Appendix 5:
Advantages of Precinct-based optical scan over DREs

1. Optical scan systems have lower rates of residual votes

Multiple studies indicate that precinct-based optical scan voting systems provide a lower rate of residual votes than do DREs. Elections officials compare the performance of alternative voting systems by comparing the percentage of residual votes for each system. The residual vote metric is the sum of unmarked or inadequately-marked ballots (under-votes), over-votes, and any other ballots that are cast by voters but uncounted for any other reason.

The most extensive study was "The MIT/Caltech Voting Study", which examined residual vote rates among all of the ballot types used in the years 1988 through 2000. A copy of this report can be found at:
http://www.vote.caltech.edu/Reports/2001report.html

Table 1 of that report (found on page 21), contains the following data:

RESIDUAL VOTES AS A PERCENT OF ALL BALLOTS CAST,1988-2000

Machine Type	President	Governor & Senator
Paper Ballot	1.8%	3.3%
Punch Card	2.5	4.7
Optical Scan	1.5	3.5
Lever Machine	1.5	7.6
Electronic (DRE)	2.3	5.9

This shows the optical scan voting systems consistently delivered the lowest rates of residual votes of any of the voting technologies in use, including DRE voting machines.

A more recent (2004) study conducted in Florida compared the number of under-votes reported by DRE and optical scan systems in elections where there was only a single race or question on the ballot. It is assumed that in such single-contest elections, voters are unlikely to make a trip to the polling place to cast a blank ballot, so that under-votes that occur in such elections reflect a failure of the voting technology in use to record those votes. This study found that in such single-contest elections, DRE voting systems registered roughly 8 times as many under-votes as were registered by optical scan systems. While the optical scan systems incurred an over-vote rate of 0.01%, those presumably occurred on central-count optical scan systems. Both DREs and precinct-based optical scan systems prevent over-votes.

For details, see: "Analysis reveals flaws in voting by touch-screen" by Jeremy Milarsky and Buddy Nevins, in the July 11, 2004 issue of the Sun-Sentinel. An archived version of this article is available at:
http://www.verifiedvoting.org/article.asp?id=2473

2. Optical scan ballots are inherently voter-verified

Most optical scan ballots are inherently voter-verified because they are marked directly by the voter. But a "voter-verified paper ballot" (VVPB) that is produced by a printer attached to a DRE may or may not be verified by the voter, because there is no requirement that the voter actually inspect such a VVPB.

3. Optical scan ballots allow voters to verify correct ballot type

A polling-place-based optical scan voting system enables the voter to provide another critical verification: verification that the voter has been given the correct type of ballot before they start to vote.

A recurrent and serious problem with DREs is that voters sometimes receive the wrong ballot type (or an incomplete ballot) but can't find out that this has happened until after they start voting. Such incidents have been documented in several states where DREs are used, including California, Maryland, Georgia, and most recently in Hawaii. In some of these cases, voters have been partially disenfranchised, as they have been denied the opportunity to vote on races for which they were entitled to vote.

With a DRE-based system, when a voter signs into the poll book and is handed an "electronic ballot" by the poll worker, they are given either a "smart card" (on which the ballot is electronically encoded) or a 4-digit code number (e.g., Hart InterCivic eSlate system). In either case, what the voter receives from the poll worker is opaque and inscrutable, because to the eye, all smart cards look identical. The voter has no way to verify, prior to entering the voting booth and starting to vote, that he or she has received the correct type of ballot.

It is only after the voter has started voting (and often not until they finish voting) that a voter may realize that the ballot he or she received was the incorrect type or that it is missing one or more races or questions. In many cases, this realization comes too late, as some voters have inadvertently cast their DRE ballots while searching for the missing races or questions. And even when voters detect this mistake in mid-ballot, they typically have to compromise the secrecy of their electronic vote when showing poll workers that their partially-voted electronic ballot is of the wrong type.

Contrast this with an optical scan ballot system, where voters can inspect the complete ballot at the time they receive it from the poll worker and can exchange any incorrect ballots for the correct ballot type before they begin to vote. Such exchanges can be done without compromising ballot secrecy.

The problem of poll workers mistakenly giving voters an incorrect ballot type is clearly a human problem that can occur regardless of whatever voting technology is used; it can partially be addressed by better training of poll workers. However, it is a problem that will never be completely eliminated, and one which any voting system must adequately address. To date, DREs have not adequately addressed this problem, nor will it be addressed by adding VVPB printers to DREs.

Several recent magazine and newspapers stories show that this is a recurring problem that is not isolated to any one state or type of voting machine.

"The Vexations of Voting Machines" by Viveca Novak in the May 3, 2004 edition of TIME Magazine,
http://www.time.com/time/archive/preview/from_redirect/0,10987,1101040503-629410,00.html

"Jeffrey Liss had finished making his selections on Maryland's Democratic-primary ballot and strolled out of the polling place at Chevy Chase Elementary School on the morning of March 2, Super Tuesday. On the sidewalk, he spied a campaign posted for Senator Barbara Mikulski, who is running for her fourth term. Funny, he thought, he didn't remember voting in the Senate race.

Liss went back inside to talk to an election official. And another, and another. He was told he must have overlooked the Senate race on the electronic touch-screen voting machine. But Liss, a lawyer, finally persuaded a technician to check the apparatus. Sure enough, it wasn't displaying the whole ballot.

According to voter complaints collected by Mikulski, who won in the primary, her race didn't appear on ballots in at least three Maryland counties...

Liss is still awaiting satisfaction. He was finally allowed to cast a provisional ballot for the Mikulski race. Then the state refused to count it. Liss filed a petition with the county board of elections and awaits a decision."

"New Voting Glitch Had Old Cause", by Stuart Pfeifer, in the March 6, 2004 edition of the Los Angeles Times. An archived version of this article is available at:
http://www.verifiedvoting.org/article.asp?id=1444

"Confusion in Orange County that led to some voters receiving the wrong ballots on Tuesday highlights a problem election officials have been struggling with for years: recruiting and training temporary poll workers.

With the advent of high-tech voting, the problem is only going to get worse, some analysts say.

In Orange County, poll workers — including some who said they received inadequate training — gave some voters incorrect access numbers that led some of them to vote for candidates in the wrong political party or in the wrong election district.

Officials are investigating the problem, but say they may never know how many votes may have gone astray..."

Also see:
"7,000 Orange County Voters Were Given Bad Ballots", in the March 9, 2004 edition of the Los Angeles Times. An archived version of this article is available at:
http://www.votersunite.org/article.asp?id=1476

"7,000 Orange County Voters Were Given Bad Ballots
By Ray F. Herndon and Stuart Pfeifer, Times Staff Writers

Poll workers struggling with a new electronic voting system in last week's election gave thousands of Orange County voters the wrong ballots, according to a Times analysis of election records. In 21 precincts where the problem was most acute, there were more ballots cast than registered voters.

Wide margins in most races seem likely to spare the county the need for a costly revote. But the problems, which county officials have blamed on insufficient training for poll workers, are a strong indication of the pitfalls facing officials as they try to bring new election technology online statewide.

'The principal of democracy is every vote should count. That's why we need a better election system,' said Henry Brady, a political science professor at UC Berkeley and an expert on voting systems.

At polling places where the problem was most apparent because of turnouts exceeding 100%, an estimated 1,500 voters cast the wrong ballots, according to the Times' analysis of official county election data. Tallies at an additional 55 polling places with turnouts more than double the county average of 37% suggest at least 5,500 voters had their ballots tabulated for the wrong precincts.

Problems occurred in races throughout the county — including five out of six congressional races, four of five state Senate contests, and five of the nine Assembly races that are decided in whole, or in part, by Orange County voters.

Election officials acknowledged that poll workers provided some voters incorrect access codes that caused them to vote in the wrong legislative districts but said there was no evidence yet that any result was in jeopardy...

The Times arrived at its estimate of 7,000 improper ballots by comparing precincts with unusually high voter turnout to the average turnout at polling places. Orange County election officials have traced the problem to poll workers who were responsible for giving each voter a four-digit code to enter into the voting machines.

After signing in, each voter received a ticket bearing his or her precinct number and party affiliation from a poll worker. The voter would take the ticket to a second worker, who was supposed to scroll through a computer screen and use the voter's precinct and political party to obtain an access code that would identify the appropriate ballot. Several workers who handled this stage of the process — including some who said they didn't know more than one precinct had been assigned to their polling place — gave voters codes for the wrong precincts, causing the wrong ballots to appear on their screens.

Some voters noticed the problem and were able to get workers to give them access codes for the proper ballots. But many voters did not..."

See also:
"Primary Election Runs Into Problems, Some Errors Caused by Electronic System", posted 4:31 PM September 24, 2004 by KITV Channel 4 News, Honolulu, Hawaii, (http://www.thehawaiichannel.com/news/3760175/detail.html)

"New paperless electronic voting machines caused some problems in Saturday's primary election...The machines mistakenly allowed voters on Oahu and the Big Island to select Green Party ballots even though there were no Green Party Candidates."

4. Voters complain DREs provide inadequate privacy

Voters in many states, including some of the Connecticut voters who participated in the 2003 trials of DRE voting systems, have complained that DRE voting systems do not provide adequate ballot secrecy due to the lack of voting booth curtains coupled with the fact that the DRE voting displays are nearly vertical. In many cases, voters voting on adjacent DREs or other voters waiting in line could view the selections made on a given voter's DRE touch screen display. In other cases, when voters encounter a problem in mid-ballot and invoke the assistance of a poll worker, they often have to give up the secrecy of their ballot in order to page back and forth through their electronic ballot to demonstrate the problem to the poll worker.

5. Logic and accuracy tests on DREs are cumbersome or opaque

Logic and accuracy tests can be conducted on DREs in one of two ways. In the first method, election workers can follow a script and enter test votes into a DRE via the touch screen. Once all of the test votes have been entered, the vote totals produced by the DRE can be compared with the correct numbers that were determined when the test script was created. Members of the public and representatives of various political parties can witness such tests to make sure that the test votes are entered correctly and that the appropriate totals are produced by the DRE. The difficulty with this method is that because it is very cumbersome, time consuming, and expensive, it can only be performed on a small fraction of the machines that will be deployed.

The second method bypasses the touch screen completely and uses a "test cartridge" that is plugged into the voting machine to simulate a human casting votes via the touch screen. While this automated test method is more efficient, it is also completely opaque to anyone trying to witness the test; there is no way for such witnesses to view or verify what the test cartridge is actually doing. Instead, they have to "take it on faith" that the test cartridge is doing what the voting machine vendors and elections officials claim that it is doing. The transparency of the voting system is thus compromised in the interest of efficiency, thus lowering public confidence in the system.

Optical scan voting systems provide a more transparent and publicly-verifiable means for conducting pre- and post-election logic and accuracy tests. A test deck of optical scan ballots can be marked by election observers and then publicly counted by hand, multiple times and by multiple parties until all agree on the correct count. That test deck can then be run through the optical scanner, and its vote count is then compared to the publicly-verified manual count of that same test deck.

The test deck can even be run through the scanner multiple times to more accurately simulate the actual number of voters whose votes would be counted on that scanner in an actual election. For example, if the test deck is run through the optical ballot scanner 10 times, it should produce a result that is ten times the public-verified manual count for that test deck.

In addition, multiple optical ballot scanners can be quickly and efficiently tested using this same deck. This is considerably more cost-effective, open, and transparent than comparable logic and accuracy tests on DREs, particular those conducted via the second method described above.

6. Optical scan ballots provide a more uniform voting system

The section of the State Plan entitled "State Plan Required Elements", subsection D, "Voting Systems Guidelines and Processes", states that:
"Currently, Connecticut does not require uniform voting systems for polling place and absentee voting. With the assistance of the HAVA State Planning Committee, the Secretary of the State will review the possibility of recommending to the Connecticut State Legislature uniform standards to be set in place by 2006." While it is clearly not practical to mail DRE voting machines to absentee voters, it is both practical and cost effective to mail optical scan ballots to such voters. Thus, a voting system solution employing optical scan ballots for both polling place and absentee voting would enable such uniform standards. It ensures that all voters in a jurisdiction would use an identical type of ballot and that all ballots would be scanned and counted using the same type of voting system.

7. VVPB printers increase the complexity and cost of DREs

The addition of VVPB printers to DREs is needed to provide adequate protection against the possibility of unrecorded or mis-recorded votes and it may also soon be required by federal law. But adding an accessible VVPB printer (i.e., one that includes an audio feedback capability as required to make the VVPBs accessible to blind voters and one which also produces a VVPB that can be optically-scanned) significantly increases both the cost and complexity of what is already an expensive and complicated technology.

Some vendors have estimated the costs of such printers at $1,000 each. The VVPB printers recently supplied by Sequoia Voting Systems to the State of Nevada for use in their primary election in September cost $800 each and did not provide audio feedback or a VVPB that could be optically scanned. While some vendors (e.g., Sequoia and Diebold) have contracted to give some jurisdictions VVPB printers for free (e.g., Santa Clara and San Diego counties), they are unlikely to provide such contracts to all jurisdictions. However, other vendors (e.g., Avante and AccuPoll) include VVPB printers as a standard part of their DRE voting systems.

Summary

A polling-place-based optical scan solution provides capabilities that are comparable to DREs in terms of providing the same opportunities for voters to detect and correct errors such as over-votes and under-votes and, when augmented by ballot marking devices, for accessibility by voters with disabilities. Such a solution is fully compliant with the provisions of HAVA. It also ensures that most ballots will in fact be voter-verified, and it reduces the likelihood of voters voting on ballots of the incorrect type. It also ensures that all of the voters (absentee, non-absentee, disabled and non-disabled) in any town deploying such a solution receive an identical ballot and that all such ballots are counted the same way, thus simplifying election administration. In those Connecticut towns already using optical scan systems, the deployment of ballot marking devices minimizes the need for retraining most voters. Because it is simpler than the more complex DRE+VVPB printer solution, it will likely reduce the human error factor and make training easier, as well as requiring fewer poll workers to staff the polls on election day. And for the reasons described earlier, it provides a voter verified paper audit trail superior to that provided by DREs.