Election. It would have been May of 2005 before that audit was completed. However, we do not have a facility to house 20 teams, or enough capable and available personnel to create 20 teams; therefore, it could have taken even longer. Also, we know from the experience of managing 6 teams, that 20 teams would be way too many for us to manage with 3 managers. The price tag for such a project would have been approximately $520,000.

The paper trail tapes should not be the official record of the election to be used for recounts. We would never be able to accomplish a recount in time to move on to the runoff or whatever election fell next in the election cycle. For example, in 2004 we had to recount a statewide Court of Appeals race. In Cobb County, there were 91,301 ballots cast. From our experience with the current audit, recounting one race on a long ballot took an average of .63 minutes per ballot. We estimate that recounting the Court of Appeals race manually would have taken a total of 958 hours, or 10 teams working 8-hour days for 12 days. There are only 15 work days between a Primary and its Runoff, or 20 work days between a General Election and its runoff. It would have cost approximately $26,000. Most counties, including Cobb, do not have the facilities for housing 10 teams, or funds to rent a larger location; therefore, it could possibly have taken even longer than the estimated time.

According to SB 500, the equipment needed for the pilot project was leased by the State from Diebold ES. The equipment that we currently own cannot be retrofitted with the AVPM module. Therefore, if a decision is made to use this voting method, the first thing that must be done is to replace all of the voting equipment in Cobb County. We have 1600 Touch Screen units that were purchased for us by the State, as well as 466 units that were purchased by Cobb County. The estimated cost of replacing all of this equipment just in Cobb County would be $6.1 million.

Report of the VVPAT Pilot in Cobb County

We hope that the legislature will consider the cost versus the benefit when deciding whether to make this process a permanent part of Georgia elections.

Appendix A
Map Showing Pilot Precinct and Polling Place

MACLAND 01 (MC01)   KEY: DISTRICTS: CONG /SEN /HOUSE /COMM /SCHBD   ✳ POLLING PLACE SEPT. 2008

DISTS: 13/33/33/4/7

CURRENT POLLING PLACE:
MCEACHERN MEM. UNITED METHODIST CHURCH
4075 MACLAND RD
POWDER SPRINGS, GA 30127

Appendix A
Map Showing Pilot Precinct and Polling Place

Cobb County

KEY

1 Cobb Elections Main Office
★ McEachern Memorial UMC
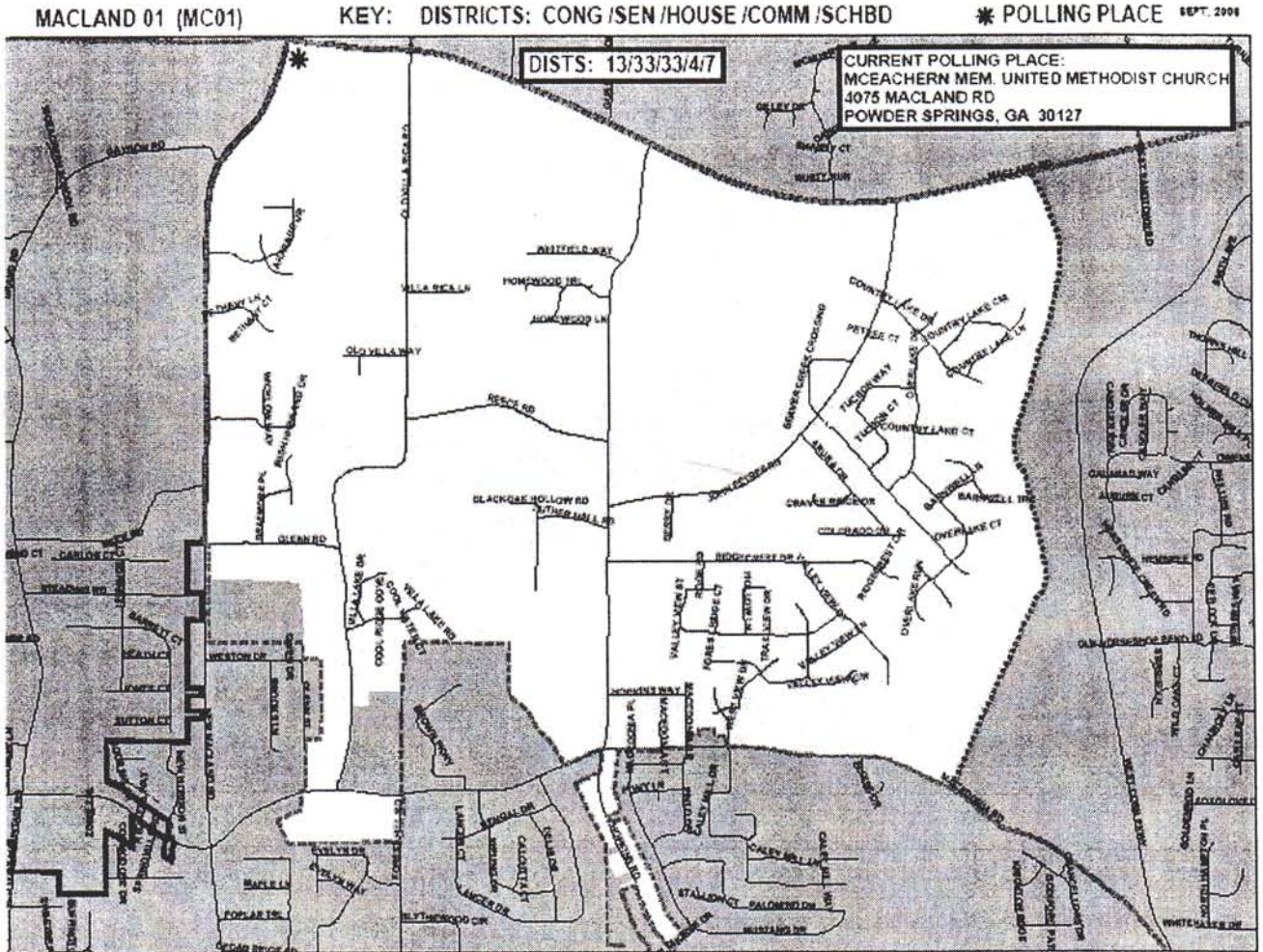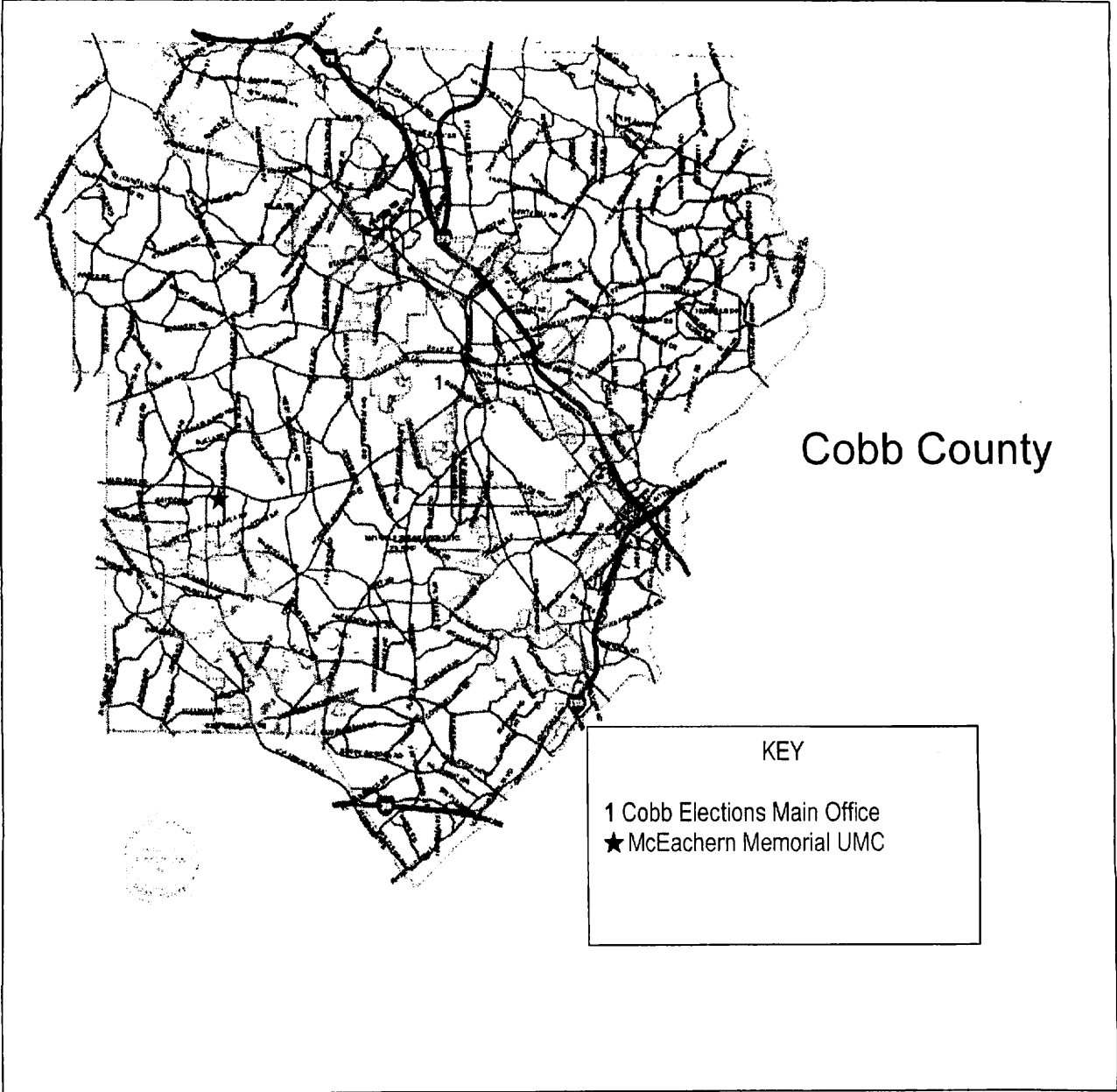
Appendix B
Time Analysis by Team

Table	TSX ID #	Canister #	Original Count or Recount	# Ballots	Date	Elapsed Time	Minutes per Canister	Ballots per Canister	Minutes per Ballot
1	0	9	Orig	13	17-Nov	1:05	65	13	5
1	0	10	Orig	84	16-Nov	:20	20		0
1	0	10	Orig	84	17-Nov	2:00	120	84	1
1	3	7	Orig	30	20-Nov	2:00	120	30	4
1	4	15	Orig	67	17-Nov	4:22	262	67	4
Total 1							**587**	**194**	**3**
2	0	9	Recount	13	20-Nov	:45	45	13	3
2	0	10	Recount	84	20-Nov	1:00	60	84	1
2	1	8	Orig	18	17-Nov	1:30	90	18	5
2	1	17	Orig	95	16-Nov	7:45	465		5
2	1	17	Orig	95	17-Nov	:30	30	95	0
2	4	6 and 15	Recount	120	20-Nov	:30	30	120	0
2	5	16	Recount	104	20-Nov	1:00	60	104	1
2	7	4	Orig	31	20-Nov	1:30	90	31	3
2	8	12	Orig	86	17-Nov	5:45	345		4
2	8	12	Recount	86	20-Nov	:30	1305	86	15
Total 2							**2520**	**551**	**5**
3	3	11	Orig	88	16-Nov	7:00	420		5
3	3	11	Orig	88	17-Nov	7:45	465		5
3	3	11	Orig	88	20-Nov	1:30	90	88	1
3	5	1	Orig	20	20-Nov	1:40	100	20	5
Total 3							**1075**	**108**	**10**
4	0	9	Recount	13	21-Nov	:10	10	13	1
4	0	10	Recount	84	20-Nov	1:50	110		1
4	0	10	Recount	84	21-Nov	:20	20	84	0
4	2	5	Orig	41	17-Nov	2:00	120	41	3
4	3	11	Recount	88	21-Nov	4:00	240	88	3
4	4	6	Orig	53	17-Nov	3:00	180		3
4	4	6	Recount	53	21-Nov	:10	10	53	0
4	4	15	Recount	67	21-Nov	:30	30	67	0
4	5	16	Recount	104	21-Nov	:15	15	104	0
4	6	2	Orig	52	16-Nov	1:30	90		2
4	6	2	Recount	52	17-Nov	1:20	80	52	2
4	6	13	Orig	65	16-Nov	4:35	275	65	4
4	7	4	Recount	31	21-Nov	:05	5	31	0
4	7	14	Recount	90	21-Nov	:10	10	90	0
4	8	3	Orig	39	17-Nov	1:00	60		2
4	8	3	Orig	39	20-Nov	1:45	105	39	3
Total 4							**1360**	**727**	**2**
5	3	7	Recount	30	22-Nov	:10	10	30	0
5	5	16	Orig	104	17-Nov	6:30	390		4
5	5	16	Recount	104	20-Nov	1:15	75		1
5	5	16	Recount	104	21-Nov	:20	20	104	0
Total 5							**495**	**134**	**4**
6	6	2 and 13	Recount	117	20-Nov	:45	45	117	0
6	7	14	Orig	90	17-Nov	7:00	420		5
6	7	14	Orig	90	20-Nov	1:00	60	90	1
Total 6							**525**	**207**	**3**

Appendix C
Employee Hours and Pay

Employee Code	Hours Per Person	Hourly Wage	Money Spent
A	13.50	$9.09	$122.72
B	14.25	$8.74	$124.55
C	7.25	$9.73	$70.54
D	7.00	$11.15	$78.05
E	15.50	$8.74	$135.47
F	16.75	$8.74	$146.40
G	6.25	$11.15	$69.69
H	11.25	$16.67	$187.54
I	10.00	$8.74	$87.40
J	13.00	$10.10	$131.30
K	10.75	$8.74	$93.96
L	25.25	$11.15	$281.54
M	8.75	$8.74	$76.48
N	17.50	$8.74	$152.95
O	16.50	$8.74	$144.21
P	13.50	$8.74	$117.99
Q	18.50	$9.09	$168.17
R	14.75	$8.74	$128.92
S	24.50	$8.74	$214.13
T	22.50	$8.74	$196.65
U	14.75	$8.74	$128.92
V	3.50	$9.09	$31.82
W	3.75	$8.74	$32.78
X	1.25	$12.26	$15.33
TOTAL	**312.25**		**$2,937.45**

3 Managers Thurs./Fri./Mon. (8 hrs x 3 people x 3 days)
2 Managers Tues. (8 hrs x 2 people)
1 Manager Wed. (8 hrs x 1 person)

Cobb County Pay Sheet

	Team # (Table #)	Thurs. 11/16 Hrs.	Fri. 11/17 Hrs.	Mon. 11/20 Hrs.	Tues. 11/21 Hrs.	Wed. 11/22 Hrs.	Total Hours per Team
	1	6.50	7.00	2.00			15.50
	2	7.25	7.50	7.75			22.50
	3	6.50	7.00	3.25			16.75
	4	7.25	7.50	3.75	0.50		19.00
	5		7.25	1.25	8.00	0.25	16.75
	6		7.00	1.75			8.75
Daily Totals of Teams		27.50	43.25	19.75	8.50	0.25	
x 3 people per team		82.50	129.75	59.25	25.50	0.75	
Plus 1 employee checking and verifying				7.50	7.00		
TOTAL		82.50	129.75	66.75	32.50	0.75	312.25
Number of Managers		3	3	3	2	1	