

**December 2, 2010**

# **Maryland Voting Systems Study**

## **FINAL REPORT**

Prepared for

**Maryland Department of Legislative Services**

Stanford Ward

90 State Circle

Annapolis, MD 21401

Prepared by

**RTI International**

RTI International

3040 Cornwallis Road

Research Triangle Park, NC 27709

RTI Project Number 0212675.001.001

RTI Project Number  
0212675.001.001

# Maryland Voting Systems Study

**December 2, 2010**

Prepared for

**Maryland Department of Legislative Services**

Stanford Ward  
90 State Circle  
Annapolis, MD 21401

Prepared by

**RTI International**

RTI International  
3040 Cornwallis Road  
Research Triangle Park, NC 27709

# Contents

---

<b>Section</b>	<b>Page</b>
<b>1. Executive Summary</b>	<b>1-1</b>
<b>2. Introduction and background</b>	<b>2-1</b>
<b>3. MDVSS Findings</b>	<b>3-1</b>
3.1 Whether the State Board of Elections voting system support contract approved by the Board of Public Works on February 24, 2010, is maximally cost-effective and includes only services that are clearly necessary for the conduct of elections.....	3-1
3.1.1 Conclusions .....	3-4
3.2 Whether the State Board of Elections' proposed procurement of an optical scan voting system for deployment in the 2010 elections is maximally cost-effective and included only equipment that is clearly necessary for the conduct of elections .....	3-4
3.2.1 Early Voting and Ballot-on-Demand Printing .....	3-9
3.2.2 Florida's Experience Moving to Ballot-on-Demand in 2008 .....	3-11
3.2.3 Conclusions .....	3-12
3.3 The necessity of the State Board's proposed procurement of voting booths and supply carts to implement an optical scan voting system for the 2010 elections .....	3-13
3.3.1 Supply Carts.....	3-13
3.3.2 Voting Booths .....	3-14
3.3.3 Retrofitting DREs as Voting Booths .....	3-15
3.3.4 Conclusions .....	3-16
3.4 Quantitative Analysis of Voting Technology Costs .....	3-17
3.4.1 Conceptual Approach .....	3-17
3.4.2 Analysis Methodology .....	3-19
3.4.3 Cost Variables, Data Sources, and Assumptions .....	3-22
3.4.4 DRE Voting System Costs.....	3-24
3.4.5 Estimated Optical Scan Voting System Costs .....	3-30
3.5 The amount, if any, by which voting system operations and maintenance costs would be reduced if an optical scan voting system were implemented...	3-37
3.6 Current and projected operations and maintenance costs for the state's current voting system .....	3-37
3.7 The projected life span of the state's current voting system.....	3-40

3.8	A comparison of the overall cost of continuing to use the state's current voting system as opposed to implementing an optical scan voting system .....	3-42
3.9	Recommendations for procuring and implementing an optical scan voting system in a cost-effective manner .....	3-47

# Tables

---

<b>Number</b>	<b>Page</b>
3-1. Matrix of Optical Scanning Contract Provisions in Maryland and Other Jurisdictions.....	3-7
3-2. Ballot on Demand.....	3-10
3-3. Voter Turnout by Jurisdiction and Election Year .....	3-21
3-4. DRE Capital Costs, FY2003–FY2014 .....	3-25
3-5. Projected DRE Replacement Costs, FY2013-FY2020 .....	3-26
3-6. Long-Term DRE Maintenance Alternative to Replenishment (Not Recommended) (thousands, \$2010), FY2013-FY2020 .....	3-29
3-7. Actual DRE Voting System Costs (thousands, \$2010), FY2003-FY2010.....	3-32
3-8. Projected DRE Voting System O&M Costs (thousands, \$2010), FY2011-FY2020...	3-33
3-9. Optical Scan, BMD and BOD Capital Costs (thousands, \$2010), FY2013-FY2020 .....	3-33
3-11. Modeled Optical Scan O&M Cost (thousands, \$2010), FY2006-FY2010.....	3-35
3-12. Modeled Optical Scan O&M Cost (thousands, \$2010), FY2013-FY2020.....	3-36
3-13. DRE O&M versus Optical Scan Modeled O&M Costs (thousands, \$2010), FY2006-FY2010.....	3-37
3-14. Current and Projected DRE Voting System O&M Costs (thousands, \$2010), FY2011-FY2020.....	3-39
3-15. Overall Cost Comparison of DRE vs. Optical Scan Voting Systems (thousands, \$2010), FY2013-FY2020.....	3-44
3-16. Alternative Scenario Overall Cost Assessment (Not Recommended) (thousands, \$2010), FY2013-FY2020 .....	3-46
3-17. SBE Headcount and Budget History, 1999-2010 .....	3-50

## **Acknowledgements**

This report acknowledges the contributions of the following individuals.

### **Expert Advisory Panel**

Conny McCormack, Los Angeles County Registrar-Recorder (Retired)  
Paul Gronke, PhD, Department of Political Science, Reed College  
Joseph Lorenzo Hall, PhD, Center for Information Technology, Princeton University and School of Information, University of California Berkeley

### **Maryland State Board of Elections**

Ross Goldstein, Deputy Administrator  
Valerie O'Connor, Director Finance & Budget Management and Procurement  
Paul Aumayr, Voting Systems Project Manager



## **1. EXECUTIVE SUMMARY**

Maryland's Department of Legislative Services (DLS) commissioned RTI International to conduct the Maryland Voting Systems Study (MDVSS). The General Assembly required a better understanding of the costs associated with the planned change in voting technology from direct-recording electronic (DRE) voting machines to a system using paper ballots and optical scan ballot counting machines. The General Assembly also required a better understanding of the necessity of the proposed combination of goods and services associated with the implementation of a new statewide voting system. In particular, this study inquires into the State Board of Elections' (SBE) procurement of support services; its proposed, but not completed, procurement of new optical scan voting equipment; the cost ramifications of making a change from DRE machines to optical scan machines; and the need for voting booths and carts.

This report is presented by RTI in partial fulfillment of this contract. Supported by our expert panel (including two academic experts and a veteran election administrator), RTI collected data from the Maryland SBE, from advocacy groups, and from other U.S. jurisdictions. This report is informed by price proposals and provisions of voting contracts from Maryland and of other U.S. jurisdictions and by key-informant interviews with election officials in Maryland and elsewhere. It is informed by vendors and their promotional literature. Many of the contracts from jurisdictions outside Maryland and used for comparative purposes were acquired through A Center for Correct, Usable, Reliable, Auditable, and Transparent Elections (ACCURATE)—a National Science Foundation-funded consortium studying voting technologies. Understanding our mission, the Maryland SBE provided us with documentary information, including its requests for proposals, as well as vendor proposals, their responses to questions about the proposals, financial summaries and pricing information, contract modifications, and invoices relevant to this task. SBE provided us with information verbally and via email. Based on SBE's solicitations and the contract, financial data, and proposals provided by SBE, RTI has modeled the real and anticipated costs of Maryland continuing to conduct its elections using its current DRE machines. SBE was invited to review and comment on our data, analysis, and findings. SBE offered helpful and informative comments, most of which we acted on.

SBE expenditures (proposed or actual), which are the focus here, are only part of the cost of election administration. Spending by other state agencies to support the conduct of elections is not examined. Local expenditures are examined only to the extent that they are part of the cost sharing arrangement for voting system equipment and services. This study does not address whether optical scan systems are superior to DRE systems as a mode of voting, nor does this inquiry address the relative strengths and weaknesses of either system.

Our primary findings are as follows:

- Maryland's service agreement for converting to an optical scanning system from DRE appears to maintain a level of support appropriate for managing DRE machines, which are more numerous and complex. In particular the requirement for six regional managers is high. Our research indicates that the level of effort to implement elections under optical scanning will require fewer personnel.
- Contracts in the ACCURATE data set indicate that service contracts typically bundle one or two support functions. (Maryland's service agreement included far more.) While bundling many services into a single agreement may have served the administrative convenience of SBE, it limited competition that could have occurred had the service agreement been severed into its component parts.
- Titles of RFPs should be careful not suggest a need for election expertise unless such expertise is required.
- Direct comparisons of Election Systems and Software (ES&S) pricing on software and hardware from past contracts demonstrate that the price quotes in the ES&S proposal to the Maryland SBE are at a reasonable level.
- Though not strictly "necessary," the procurement of more than one optical scan machine per polling place provides Maryland with enough units that would be used for spares, for training, and to allow for a second machine at high-volume polling places. This practice is common in other jurisdiction and will provide Maryland with coverage in the event of machine failures or high turnout.
- Though not "necessary" in the strict sense of the term, the proposed acquisition of dedicated, customized carts to protect the new optical scan counters is an investment in the long-term reliability of the new machines. It is common in other jurisdictions to provide for dedicated equipment. These carts are organized in such a way that the absence of election-day materials can be noticed easily. Our experts agree that such devices are a prudent expenditure that aids volunteer poll workers in performing their duties.
- The use of a privacy shield is a necessary feature for the conduct of elections in the state of Maryland (Sec. 9-203 of the state's statutes). However the means by which voter privacy is protected is not specified in law. The use of free-standing voting booths is a common practice. The ES&S proposal for [REDACTED] per unit voting booth provided for a heavyweight, durable piece of equipment. We have identified list prices for lighter weight booths range between \$100 and \$180 per unit, depending on features. We recommend considering the units with aluminum legs, sturdy plastic carrels and a light, which are available at a catalogue price of \$125. With this in mind, our expert panel agrees with SBE's intention to issue a separate RFP for these items. Alternatives to standing voting booths exist, but these would be impractical in many situations in Maryland.
- Ballot-printing costs are the biggest contributors to the year-over-year variance in optical scan operations and maintenance (O&M) costs. Ballot-printing costs range from no costs for fiscal years in which no elections are held to \$2.6 million per year during years in which two elections are held. These costs are expected to contribute \$1.3 million per fiscal year to O&M costs on average.
- Overall, the cost of continuing to use the state's current voting system will be higher than transitioning to an optical scanning system. Inclusive of all known capital, operations, and maintenance expenses we estimate that the optical scan



system would provide cost savings of \$9.5 million over the period from FY2013 to FY2020 relative to the use of a DRE system.

SBE indicated that it may request one-time optical scan implementation support for project management, DRE disposal, documentation, and quality assurance for a total cost of \$1.3 million, which would lower cost savings to \$8.2 million.

SBE may also request funds for an extensive voter outreach campaign [REDACTED] and comprehensive training for local elections staff, judges, and technicians [REDACTED]. We are not convinced that such extensive outreach and training would be necessary given that optical scan systems are currently used for absentee and provisional voting and were used for all elections in 19 counties before the introduction of the DRE system.

- The DRE units are approaching the end of their useful lives, as specified in the manufacturer's literature. If they remain in service, these units will need to be replaced or maintained at great expense. While Maryland and other jurisdictions report machine failure rates of about 1.5 percent per election year during the normal lifespan of the equipment, there is no information available about the potential for failure after this lifespan. We can only assume there will be greater degradation and higher repair costs beyond that time.
- A phased, planned transition to an optical scanning system will allow election officials to familiarize themselves with these systems, inform the public about their use, and minimize voting disruptions.

## Scope and Limitations

To fulfill the General Assembly's information needs, RTI defined the scope of this inquiry in important ways. The analysis compares the *relative* cost of conducting elections using the current DRE system to the *anticipated* cost of conducting elections using a new optical scan system. This report is designed to identify whether the provisions for equipment and support of the optical scanning system are necessary for the conduct of elections. Our study of the services focuses on the Cirdan Group contract that the State Board of Public Works approved as of February 2010 and the cost proposals offered by Election Services & Software dated September 9, 2009.



## 2. INTRODUCTION AND BACKGROUND

In 2001, the Maryland legislature mandated that the State Board of Elections (SBE) select and purchase a single voting system for the entire state. Prior to this initiative, Maryland's local voting jurisdictions had used a variety of systems. Baltimore City used a DRE system. Montgomery County used punch cards; Dorchester, Allegany, and Prince George's counties used lever machines; and the remainder of Maryland used an optical scan system. The 2001 reforms were intended to implement a unified voting system throughout the state, with the state and county jurisdictions sharing the costs of acquiring new voting machinery. The legislative reforms were in response to recommendations made by two advisory panels: the 1997 Commission to Revise the Election Code, chaired by former Maryland Administrator of Elections Marie M. Garber (the Garber Commission<sup>1</sup>), and in 2000 and 2001 the Special Committee on Voting Systems and Election Procedures, chaired by the Secretary of State John T. Willis (the Willis Committee).

The Garber Commission recommended changes in all aspects of Maryland's voting administration, processes, and equipment. Its recommendations included, among other things, the testing and certification of an integrated, electronic voting system for the entire state. The recommendations led to reforms that empowered the SBE to coordinate this election equipment certification through a laboratory.<sup>1</sup>

Concerns about the accuracy of vote tabulation in the 2000 Presidential election in Florida created further impetus for voting systems modernization in Maryland. Governor Paris Glendenning empanelled the Willis Committee, which concluded (as did the Garber Commission) that Maryland should have a standardized system of voting. However, the Willis Committee went a step further and recommended that Maryland's voting system should rely principally on a specific type of voting equipment: direct-recording electronic (DRE) voting machines. After the spectacle of the "hanging chads" in the Florida recount process, electronic voting was seen by many reformers as offering a clearer way to record votes. In its report, the Willis Committee recommended the use of optical scan systems only for absentee balloting and stipulated that the state's voting system provide for the "highest degree of secrecy practicable" (pp. 27-28).<sup>2</sup>

Responding to the Willis Committee's recommendations, the state legislature in 2001 required that local jurisdictions purchase their new DRE equipment through the SBE. The SBE solicited bids to acquire equipment, software, and support services, and selected the AccuVote TS system from Diebold Election Systems, Inc. The AccuVote TS presents ballot choices on a touch screen, and voters cast their votes by touching the appropriate choice.

---

<sup>1</sup> Garber, M. M., et al. (1997, December). *Report of the commission to revise the election code*. Maryland Commission to Revise the Election Code.

<sup>2</sup> *Review of election administration in Maryland*. (2001). Department of Legislative Services, Office of Policy Analysis, Annapolis, Maryland, November 2001.

Purchase of the machines was supported by federal aid through the Help America Vote Act (HAVA), passed by Congress in 2002. HAVA was the federal response to the policy issues raised by the 2000 presidential election. Beginning in 2002, SBE acquired 18,810 DRE units in three phases at a total cost of \$62.7 million. In addition to the DRE purchases, a total of \$45.1 million for services and consumables were provided through FY2009. The equipment acquisitions include three phases:

- Phase I: 5,095 units (\$14.2 million) entered service in calendar year 2002 for Montgomery, Prince George's, Allegany, and Dorchester counties.
- Phase II: 10,952 units (\$40.2 million) entered service in 2004 for all remaining counties, but not Baltimore City.
- Phase III: 2,763 units (\$8.2 million) entered service in 2006, 1,900 of which were for Baltimore City, and the balance for the rest of the state.

All of the local jurisdictions, except Baltimore City, implemented the DRE system in time for the 2004 Presidential election. Maryland voters have used the same system in every election since, including the just-completed 2010 election. Maryland also uses optical scan ballots for absentee and provisional voting. In addition to the 18,810 touch screen voting machines, the system currently deployed in Maryland includes:

- About 70 optical scan ballot counting machines;
- Approximately 6,500 electronic poll books, used to verify voter registrations and encode the cards that give voters access to the touch screen machines;
- Fifty computer servers that house the state's Voting Election Management System (VEMS); and
- Voting management and support services.

In 2007, responding to rising concerns about security, reliability, and accuracy of DREs, the Maryland General Assembly passed legislation requiring a new voting system. Chapters 547 and 548 of 2007 required that the voting system be capable of producing a voter-verifiable paper audit trail (VVPAT). A VVPAT is a printout from the voting machine that allows the voter to verify that the ballot correctly reflects the voter's choice. One well-known example of a voting system that produces a VVPAT is optical scan voting. Optical scan systems use paper ballots, similar to the answer sheets used for standardized testing in schools. Voters use a special pen to mark their choices and the ballot is then fed into a machine that reads and counts the votes. The paper ballot is retained and available for recounts or audits. According to § 9-102 of the Election Law Article, only an optical scan voting system satisfies the VVPAT requirement.

In 2009, SBE issued two solicitations for new voting equipment and services. The equipment solicitation drew two proposals, and the solicitation for support services drew a single bidder. The two voting machine companies that responded, however, merged during the procurement process, so one of the proposals was disqualified. On December 17, 2009,

the SBE approved two proposals for submission to the state Board of Public Works. They include a \$14 million (base price) for optical scan equipment with Election Systems & Software (ES&S) and a separate support services contract with a 3-year, \$20.9 million (base price) contract with Cirdan Group, a Maryland-based contractor.

Citing the state's fiscal situation, the Governor did not include funding for the new system in the fiscal year 2011 budget, preventing SBE from buying the new equipment. The state is using the DRE system during the 2010 primary and general elections, and plans to continue to use the DRE machines until funding is provided for a new system.



### 3. MDVSS FINDINGS

#### 3.1 Whether the State Board of Elections voting system support contract approved by the Board of Public Works on February 24, 2010, is maximally cost-effective and includes only services that are clearly necessary for the conduct of elections

**Summary:** The support services contract for the optical scan system fails to capture the potential savings that should be realized by moving to an optical scan system. In addition, the fact that the solicitation attracted only one bidder suggests that better procurement practices, including breaking up the solicitation into multiple parts, may have resulted in cost savings through competition.

In January 2010, following a 2009 solicitation, the SBE negotiated an agreement with Timonium, Maryland-based Cirdan Group to provide support for an array of election services, including project management. The agreement was approved by the state Board of Public Works on February 24, 2010. Cirdan's proposal listed personnel for five key areas of responsibility included in the solicitation:

- A project management team, with both management and tactical responsibilities, including joint coordination of the other teams;
- A voter outreach team, to design and deliver voter outreach services;
- A training team, responsible for developing and delivering training to local election technicians and poll workers;
- A voting systems team, to support voting equipment and the voting process; and
- A transportation team.

Cirdan's proposal subcontracted some of the project. For example, Cirdan contracted with gkv Communications to oversee the voter outreach and hired staffing and transportation companies. Subcontracting is necessary in order for Cirdan to meet Minority Business Enterprise (MBE) goals required for each state contract.

The original contract, signed in January 2010 and approved in February 2010, was modified in subsequent months to reflect the fact that an optical scan system would not be deployed in the 2010 elections, as originally had been planned. The following analysis focuses on the original contract as signed in January, since it is the one relevant to the way SBE proposes to manage an optical scan deployment.

Using a unique database of election contracts, we compared the services contract to other procurements across the country. Direct comparisons to other jurisdictions are difficult for a number of reasons:

- The division of labor between states and their local election offices varies across the country.

- State offices may be staffed with different combinations of contract and regular state employees.
- States deploying new technology, as the original Cirdan contract was designed to do, may incur additional costs to ensure a smooth transition.
- It is particularly risky to compare states to counties, even large ones, and even after controlling for differences in area or population.

Our research uncovered a number of examples of statewide voting systems procurements, but the state involvement in those cases is typically to leverage collective buying power of all local jurisdictions in the state, negotiating better terms and pricing. Our research has identified states such as Connecticut and Florida that have transitioned to an optical scan system and Oklahoma, which is in the process. In that case, support to local election officials was mostly for negotiating contracts and financing purchases.<sup>3</sup>

Maryland's services contract reflects the initial costs inherent in implementing a new voting technology. These costs include revising existing documentation, such as the extensive *Conducting the Election Guide* and the *Election Judges Manual*, and developing new procedures, schedules, and processes to reflect the new machinery. SBE is anticipating a comprehensive voter outreach campaign to make certain that Maryland voters are aware of the new voting system. Though Maryland is using optical scan in provisional and absentee voting and had done so in most counties prior to adopting DREs, transition activities will be necessary if the state is going to successfully switch to an optical scan system as its primary voting technology.

Beyond the transition costs, the Cirdan contract does not reflect the potential on-going cost savings available from managing a simpler technology with far fewer voting machines. Based on comparisons to other voting services contracts from other jurisdictions making similar transitions, and from interviews with election officials, it is reasonable to conclude that the yearly requirements of running a statewide optical scan system—after initial transition costs—should be markedly lower with optical scan than with DRE systems. The 2010 agreement maintains a level of support comparable to that needed to manage DRE machines, which are far more numerous and complex. The services contract appears to be larger than required by other jurisdictions.

We are not able to identify another contract that provides such a rich structure of support personnel. The contract requires six full-time, permanent regional managers. We were unable to find other states that require regional support managers. More usually, project managers for equipment transition periods are temporary positions, hired to manage the transition from the old system to the new system. Connecticut, for example, included such a position for 12 to 18 months, effective on execution of the contract. However, in the case of Maryland, these would be effectively permanent positions, lasting for the base term

---

<sup>3</sup> Phone interview with Connecticut Deputy Secretary of State Lesley Mara, October 6, 2010.



and all option years. Oklahoma provides another point of comparison. Oklahoma is reviewing proposals for a transition to uniform, optical scanning system involving 2,800 optical scan readers and 2,500 devices for compliance with the Americans with Disabilities Act (ADA). Oklahoma's state board of elections is comparable in size to Maryland's and services 77 counties over broader geographic territory. Oklahoma anticipates phasing in its optical scan system beginning in 2011 and full implementation by 2012. Oklahoma is requiring scalable support, only through 2012, rather than the life of the contract.

Again, it should be noted that Maryland's state-level election administration is structured very differently, so functions that in other states are typically delegated or staffed by local officials are necessarily staffed and performed by the state. Although some of these positions do exist in other states, they are typically not positions staffed by a contractor but rather by local election offices or state-level election administration.

One notable feature of the Maryland solicitation is that it attracted only one bidder, likely because the solicitation bundled several different tasks through one RFP, and the title of the RFP suggested a specialization in election services. The advantage in bundling tasks is that it results in a highly integrated project and saves the agency the expense and trouble of managing multiple tasks and contractors. The disadvantage is that it may restrict competitive bidding for the individual areas of the solicitation.

In Maryland's case, the presence of the specialized election services contracts may have prevented firms from competing for the more general tasks, absent a prime contractor with election experience. SBE reports that its own analysis, conducted as required by state procurement regulations, found that many potentially qualified vendors saw the word "election" in the title and decided not to bid because they had no election expertise. Even vendors who understood that election experience was not necessary for many of the tasks in the solicitation might have been intimidated by the competitive presence of Cirdan, a well-established competitor.

Contracts in the ACCURATE database indicate that one or two support functions are part of a contract, but none bundled the number and breadth of functions in the Maryland RFP. Maintenance and support are common features included in voting system procurement (this includes ongoing software licenses, upgrades, and hardware maintenance). In a number of cases, contracts also include election administrator and poll worker training. However, there is little evidence that other voting system procurements include these services in addition to developing and executing voter outreach campaigns, acceptance testing, equipment transportation, voting system disposal, and inventory management. These types of services are typically performed in-house or subject to separate procurement efforts.

RTI is not asserting that SBE could save state taxpayers a specific amount of money by making separate solicitations. Rather, our experts agree that SBE would have more

confidence that it is receiving the most favorable combination of prices and services through more competitive bidding in its solicitations. Having multiple bidders encourages each vendor to provide the best possible price, in order to win business. This best practice is likely to result, over the long term, in cost savings to the state.

### **3.1.1 Conclusions**

Beyond the question of whether the state is receiving the best possible price for the component services is the larger question of whether the scope of the entire contract is appropriate for managing an optical scan deployment in an era of tight state budgets. It may well be that the SBE, working with a small staff, is augmenting its capabilities by contracted positions. Therefore, the contracted staff fills positions that in other states are filled through regular state employment. However, this fails to explain why the switch to an election system with a smaller number of machines has not resulted in at least some cost savings in services. For example, the SBE observes that assistance needed in logic and accuracy (L&A) testing of equipment would be significantly reduced, particularly at the local level. Additional staff may result in a superior election system for the state, but it is not, in the judgment of this report, “maximally cost-effective,” which is the question asked.

Some of the costs involved in managing voting technology deployments are not highly elastic. Transportation costs, for example, may not be greatly reduced simply because fewer machines are deployed. Costs for a driver and fuel for a truck will remain largely the same. In other cases, however, our research suggests that cost savings may be realized. For example, fewer machines should result in savings on logic and accuracy testing expenditures. Local jurisdictions may be equipped to conduct such testing themselves. Project management costs should be reduced as well, as there are fewer machines to keep track of. Overall, our reading of the Maryland services contract, and its peers across the country, suggests to us that SBE’s approach to managing a new optical scan voting system aimed to preserve the funding it had in past elections. Maryland would benefit by identifying areas where savings could be realized by transitioning to optical scan.

## **3.2 Whether the State Board of Elections’ proposed procurement of an optical scan voting system for deployment in the 2010 elections is maximally cost-effective and included only equipment that is clearly necessary for the conduct of elections**

**Summary:** Because a final contract was never negotiated, analysis is difficult, but SBE’s procurement of equipment for an optical scan voting system was apparently reasonable and within the general range of similar equipment purchases by other states. The equipment to be procured appeared to be reasonable investments in protecting the new optical scan equipment and in continuing to provide a superior experience for Maryland voters.

SBE issued its solicitation for optical scan equipment on August 3, 2009. The RFP initially attracted two bids from election equipment companies, one from Premier Election Solutions and the other from Election Systems and Software (ES&S). After the bids were submitted, however, ES&S bought Premier, disqualifying the Premier bid under the terms of the solicitation. While ES&S was the sole bidder, a contract was never executed between the vendor and the SBE; negotiations over contract provisions between SBE and ES&S reached an impasse over questions of liability and intellectual property, and time has now expired on the original proposal. Our discussion is therefore limited to the initially proposed prices and quantities, with the realization that those prices may well have been modified had negotiations been concluded and a contract executed.

The ES&S proposal was valued at \$14.4 million and included the following:

- 2,083 optical scan ballot-counting machines for use in polling places;
- 34 high-speed, central-count optical scan machines;
- Maintenance and software licensing;
- Servers and related equipment for the voting system’s election management system (commonly called GEMS); and,
- A full-time project manager and part-time staff to support training, ballot layout, and other needs.

In addition, ES&S proposed more than [REDACTED] in optional equipment, including voting booths and equipment carts (which is addressed in a later section) and additional services. One item not included in the solicitation and the ES&S proposal, but necessary now, is the acquisition of ballot-marking devices (BMDs) for the disabled. Under Section 9-102 of the Election Law Article, SBE did not include BMDs because at the time of the solicitation, no equipment had been certified to the 2005 Voluntary Voting System Guidelines. Instead, SBE planned to use its current DREs to provide service to voters with disabilities. After the release of the solicitation, however, a BMD for disabled voters was certified to the guidelines, meaning that such a device is now required by law.

The ES&S proposal included 2,083 optical scan units for use in 1,830 precincts; the additional machines would serve as a reserve in the event of machine failure, for deployment at particularly busy polling places, and for training or demonstration purposes. Three “central count” units would be held by SBE and deployed as spares at the county level when needed, and used for testing and development of procedures. Each of the larger counties in the state would have two, and the rest of the counties would have a single high-speed counter. The high-speed counters had an original base cost of [REDACTED], per unit. Subsequently, SBE negotiated terms in which the vendor, as part of its equipment contract, would provide a smaller number of high-speed counters for the largest counties at no additional cost to the state.

The ES&S proposal for the equipment, which was not executed, is in some ways unique to Maryland (see Table 3-1). In other ways it is familiar. One common feature is the “best price” (or “favored county”) that most state or local governments negotiated. This guarantees prices that are in line with most favorable prices that ES&S negotiates elsewhere. Distinct features are also notable. For example, Miami-Dade County, Florida, acting on a recommendation from the county administrator, purchased approximately two scanners per voting location, whereas Maryland estimated need for slightly more than one per location. Cuyahoga County, Ohio, meanwhile, chose to acquire approximately 5 percent more scanners than needed per location to provide for coverage in the event of malfunction, for training, and for demonstration. Most contracts, including Maryland, require the jurisdiction to be listed as “additionally insured” on the ES&S insurance agreements.

Variation is also evident in the warranty and service agreements in the jurisdictions we compared. The length of the service agreements vary most widely. In almost all cases, the contracts permit extension of the initial service warranties. Maryland has a unique contractual provision for meeting the needs of the disabled, while ES&S has agreed to re-sell Nassau County, New York’s older equipment and use the proceeds to pay for new equipment for the county.

**Table 3-1. Matrix of Optical Scanning Contract Provisions in Maryland and Other Jurisdictions**

	Maryland <sup>a</sup>	Nassau County, New York	Miami-Dade County, Florida <sup>b</sup>	Cuyahoga County, Ohio	Connecticut	Arizona <sup>c</sup>
Vendor	ES&S	ES&S	ES&S	ES&S	Diebold	ES&S
Number of polling places	1,824	1,142	519	1,436	769	2,109
Contract period	2010-2013	2010-2012	2008-2012	2008-2012	2007-2026	1 year
Total number of precinct scanners	2,083	1,503	1,600	1,503	1,538	2,109
Percent of total scanners allocated for spares, training, and demonstration	10%	24%	48%	5%	NA	NA
Price per precinct scanner	██████	██████	██████	██████	██████	██████
Number of central scanners	34	15	NA	15	169	NA
Number of ADA-compliant units	NA	650	NA	650	NA	2,109
Warranties/guarantees	4-year service agreement; options could be negotiated for 16 years	NA	One-year warranty on parts and workmanship for normal use. Guarantees software is virus free.	Warranties against malfunctions "under normal use."	Vendor will make programming updates based on recommendations of University of California at Berkley.	First-year support included in pricing.

(continued)

**Table 3-1. Matrix of Optical Scanning Contract Provisions in Maryland and Other Jurisdictions (continued)**

	<b>Maryland<sup>a</sup></b>	<b>Nassau County, New York</b>	<b>Miami-Dade County, Florida<sup>b</sup></b>	<b>Cuyahoga County, Ohio</b>	<b>Connecticut</b>	<b>Arizona<sup>c</sup></b>
Other features	Vendor provides SBE with semiannual report on vendor's activities to make voting more accessible to the disabled; SBE is "additionally insured" in vendor's policy; opt-out option; "most favorable cost" provision with some conditions.	Agrees to re-sell old units for minimum \$500,000 to be applied to purchase of new equipment.	Receives "favored county" pricing, to buy equipment at lowest price offered to other jurisdictions at time of purchase. County is "additionally insured."	Vendor provides "routine maintenance"; vendor provides software updates during term of agreement; receives "favored county" pricing.	Protects state agency if funding is not available to complete purchase; state may opt out of contract at any time.	NA

NA = Not applicable.

<sup>a</sup> This contract offer, made September 9, 2009, as amended, was never fully executed.

<sup>b</sup> Based on draft contract dated October 18, 2007, and from memo from County Manager George M. Burgess to the County Board of Commissioners, dated May 27, 2005.

<sup>c</sup> Contract is for ADA-compliant equipment only.

### 3.2.1 Early Voting and Ballot-on-Demand Printing

Maryland's introduction of in-person early voting at satellite locations in conjunction with the 2010 elections complicates equipment and printing needs. Maryland used its current DREs in its first experience with early voting in September 2010, deploying them at 46 satellite locations statewide for the primary. Election jurisdictions nationwide use DREs for early voting, due to their ability to be programmed with multiple ballot styles to accommodate voters living anywhere within the jurisdiction's boundaries.

The challenge in conducting early voting with optical scan systems is ensuring a sufficient number of ballots. Early voting centers serve voters in their county of residence; however, they must accommodate many combinations of local electoral units within that county. This means that multiple ballot styles in adequate numbers must be available. Unfortunately, the traditional method of "print-and-deliver" to the polling place poses three challenges to election officials running early voting centers. First, it requires each polling place to have sufficient storage space for the blank ballots. Second, it requires the estimates of expected turnout to be relatively accurate to avoid running out of ballots or wasting paper.<sup>4,5</sup> Third, it requires that the poll worker assign the correct ballot style to the voter. A key limitation of optical scan technology is the need to have a sufficient supply of (many) different ballot styles available at each early voting location. Pre-printing enough ballots is enormously wasteful (most end up being unused), and has a significant cost implication. New Mexico's Bernalillo County, for example, estimated that they would need 1.5 million ballots for just 80,000 voters—at a cost of \$1.125 million.

Florida counties—which are required by law to conduct early voting and which were required to transition from DREs to optical scan for the 2008 elections<sup>6</sup>—use Runbeck Election Services for "ballot-on-demand" (BOD) printing. Some small Florida counties pre-print a stock of ballots, at an average cost of \$0.30 to \$0.40 per ballot, and discard unused ballots. However, that approach is especially costly for mid-sized or large counties. A growing number of California counties have also transitioned to BOD and have found "click charges" (the cost to print individual BODs) are especially costly where there are many ballot choices. For example in California the length of Sacramento County's ballot in 2010

---

<sup>4</sup> Hastings, D. (2008, March 31). Why elections run out of ballots. Associated Press. Retrieved from [http://articles.sfgate.com/2008-03-31/news/17169876\\_1\\_ballots-polling-places-election-officials](http://articles.sfgate.com/2008-03-31/news/17169876_1_ballots-polling-places-election-officials)

<sup>5</sup> "Ballot shortages at some polling places." (2008, January 9). The Salem News. Retrieved from <http://www.salemnews.com/election/x1876414705/Ballot-shortages-at-some-polling-places?keyword=topstory>

<sup>6</sup> McCormack, C. (2008, September 2008). *Florida's transition from touch screens to op scan ballots for early voting: A snapshot review in two counties*. Pew Center on the States. Retrieved from <http://www.pewcenteronthestates.org/uploadedFiles/FLtripEVAug08.pdf>. Browning, K. [Florida Secretary of State]. (no date). *Election 2008: An update on voting procedures*. Naples Chamber of Commerce. Retrieved from <http://www.napleschamber.org/business/articles/articlesDetail.aspx?id=2257>

required two ballots per voter, resulting in a negotiated combined “click charge” of \$0.65 per voter to pay for ballot paper, toner, set-up, maintenance, and services.

Large, specialized BOD printers with database back-ends are able to print the correct ballot for each voter, as needed. Prices for this equipment are highly variable and are affected by size and extra features (such as built-in cameras, duplexing, and self-audit capabilities). Generally, quality and speed are similar across models. BOD systems entail costs for purchase, or lease, of printer hardware plus a charge per each ballot printed.

The dominant national vendor in this field is Runbeck Election Services, Inc. Runbeck’s printing machines start at \$16,500 for a small tabletop printer (suitable for low-volume county offices). Printers designed for use in higher-volume locations range from \$20,000 to \$40,000. Table 3-2 summarizes the costs of some notable systems currently in use.

**Table 3-2. Ballot on Demand**

	<b>Florida</b>	<b>Sacramento, CA</b>	<b>Bernalillo, NM</b>
Vendor	Runbeck	Runbeck	AES AutoVOTE
Cost per machine	\$20,000 (small) \$40,000 (large)	\$20,000 to \$40,000	\$8,000
Machines per location	2	5 (at county office only)	5
Total cost per location	\$40,000 to \$80,000	NA	\$40,000
“Click charge” per ballot	45¢	45¢ (65¢ for long ballot)	NA

Conversely, the more expensive, preferred model—used in Miami-Dade County and all of the other mid-sized to large counties in Florida—is a feature-rich printer encased in a customized, wheeled cart that includes post-print audit capability to ensure and document that the correct ballot style/combination was issued. Although print time for the larger versions is no faster than the smaller, less expensive models, this model includes a camera and software to capture and audit ballot production in real-time. Each of Florida’s early voting locations has a minimum of two printers.<sup>7</sup>

ES&S’s principal competitor, Dominion, does not currently provide BOD services but is in the early stages of design and development of a competing BOD product/platform.

<sup>7</sup> Depending on early voting anticipated voter turnout, especially in presidential elections, a third printer is deployed in some heavy-use locations. Clark, D. [Pinellas County Supervisor of Elections]. (no date). *Using “ballot on demand” and the Pitney Bowes Mail system in Pinellas County.*



### 3.2.2 Florida’s Experience Moving to Ballot-on-Demand in 2008

Conny McCormack, former clerk-recorder of Los Angeles County, examined Florida’s 2008 experience in managing the transition away from DREs to optical scan systems for early voting. This was also the nation’s first statewide use of BOD systems.<sup>8</sup> According to McCormack:

*Looking at the transition experience of two large Florida counties, Miami-Dade and Hillsborough (Tampa area), in conjunction with the August 2008 statewide primary election revealed it takes longer to process each early voter using an optical scan system primarily due to the time required to print each voter’s ballot. Printing a one-page ballot required approximately 20-30 seconds compared with 2-3 seconds to prepare the access card for a DRE system. The change in equipment also entailed deploying more staff at the early voting sites. The multiple equipment components (printers and optical scan readers) also require more space than setting up an early vote site with DREs.*

*The key factors impacting longer voter processing time are length of the ballot combined with voter turnout. For the August 2008 primary election, ballot content in each of the two counties fit onto a one-page optical scan ballot, and voter turnout was very low. As a result, early voters were processed efficiently without delay despite the increased processing time needed for each early voter compared to the past. However, for the November 2008 general election, multiple page ballots per voter will be required in both counties. The additional time needed to print up to four optical scan ballots, coupled with the expectation that the volume of early voters will increase sevenfold or more compared with the August primary election, is a cause for concern that voters may encounter long waiting lines as a result of the equipment change.*

The ES&S proposal included one BOD printer per county. Early voting is likely to grow quickly in Maryland, based on the experience of other states that have adopted the practice. Given the probability that early voting will increase in future elections (Dr. Paul Gronke of the Early Voting Information Center estimates that it will reach 20 percent), SBE may want to consider obtaining additional printers to prevent long waiting times at peak periods during early voting.

Maryland law required 46 early voting locations for the 2010 elections. The five largest counties (including the City of Baltimore) each had five early voting locations, Howard County had three locations, and all other counties had one location. Assuming the large counties, and perhaps some of the mid-sized counties, used the \$40,000 printer, while smaller counties used a printer model costing between \$16,500 and \$25,000, estimated costs could be anticipated as noted below:

- **Capital Costs:** If the five largest counties, with 25 (of 46) early voting locations, purchased two feature-rich printers for each early voting location, that would entail 50 printers at \$40,000 each, or \$2.0 million. If Howard County purchased one printer for each of its early voting locations at \$40,000 that would be an additional \$120,000. If the remaining 18 counties each bought one lower priced

<sup>8</sup> McCormack, C. (2008, September 2008). Florida’s transition from touch screens to op scan ballots for early voting: A snapshot review in two counties. Pew Center on the States. Retrieved from <http://www.pewcenteronthestates.org/uploadedFiles/FLtripEVAug08.pdf>

printer at an average cost of \$20,000 each, that would add \$360,000, for a total of \$2.48 million over a 4-year period.

**Consumable Costs:** With approximately 3.5 million registered voters in 2010, if Maryland follows recent trends, voter turnout should be as follows:

- a. Gubernatorial Primary—approximately 30%
- b. Gubernatorial General—approximately 60%
- c. Presidential Primary—has ranged from 25% in 1996 to 42% in 2008
- d. Presidential General—approximately 80%

If 10 percent of voters in each election chose to vote early, with a \$0.45 click charge, the cost would amount to between \$47,000 in a gubernatorial primary to \$126,000 in a presidential general election. As Maryland voters learn of the opportunity to vote early, and assuming Maryland begins to follow national trends, up to 20 percent of voters could be anticipated to cast a ballot during early voting.

### **3.2.3 Conclusions**

The proposed purchase of the optical scan devices and related equipment appears to be in line with what other jurisdictions have paid for identical equipment. In all cases where direct comparisons can be made of ES&S pricing on software and hardware from past contracts, the price quotes in the Maryland response are comparable or better. This suggests that the ES&S response, and presumably any subsequently negotiated and executed contract, is well within the scope and pricing of what other jurisdictions have experienced.

SBE's decisions with regard to the provisions of the procurement appear reasonable, even if, strictly speaking, adequate elections could be conducted with less equipment than is included in the RFP. For example, SBE has proposed the procurement of additional optical scan machines to serve as back-ups, for training, and to allow for a second machine at high-volume polling places. Our review of the experiences of other jurisdictions with optical scan machines found reported failure rates during acceptance testing that suggest a 10 percent reserve is reasonable. While the state could save some minimal amount of money by reducing the reserve of counters, the 10 percent reserve provides insurance against Election Day equipment failures, allows for training and voter outreach while other machines are in use, and appears to be a good management practice.

The single qualifying bid was less of a concern in this procurement than in the services solicitation. The number of election equipment manufacturers is small and dwindling, and the provision of election equipment is a highly specialized service; the number of vendors of high-speed ballot counters, for example, is not nearly as high as the number of potential vendors of transportation services, or public outreach campaigns. At the same time, there may be individual equipment requirements that can be broken out for separate solicitations to increase competition and potentially save money.

Any significant cuts in the budget to buy equipment could result in either a degraded experience for Maryland voters or an increase in the risk of a serious problem on Election Day or early voting. Some marginal savings might be possible by breaking out component parts of the solicitation into separate procurements, in hopes of generating more competition.

### **3.3 The necessity of the State Board’s proposed procurement of voting booths and supply carts to implement an optical scan voting system for the 2010 elections**

**Summary:** The purchase of voting booths and supply carts is an investment in the quality of the voting experience and the care and maintenance of new optical scan machines. Our research suggests that the SBE will ultimately pay significantly less than the proposed amount for both pieces of equipment, either through negotiation with the winning bidder or from better and more competitive procurement practices.

#### **3.3.1 Supply Carts**

The procurement of supply carts is an expensive part of the SBE’s planned implementation of optical scan voting. SBE had intended to solicit these products separately. To put this in perspective, the ES&S VSS RFP response<sup>9</sup> includes 2,083 of the AutoKART product from Casto and Harris, Inc. The AutoKART holds the DS200 optical scanner and AutoMARK ballot-marking device, as well as voting booths, in one unit.<sup>10</sup> The price to Maryland—[REDACTED] for 2,083 carts [REDACTED] each)—is high compared with similar quotes in the ACCURATE data for carts for housing DRE machines. We called the manufacturer, Casto and Harris, and asked for a price quote for this product. Casto and Harris initially provided an “at cost” figure, with the representative quoting a price of \$895 each. The representative specified that the retail price is \$1,325. The representative further added that the price drops to \$1,125 for quantities between 500 and 1,000.

The purchase of carts is usual for both optical scan and DRE procurements. When converting to an optical scan system in 2006, for example, Cook County, Illinois, purchased custom-designed carts to transport all equipment and supplies together to each voting location.<sup>11</sup> An examination of the contracts in the ACCURATE sample for optical scan voting system purchases did not turn up evidence of the purchase of carts or dollies. In the ACCURATE data, all of the contracts that include carts are for DRE systems, in which a precinct would have multiple DREs.<sup>12</sup> In these cases, a cart must hold a number of DREs as

<sup>9</sup> See page 38 of the ES&S financial proposal-OCR.pdf.

<sup>10</sup> For a description of the AutoKART and images, see <http://mobileprecinct.com/>.

<sup>11</sup> The self-contained, lockable carts purchased by Cook County in 2006 cost significantly more than the new carts contemplated by SBE’s proposed purchase, based on conversations with Cook County Clerk David Orr.

<sup>12</sup> Here is a non-comprehensive list of DRE cart data from our data set: “Warehouse Storage Carts for AccuVote TS Tabulators” provided for \$250 ea. (p. 168 of AZ\_state\_diebold\_2003.pdf); \$392 ea. for

one unit and be designed specifically for the DRE model in question in terms of physical case dimensions and handling requirements. As with the DREs, the purchase of dedicated, customized carts to protect the new optical scan counters is an investment in the long-term reliability of the new machines. These machines are at their most vulnerable during transportation and storage.

### 3.3.2 Voting Booths

The SBE decided to seek prices for high-quality, standalone voting booths, which voters would use to fill out optical scan ballots. The ES&S proposal placed the total cost of 20,000 booths at [REDACTED], or about [REDACTED] per 9-C Easy Vote booth.<sup>13</sup> The SBE had estimated that it could acquire booths at about \$200 per unit.<sup>14</sup> That estimate, if realized, would have resulted in Maryland paying about [REDACTED] per unit less than Nassau County, New York, was offered for stand-up booths after it transitioned to optical scan.<sup>15</sup>



The Easy Vote unit that ES&S initially proposed (pictured above right) is an all-steel product weighing about 42 pounds. Other vendors sell lighter-weight booths with aluminum legs and plastic writing surface and privacy screens at lower base prices (pictured left). SBE received a proposal for booths from Premier for [REDACTED], or [REDACTED] per unit, suggesting Premier had offered the lighter weight models. Our examination identified examples of ES&S (or a reseller that sells ES&S products) bundling voting booths with the purchase of the M100 optical scanner. The two instances where the ACCURATE data set identified per-unit prices are for \$100 each in 2004 and about \$215 to \$245 from 2006 for the same model booth (in the second case the unit that is accessible to the disabled is more expensive).<sup>16</sup>

---

AV-TSX DREs (p. 14 of AZ\_state\_diebold\_2ndresponse\_2005.pdf); \$386 ea. for AV-TSX DRE carts (p. 7 of FL\_citrus\_2005.pdf); \$0 ea. (included in price) for Hart DREs, this price is included likely because this style of DRE is "daisy-chained" together (p. 94 of CA\_orange\_2003-2.pdf); \$400 ea. for AVC Edge carts (p. 21 of CA\_santaclarita\_2003-2.pdf); \$500 ea. for AVC Edge II carts (p. 22 of CA\_santacruz\_2006.pdf); \$350 ea. for AV-TSX carts (p. 5 of CO\_elpaso\_2006.pdf); \$400 for AVC Edge carts (p. 29 of FL\_palmbeach\_2001.pdf); \$975 ea. for "precinct carts" for AVS WinVote DREs (p. 13 of VA\_fairfax\_city\_2003.pdf).

<sup>13</sup> Financial Proposal, Volume II, Maryland Statewide Optical Scan Voting System, September 9, 2009, by Election Systems & Software, Inc., Omaha, Nebraska (p. 27).

<sup>14</sup> Email from Ross Goldstein, Deputy Administrator of Elections, to Rebecca Wilson (Save Our Votes) dated February 1, 2010. Subject: "Copy of Presentation."

<sup>15</sup> DS-200/Auto-Mark Purchase Proposal, to Nassau County, New York from Election Systems & Software, Inc., Omaha, Nebraska. Undated offer, expires January 4, 2010.

<sup>16</sup> The contract from Solano County, California, (2004) with ES&S purchased 850 Model VI Gemini Booths (used) for \$85,000 (\$100 each) and 250 ADA-compliant of the same model for \$25,000 (also \$100 ea.) for the ES&S M100 (p. 14 of CA\_solano\_2004.pdf); The Luzerne County, Pennsylvania, contract from 2006 quotes \$215/\$245 for normal/accessible voting booths (Model VI) with a light for an ES&S system through a reseller (p. 41 of PA\_luzerne\_2006.pdf).

Voting booth prices vary with specific features; some models include lighting, curtains, higher quality materials, or larger writing tables. Vendors who sell voting booths, such as Election Source or Printelect, list voting booths at prices beginning at \$125 for aluminum and plastic products. Miami-Dade County, Florida, received bids ranging between \$110 and \$167 for lighted booths. With large-quantity purchases, new voting booths can cost as little as \$50 to \$80 each. Vendors list the lighter-weight used products beginning at \$69 per unit, with lighting.



There are feasible alternatives to standing voting booths. “Privacy screens” (pictured at right) are made of corrugated plastic or cardboard and are designed to be placed on a table to create a voting carrel. They are lightweight and can be folded for easy transportation and storage. The reusable privacy screens retail from \$7 for the cardboard version to \$19.50 for the plastic variety.

The prospect of using privacy screens was not greeted favorably by local election officials in Maryland. An SBE survey of local election officials found that administrators view the privacy screens as neither comparable products nor a preferred alternative to voting booths.<sup>17</sup> Local election officials cited several objections to widespread reliance on privacy screens. First, the screens need to be set on tables, which are often unavailable at many of Maryland’s voting locations. Second, to facilitate this option, state or local governments would need to arrange for rental, transport, and setup of tables and chairs. Third, administrators stated that many voting locations have insufficient floor space to accommodate the number of tables and chairs that would be needed. Fourth, many local administrators contend that these screens do not provide adequate privacy. Fifth, some stated that privacy screens lack lighting, whereas voting booths are able to provide lights. Finally, privacy screens, though initially less expensive, are not durable and must be replaced frequently. In addition to the concerns of Maryland election officials, some voting experts with whom we talked indicated that voters take more time to complete their turns when they sit rather than stand. This could result in longer waiting at polling places.

### **3.3.3 Retrofitting DREs as Voting Booths**

It has been suggested that SBE, as a cost-saving measure, consider retrofitting the state’s current DRE booths to serve as voting booths. This would be accomplished by removing the voting screen and internal components and installing a writing surface. Carteret County, North Carolina, is one jurisdiction that is said to have converted its touch screen DREs into voting booths. The situation in Carteret County is significantly different from Maryland. The UniLect Corp. Patriot model used in Carteret County was not embedded in a stand-alone booth. Rather these very portable devices sat inserted into a slightly

<sup>17</sup> Having a small inventory of privacy screens available to LBEs is an option to consider for potential use as extra voting booths for elections with the highest voter turnout.

modified voting booth. When Carteret County experienced miscounts attributed to the Patriot, it discarded the touch screen, and a volunteer with the Board of Election fashioned fiberboard writing surfaces to insert into 35 units. These were all discarded prior to the 2006 election, due to dissatisfaction with the modified units as voting booths.

Such a conversion for Maryland would be further complicated due to the DRE model that Maryland uses, the Diebold R-6. In the R-6, the touch screen is embedded in the booth. Los Angeles County used these devices for early voting in elections from 2000 to 2004, before converting to the lighter weight, more portable TSX models after 2004. The re-designed TSX model could be retrofitted as a tabletop voting booth for paper ballots because its touch screen may be separated from the shell. The San Diego County (California) Registrar of Voters has experience with both the R-6 and TSX Diebold DRE models. She concurred that the R-6 model could not be easily retrofitted as a voting booth.

### **3.3.4 Conclusions**

RTI recommends that the SBE proceed with the purchase of both the supply carts (as investments in the long-term maintenance of new optical scan equipment) and the voting booths (as investments in the quality of service to the Maryland voter). We are confident that SBE can obtain better prices on both pieces of equipment than is contained in the ES&S proposal, which was never negotiated to a final contract. SBE had intended to solicit carts and voting booths separately in hopes of attracting more competition through multiple bids. Doing so will assure SBE that it is receiving the most favorable market price for each item.

While not strictly necessary, the purchase of supply carts is a reasonable investment in the care and maintenance of new equipment. The new optical scan machines are vulnerable to damage while being transported and stored, and in most election jurisdictions across the country, concern over damage to expensive equipment results in acquiring customized carts. Even with optical scan units on wheels,<sup>18</sup> jurisdictions typically purchase delivery carts, primarily to package the optical scan unit, voting booths, ballot box, and other precinct supplies together.

Our recommendation on the voting booths is based on the following points:

1. Standing voting booths costing approximately \$125 per unit are available in the marketplace, and would satisfy Maryland's need for voting privacy.
2. Other jurisdictions that have tried to repurpose DREs into voting booths have had unsatisfactory results.
3. Standalone voting booths can contribute to better organized and more smoothly operating polling places, reducing waiting times.

---

<sup>18</sup> In Los Angeles County, California, in 2006 new optical scan precinct units came equipped with wheels for easy setup within the polling places. However, customized carts were ordered to transport the units and supplies to the regional transportation centers for distribution to polling places.

4. The price stated in the ES&S proposal is not the price that SBE is likely to pay in a final agreement.

Maryland may save money by proper handling of the procurement of booths and carts. The state may consider—in the future, after optical scan machines have been successfully implemented—issuing a master agreement for the state. Under such an arrangement the state would negotiate for a menu of equipment purchases. In this arrangement, local boards of elections (LBEs) would be at liberty to purchase the type and quantity of voting booth each desires, while benefitting from the price negotiated by the state. As local units are required to pay half the costs, such an arrangement would provide local jurisdictions with greater discretion over their expenditures, within the limits of those supplies and services approved by the SBE.

### **3.4 Quantitative Analysis of Voting Technology Costs**

Questions 4 through 7 pertain to the historical, current, and projected costs of voting using DRE versus optical scan voting systems.<sup>19</sup> The General Assembly posed four questions, the responses for which emerge from a single time-series analysis of historical, future, and projected costs of voting using DRE versus optical scanning technologies:

- The amount, if any, by which voting system operations and maintenance costs would be reduced if an optical scan voting system were implemented (Question 4);
- Current and projected operations and maintenance costs for the state’s current voting system (Question 5);
- The projected life span of the state’s current voting system (Question 6); and
- A comparison of the overall cost of continuing to use the state’s current voting system as opposed to implementing an optical scan voting system (Question 7).

Our summary responses to these questions are presented in Sections 3.5 through 3.8 below. The purpose of this intermediate discussion is to step through our approach, data sources, and assumptions sequentially to best facilitate assimilation of the quantitative analysis results and our responses to the Assembly’s questions.

#### **3.4.1 Conceptual Approach**

Our approach was to estimate the cost of carrying out an election under each voting system technology alternative for FY2006 through FY2020. We first created a baseline under which use of a DRE system continues. We then estimated, based on the ES&S and Cirdan technical and financial proposals submitted in response to the Voting System and Support Services RFPs, the cost of procuring and implementing an optical scan system. To compare costs before the introduction of early voting and other changes, actual costs for the DRE system were compared to typical operating and maintenance costs under an optical scan

---

<sup>19</sup> RTI defines current costs as FY2010 and future costs as FY2011 through FY2020.

system modeled as though optical scanning were in operation between FY2006 and FY2010. The future cost forecast reviews FY2013-FY2020.

The cost estimates detailed in this report reflect only those costs that are affected by voting system technology. Thus, the model does not estimate the total costs of an election. Instead it informs the General Assembly of the total costs of procuring and implementing an optical scan system and the relative cost effectiveness of a DRE versus an optical scan system. Future estimates were developed using SBE's best available projections of future needs to meet Maryland's voting technology needs. SBE's voting services contracts are time and materials contracts. As such, should this assessment be performed retrospectively at a future date, actual costs may differ significantly from the costs presented herein.

The data used to inform the quantitative analysis was almost entirely provided by SBE. Data sources included comprehensive system and equipment requirements, RFPs, executed voting services contracts, and vendors' responses to proposals, including the suspended optical scan voting system procurement for which negotiations were not concluded and for which a contract was not executed.<sup>20</sup> At the recommendation of the expert panel, RTI supplemented or replaced SBE's information with revised timeline estimates for any implementation of a new voting system technology, lower voting booth costs, and other jurisdictions' experience with maintaining and extending the useful life of DRE units.

The analysis included the following:

- Reviewing historical and projected SBE expenditures and budgets for costs dependent only upon voting system technology selection.
- Using election, voter registration, and contract data from FY2006 through FY2010 to compare estimates of operations and maintenance (O&M) costs of voting using each system. A comparison using historical information ("backcasting") was necessary as Maryland has yet to vote using optical scanning systems. The model allows for the comparison of DRE operating costs and what optical scan costs would have been.
- Using vendor contracts for voting systems and support services to project the current and future O&M costs of voting using both systems for FY2011 to FY2020. The state's current DRE units will reach the end of the manufacturer's estimated useful life in FY2012 (Phase 1: 5,095 units), FY2014 (Phase 2: 10,952 units), and FY2015 (Phase 3: 2,763 units). With comprehensive maintenance, SBE may be able to extend the useful life beyond that specified by manufacturer; however, such maintenance was suspended after the 2008 elections as a result of the passage of the law requiring a transition to optical scan voting technology. RTI included the possibility of extending the useful life.
- Incorporating current and future capital lease payments and one-time equipment expenditures for procured DRE units (sunk costs) as well as optical scan

---

<sup>20</sup> In the case of the optical scan voting technology procurement, the procurement was not completed, and SBE suspended negotiations after the necessary funds were withdrawn from the state budget.



equipment and other one-time expenses (as a one-time cash outlay and amortized over time as a major IT expense).

### **3.4.2 Analysis Methodology**

The model framework incorporates the “work-flow” of each phase of an election and calculates costs based on technology and work-flow activity (e.g., logic and accuracy testing, transportation and warehousing, replacing supplies for voting machines). Costs were categorized as (1) labor, (2) capital, or (3) materials. Using the data sources provided by SBE, RTI forecasted O&M costs (FY2011–FY2020) for voting using the DRE system and backcasted (FY2006–FY2010) and forecasted (FY2011–FY2020) O&M costs for an optical scan system. Actual and projected capital costs were added to assess total costs.

The model pairs a technical metric (e.g., “number of DRE units required” and “number of ballots required”) and an economic metric (e.g., “cost per DRE unit” and “cost per ballot”) to each activity. These metric pairs are used to quantify and monetize costs. In addition, the model differentiated between those cost that are “one-time” and those that are “recurring.” This differentiation takes into account the projected life span of each voting system (i.e., capital procurement costs will be annualized over the projected life span) and is based on the best information available. Where we were unable to satisfactorily generate pairs of metrics, our forecasted DRE O&M cost reflected the average of the historical booked costs (FY2006–FY2010), as provided by SBE.

Relevant cost categories were first identified through examination of the elections literature and review of SBE cost data sources to identify costs that vary by voting technology. After settling on a preliminary set of cost variables to be modeled, the RTI advisory panel reviewed and commented on the cost variables. After comments and recommendations were received from the advisory panel, a final set of cost variables was established.

- To generate the technical and economic metrics for the DRE system, we used the summary cost information from SBE’s original DRE contract (SBE 2002-01), SBE’s 2010–2016 cost analysis, and various data sources, as provided by SBE. Once the technical and economic metrics were generated, we were able to forecast future O&M costs using DREs.
- Estimating the extent to which an optical scan voting system would lower O&M costs, if at all, required two assessments. First, one must review a comparable time period with common constraints (e.g., number of polling stations and number of registered voters). We chose the FY2006–FY2010 period for comparison because all Maryland LBEs used DRE units in these years. We assumed that the optical scan system was operational in FY2006 and that this year would reflect the first year of the base contract period, as described in both the ES&S and Cirdan financial proposals.<sup>21</sup> Second, one must forecast current and

---

<sup>21</sup> This step required that a time value of money adjustment be made to reflect the value of 2010 dollars in terms of 2006 dollars. The adjustment was made using the real gross domestic product deflator from the US Department of Commerce’s Bureau of Economic Analysis.

future O&M costs to offer a projection of how an optical scan system may compare with the current DRE voting system.

All cost variables, assumptions, and data sources were presented to SBE to ensure that they were reasonable and that our understanding and presentation accurately reflected SBE data sources.

**Table 3-3. Voter Turnout by Jurisdiction and Election Year**

County	2006					2008					2010 <sup>a</sup>				
	Precincts	Polling Stations	Registered Voters	Primary Votes Cast <sup>b</sup>	General Votes Cast <sup>b</sup>	Precincts	Polling Stations	Registered Voters	Primary Votes Cast <sup>b</sup>	General Votes Cast <sup>b</sup>	Precincts <sup>c</sup>	Polling Stations <sup>c</sup>	Registered Voters	Primary Votes Cast <sup>c</sup>	General Votes Cast <sup>c</sup>
ALLEGANY	35	35	41,499	11,045	20,161	36	36	42,170	17,854	30,090	36	36	42,452	11,299	20,624
ANNE ARUNDEL	185	167	309,069	83,990	169,662	189	170	329,437	104,980	261,671	194	175	330,737	89,878	181,557
BALTIMORE	215	189	458,161	125,901	254,000	219	192	502,327	162,086	384,706	223	196	493,152	135,516	273,399
CALVERT	23	23	50,360	10,869	27,250	23	23	55,553	16,114	44,414	24	24	56,296	12,150	30,462
CAROLINE	8	8	16,192	3,970	8,263	8	8	17,597	5,723	13,359	8	8	18,039	4,423	9,206
CARROLL	45	33	99,316	26,553	56,768	46	34	105,450	30,037	85,317	47	35	105,181	28,121	60,120
CECIL	19	17	52,499	9,845	26,316	19	17	62,643	14,482	42,789	20	18	59,835	11,221	29,993
CHARLES	35	35	77,389	16,467	37,688	36	36	87,735	29,424	70,686	39	39	90,012	19,153	43,835
DORCHESTER	30	20	18,329	5,593	9,827	31	20	19,352	7,207	15,439	32	21	19,783	6,037	10,607
FREDERICK	65	60	126,473	30,560	66,825	66	61	134,263	44,389	112,063	69	64	137,751	33,285	72,784
GARRETT	19	19	17,790	6,281	9,040	19	19	18,104	5,192	13,012	19	19	18,436	6,509	9,368
HARFORD	71	64	136,554	37,152	81,471	72	65	149,653	48,290	124,249	74	67	149,097	40,565	88,954
HOWARD	108	82	165,019	38,951	93,713	110	83	175,112	61,949	146,304	114	86	178,164	42,054	101,178
KENT	10	9	11,961	4,737	6,978	10	9	12,767	4,872	10,159	10	9	12,484	4,944	7,283
MONTGOMERY	240	240	507,924	120,944	268,753	245	244	557,670	194,814	443,652	261	261	573,758	136,620	303,587
PRINCE GEORGES	218	209	440,061	114,763	191,089	223	213	497,420	174,152	380,925	244	233	517,900	135,063	224,889
QUEEN ANNES	17	17	28,173	8,512	16,042	17	17	29,334	10,466	24,287	17	17	29,718	8,979	16,922
ST. MARYS	30	29	54,755	12,870	26,172	31	29	57,743	18,533	44,794	32	30	59,229	13,922	28,310
SOMERSET	22	13	12,451	2,992	6,129	22	13	13,070	4,584	10,125	23	13	13,273	3,190	6,534
TALBOT	12	12	25,563	7,495	13,459	12	12	24,689	9,719	20,473	12	12	25,308	7,420	13,325
WASHINGTON	49	48	79,776	18,645	37,779	50	49	85,178	24,377	62,245	50	49	83,282	19,464	39,439
WICOMICO	37	29	49,671	12,615	25,444	38	30	52,885	19,056	42,384	40	31	54,289	13,788	27,810
WORCESTER	18	18	33,903	8,854	17,632	18	18	34,351	12,186	27,635	19	19	35,507	9,273	18,466
BALTIMORE CITY	284	216	331,958	83,054	138,247	290	220	368,142	107,997	251,127	300	228	365,767	91,513	152,327
Total	1,793	1,591	3,144,846	802,658	1,608,708	1,830	1,618	3,432,645	1,128,483	2,661,905	1,907	1,691	3,469,450	884,385	1,770,979

<sup>a</sup> 2010 voter turnout (both primary and general election votes cast) is modeled after the 2006 election.

<sup>b</sup> Votes cast at physical polling stations, excludes absentee and provisional votes.

<sup>c</sup> Estimated based on registered voters as of October 31, 2010 ([http://www.elections.state.md.us/pdf/vrar/2010\\_10.pdf](http://www.elections.state.md.us/pdf/vrar/2010_10.pdf)).

### **3.4.3 Cost Variables, Data Sources, and Assumptions**

Below are the cost variables modeled under each voting system and a short description of their assumptions.<sup>22</sup>

#### **DRE Cost Variables:**

**Supplies**—FY2011–FY2020 supplies metrics are based on supplies purchased for DREs in FY2011. FY2011 supplies cost data are provided by SBE.

**Training**—FY2011–FY2020 training metrics are based on the average of the historical training expense as provided by SBE for FY2007–FY2011.

**Technical Support**—FY2011–FY2020 technical support metrics are based on patterns of the historical technical support expense as provided by SBE for FY2006–FY2011.

**DRE Software License**—FY2012–FY2020 software license metrics are based on cost estimates provided by SBE for FY2011.

**Acceptance Testing**—Acceptance testing metrics for FY2013, FY2015, and FY2017 are based on FY2006 acceptance testing expenses as provided by SBE. Acceptance testing is assumed to occur only when new voting systems equipment is purchased.

**L&A Testing**—Logic and accuracy (L&A) testing metrics are based on SBE’s reported figure for FY2011 and the contract. Additionally, it is assumed that L&A costs will be split into different fiscal years for presidential elections, reflecting the fact that presidential primaries are held in February.

**Transportation and Warehousing**—FY2011–FY2020 transportation metrics are based on an average of the historical transportation expense as provided by SBE for FY2007–FY2010. FY2010–FY2010 warehousing metrics are based on an average of the historical warehousing expense as provided by SBE for FY2006–FY2009.

**DRE Maintenance**—FY2011–FY2020 DRE maintenance metrics are based on warranty information as provided by SBE for FY2011.

**DRE Ballot preparation**—DRE ballot preparation metrics are based on the historical DRE ballot preparation expenses as provided by SBE for FY2006–FY2011.

**Voter Outreach**—FY2011–FY2020 voter outreach campaigns dedicated solely to informing the public on the use of DREs were assumed to be zero. After nearly 10 years of

---

<sup>22</sup> In many cases for the DRE voting system, the projected future operations and maintenance cost was based on the historical cost experience and represents an average of that cost history. The O&M costs for an optical-scan voting system are as bid from the ES&S and Cirdan technical and financial proposals. The O&M costs for DREs are comparable to historical costs, using summary data of SBE’s Premier contract as a source for line item expenses. Additionally, RTI has relied on SBE’s FY2010–FY2016 cost projections and other FY2010 cost data as the remaining sources for line item expenses.

implementation, it stands to reason that the general public is well-informed on the use of DREs.

DRE Rental—SBE rented additional DRE units for the 2008 presidential election. SBE rented additional units in 2010 for non-voting purposes at no additional cost. This is treated as a one-time cost and is not modeled in any additional elections.

**Optical Scan Cost Variables:**

General Ballots—FY2006–FY2020 general ballots metrics are based on the assumption that ballots are pre-printed for 100 percent of total registered voters at a cost of \$0.35 per ballot. The Baltimore City municipal election is included in FY2008, FY2012, and FY2016. FY2012–FY2020 estimates were adjusted by the annual growth rate of Maryland’s population from 2000–2009 to approximate the expected increase in registered voters. With the inception of early voting, some registered voters will not require general ballots. Printing a number of ballots equivalent to the number of registered voters implicitly affords a buffer that would account for ballot spoilage.

Primary Ballots—FY2006–FY2020 primary ballot metrics are based on the same assumptions as the general ballots.

Early Voting Ballots—FY2010–FY2020 early voting ballot metrics are based on Runbeck’s “click charge” of \$0.45 per ballot cast.

Supplies—FY2006–FY2020 supply metrics are based on the line item supplies cost listed in the ES&S financial proposal. These consumables include such items as toner, pens, thumb drives, and ballot boxes. The category for supplies does not include booths and carts, which are capital equipment.

Training—FY2006–FY2020 training metrics were based on historical DRE experience as a conservative estimate because the Cirdan proposal has a line-item for training that includes all training activities, including those that would occur irrespective of voting technology choice.

Technical Support—FY2006–FY2020 technical support metrics are based on the line-item technical support costs in the Cirdan financial proposal and Cirdan’s FY2012 cost estimate spreadsheet as provided by SBE.

Software License—FY2006–FY2020 software license metrics are based on the FY2010–FY2011 cost estimate as provided by SBE.

Acceptance Testing—It is assumed that ballot-marking devices (BMDs) will be tested concurrently with optical scan units. It is also, assumed that no additional equipment will be procured over FY2011–FY2020 requiring acceptance testing. It is likely that LBEs would take over acceptance testing in the course of their duties.

Transportation and Warehousing—FY2006–FY2020 transportation and warehousing metrics are based on the line-item transportation cost listed in the Cirdan financial proposal.

Maintenance—FY2006–FY2020 maintenance metrics are based on the optical scan warranty information as provided by SBE for FY2011 and Georgia, which has continuing maintenance agreements. This warranty information reflects SBE’s cost of maintaining those optical scan units used for absentee and provisional voting.

Optical Scan Ballot Preparation—FY2006–FY2020 optical scan ballot preparation metrics are based on the ballot preparation line-item cost listed in the ES&S financial proposal.

Voter Outreach—FY2006 voter outreach metrics are based on those line-item voter outreach costs listed in the Cirdan financial proposal that could be identified as being dedicated to outreach efforts solely dedicated to informing the public on the new optical scan voting equipment.

EMS Training—FY2006 EMS training metrics are based on the line-item EMS training cost listed in the ES&S financial proposal.

#### **3.4.4 DRE Voting System Costs**

The procurement of the current DRE voting system occurred in three phases. Phase I began with the rollout of almost 5,100 units in four counties during the 2002 election cycle. After successful implementation of Phase I, Maryland implemented Phase II of the DRE rollout with another 11,000 units for the 2004 presidential election cycle. Phase III added nearly 2,800 additional units in 2006, bringing the stock of units to a total of 18,810 (Table 3-4).

The total cost, inclusive of administrative fees, amounted to \$62.7 million. Maryland’s remaining lease payment obligation for FY2011–FY2014 is \$15.9 million. These payments must be made irrespective of any change in voting system technology.

According to Diebold’s AccuVote-TS R6 Hardware Guide, the expected lifespan of an individual DRE unit is 10 years. Existing units will reach the end of their useful lives in FY2012 (Phase I), FY2014 (Phase II), and FY2015 (Phase III). Because current units will reach the end of this lifespan during the period of analysis, it was necessary to estimate future DRE equipment needs. One scenario is to replenish each phase. Table 3-5 presents the capital costs of replacing the DRE units at an estimated cost of \$2,800 per unit. For the purposes of comparison only, if the baseline scenario under which voting with DRE units were to continue, it is reasonable for the state to replace units as they reach the end of their useful lives. It is also the option that would best maintain the service and quality levels

expected by the voters. The expected costs would be \$14.2 million for Phase I, \$30.7 million for Phase II, and \$7.7 million for Phase III, for a total cost of \$52.7 million.<sup>23</sup>

**Table 3-4. DRE Capital Costs, FY2003–FY2014**

	<b>Phase I</b>	<b>Phase II</b>	<b>Phase III</b>	<b>All Phases</b>
Units	5,095	10,952	2,763	18,810
Total of Lease Payments	\$14,223,905	\$40,218,875	\$8,249,724	\$62,692,504
Entered Service	FY2003	FY2005	FY2006	
Exit Service <sup>a</sup>	FY2012	FY2014	FY2015	
FY2003	\$2,043,543			\$2,043,543
FY2004	\$4,873,881			\$4,873,881
FY2005	\$4,871,577	\$4,514,600		\$9,386,176
FY2006	\$2,434,904	\$4,514,112		\$6,949,017
FY2007		\$4,512,603	\$1,109,345	\$5,621,949
FY2008		\$4,511,015	\$1,786,275	\$6,297,291
FY2009		\$4,509,343	\$1,785,512	\$6,294,855
FY2010		\$3,542,960	\$1,784,713	\$5,327,673
FY2011		\$3,541,591	\$1,783,879	\$5,325,469
FY2012		\$3,540,149		\$3,540,149
FY2013		\$3,538,632		\$3,538,632
FY2014		\$3,493,869		\$3,493,869

<sup>a</sup> Although Phase I units are projected to reach the end of their manufacturer's estimated 10-year useful life in FY2012, it is the opinion of the advisory panel that these units' useful life can be extended securely through the completion of the 2012 Presidential election.

<sup>23</sup> We have chosen to amortize the replacement DREs over 10 years to be consistent with the amortization schedule of the optical-scan and BMD units.

**Table 3-5. Projected DRE Replacement Costs, FY2013-FY2020**

	Units	Estimated Cost (\$ thousands)	Estimated Annual Lease Payments (through 2020) (\$ thousands)							
			FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
Phase I <sup>a</sup>	5,095	\$14,266	\$1,588	\$1,588	\$1,588	\$1,588	\$1,588	\$1,588	\$1,588	\$1,588
Phase II <sup>a</sup>	10,952	\$30,665	—	—	\$3,414	\$3,414	\$3,414	\$3,414	\$3,414	\$3,414
Phase III <sup>a</sup>	2,763	\$7,736	—	—	—	—	\$861	\$861	\$861	\$861
Total	18,810	\$52,667	\$1,588	\$1,588	\$5,002	\$5,002	\$5,863	\$5,863	\$5,863	\$5,863

<sup>a</sup> Amortized at 2 percent over 10 years; all dollar values are in 2010 terms.



A second scenario is to enter into negotiated maintenance agreements for the current stock of units and replace or rent replacement units as necessary following unit failure. The advisory panel has suggested that this alternative is possible because of the large surplus supply of DRE units that are currently on the market for rental and purchase. This scenario may also be more compatible with the view that that useful life can be extended beyond 10 years.

Little information is known about the failure rate of DRE units aged 10 years or more, the annual negotiated warranty costs for such units, and whether rental or purchase of both replacement and additional units would be possible or practicable. A rough approximation is possible using assumptions about failure rates and rental equipment. Current failure rates for *units within their useful life* are estimated by the advisory panel to be about 1.5 percent per year, and the annual warranty agreement is estimated to be \$150 per year for comparably aged units that have been consistently maintained under a master service agreement (see Section 3.7).

However, SBE ceased its maintenance agreements in 2008 in favor of a time and materials agreement. SBE delayed implementing post-election maintenance following the 2008 election in anticipation of switching to a new system. However, the maintenance plan was performed prior to the 2010 election on a fraction of the units requiring repair. Further, not all units that the LBEs identified as needing repairs were repaired this fiscal year. If the LBEs determined they did not need those units for the 2010 Gubernatorial Election they were permitted to hold off on repairing the units. Those units will need to be prepared in 2011 for the 2012 election if the touchscreen system is used. SBE has a time and materials repair agreement with ES&S. The agreement specifies that repairs will be made at a cost of [REDACTED] per hour plus parts.<sup>24</sup>

SBE would have to negotiate resumption to a broad agreement with the vendor, and that agreement would be subject to annual renegotiations. SBE rented additional DRE units for about \$270 per unit (including transportation) in 2008.

Table 3-6 presents this alternative wherein SBE enters into an extensive maintenance agreement for all units at an assumed cost of \$200 per unit per year. SBE would rent additional units as needed (assuming a 5 percent failure rate per election, for example) to replenish the stock (\$270 per unit, per election rental rate). This alternative is inherently risky and is not recommended. The scenario would lower DRE replenishment from \$52.7 million (fixed capital expense) to \$32.6 million (variable O&M expense). Because of the paucity of information about the reliability of the machines beyond their anticipated lifespan and expected need for repairs, this cost estimate is not reliable and is therefore not fully credible. Furthermore, it is not a preferable scenario, because the manufacturer

---

<sup>24</sup> In addition to maintenance, approximately 9,000 units will need a replacement battery. The batteries are approximately \$20 each for a total cost of \$180,000.

estimates the useful life to be 10 years and, given the critical importance of the voting system, it presents a significant amount of risk over the medium to long term. The advisory panel does not recommend extending the life of Phase I units beyond the 2012 Presidential election.

**Table 3-6. Long-Term DRE Maintenance Alternative to Replenishment (Not Recommended) (thousands, \$2010), FY2013-FY2020**

	<b>FY2013</b>	<b>FY2014</b>	<b>FY2015</b>	<b>FY2016</b>	<b>FY2017</b>	<b>FY2018</b>	<b>FY2019</b>	<b>FY2020</b>	<b>FY2011- FY2020 Total</b>
Maintenance agreement at \$200 per unit, per year for 18,810 units	\$3,762	\$3,762	\$3,762	\$3,762	\$3,762	\$3,762	\$3,762	\$3,762	\$30,096
Rental expense, assuming 5 percent failure rate per election, for example	\$254	—	\$508	\$508	\$254	—	\$508	\$508	\$2,541
<b>Total</b>	<b>\$4,016</b>	<b>\$3,762</b>	<b>\$4,270</b>	<b>\$4,270</b>	<b>\$4,016</b>	<b>\$3,762</b>	<b>\$4,270</b>	<b>\$4,270</b>	<b>\$32,637</b>

The O&M costs for the DRE system vary according to fiscal year and which elections fall within those fiscal years. Table 3-7 illustrates the historical cost Maryland has experienced operating its DRE voting system technology since its phased rollout began in 2002.<sup>25</sup> Those DRE FY2006–FY2010 costs that were identified as being affected by technology are the basis for our optical scan cost comparison. The data in this table were provided by SBE as being the historical costs associated solely with the DRE system.<sup>26</sup>

Table 3-8 provides a projection of O&M costs out to FY2020 and serves as the DRE projected cost to continue operating the DRE technology going forward. These costs include those for early voting. The data in this table present SBE and RTI’s best forecast of future costs of voting using the DRE system alone.

### **3.4.5 Estimated Optical Scan Voting System Costs**

As previously mentioned, Maryland would need approximately 2,100 precinct-count optical scan units and roughly 34 central-count optical scan units to successfully implement an optical scan-based voting system.<sup>27</sup> In addition to Maryland’s optical scan procurement, the state would also need to procure approximately 2,100 BMDs<sup>28</sup> for the disabled and 71 ballot-on-demand (BOD) printers<sup>29</sup> for early voting. In addition, the state would require booths, carts, and ancillary equipment. The total capital expense would be \$35.7 million (Table 3-9). This expense would be amortized over time as a major IT expense. With the exception of the BODs, which would be amortized over 4 years at a 7 percent rate of interest, this procurement would likely be amortized over 10 years at a 2 percent rate of interest.

SBE would also incur costs associated with the implementation of a new voting system, DRE unit transportation and disposal, updating all manuals and documentation, programming interfaces between voting system and election management systems, and quality assurance, among other activities. SBE estimates these activities to cost about [REDACTED] (Table 3-10).

However, SBE estimates that it may request as much as [REDACTED] for one-time implementation support services (Table 3-10). It is not clear whether this entire amount

---

<sup>25</sup> Full implementation occurred in FY 2007, when the DREs were first used in Baltimore City.

<sup>26</sup> One exception is that some technical support for the e-pollbook system may be included in the estimates. E-pollbook maintenance, lease payment, software, and other costs were excluded, but the technical support line item includes e-pollbook support. This is true for both the DRE and optical scan cost estimates and has no effect on the comparative cost effectiveness as the e-pollbook technical support costs cancel each other out.

<sup>27</sup> The one qualifying response to proposal Maryland received included provision of the central-count units at no cost, and only the cost of precinct-count units was modeled.

<sup>28</sup> Optical-scan ballot marking devices, such as ES&S’s Automark, currently sell for between \$7,500 and \$10,000 per unit. It is assumed that a discount will be applied to any procurement of BMDs that is similar to the “Statewide Implementation Discount” that was contained in ES&S’s financial proposal (approximately 25 percent off list prices).

<sup>29</sup> BODs are expected to be amortized according to Runbeck’s Election Services’ leasing price option, which is over 4 years at an interest of 7 percent.

would be required. Together, expectations for training and voter outreach amount to [REDACTED], and RTI does not believe such an extensive outreach and training effort would be necessary. When implementing the DRE system, SBE spent about \$409,000 on training between FY2004 and FY2007 (Table 3-7), yet the expectation in Table 3-10 totals [REDACTED]. Voter outreach costs during the DRE system implementation totaled \$1.5 million between FY2004 and FY2007 (Table 3-7), yet the expectation in Table 3-10 is that [REDACTED] would be needed.

Given that optical scan systems have been used in Maryland for absentee and provisional voting, and 19 counties were using optical scan systems before the transition to DREs there should be opportunities to reduce this projected expense. As such, the amount is not included in the cost analysis, but rather as a note that would offset cost savings.

**Table 3-7. Actual DRE Voting System Costs (thousands, \$2010), FY2003-FY2010**

	<b>FY2003</b>	<b>FY2004</b>	<b>FY2005</b>	<b>FY2006</b>	<b>FY2007</b>	<b>FY2008</b>	<b>FY2009</b>	<b>FY2010</b>	<b>FY2003- FY2010 Total</b>
Hardware Payments	\$1,754	\$4,303	\$8,563	\$6,546	\$5,452	\$6,240	\$6,295	\$5,328	\$44,480
Maintenance	—	—	—	\$819	\$1,614	\$2,035	\$1,122	\$379	\$5,968
Warehouse	—	\$210	\$216	\$281	\$292	\$288	\$150	\$136	\$1,574
Transportation	—	\$248	\$256	—	\$807	\$616	\$444	—	\$2,371
All Training (SBE/LBE/Judges)	—	\$301	\$51	\$4	\$53	\$59	\$63	■	■
Absentee Ballot Printing	—	\$64	\$66	—	\$895	\$360	\$360	—	\$1,744
Voter Outreach	—	\$883	\$323	\$213	\$116	—	—	■	■
Support Services	—	\$939	\$1,021	\$65	\$1,442	\$939	\$847	—	\$5,253
VS Supplemental Lease <sup>a</sup>	—	—	—	—	—	—	\$313	—	\$313
<b>Total Services</b>	<b>\$785</b>	<b>\$2,645</b>	<b>\$1,934</b>	<b>\$562</b>	<b>\$3,604</b>	<b>\$2,262</b>	<b>\$2,178</b>	<b>\$335</b>	<b>\$14,305</b>
Technical Support	—	\$1,322	\$1,395	\$671	\$2,516	\$1,699	\$2,150	■	■
Acceptance Testing	—	\$434	—	\$34	—	—	—	—	\$468
IV&V	—	\$335	\$175	—	—	—	—	—	\$510
Set-up Breakdown	—	\$161	\$166	—	\$39	—	—	—	\$365
DRE Ballot Preparation	—	\$34	\$35	—	\$20	\$58	\$42	—	\$187
Project Management	—	\$648	\$745	\$875	\$914	\$942	\$684	■	■
<b>Total Optional Services</b>	<b>—</b>	<b>\$2,933</b>	<b>\$2,516</b>	<b>\$1,579</b>	<b>\$3,488</b>	<b>\$2,699</b>	<b>\$2,876</b>	<b>■</b>	<b>■</b>
<b>Total</b>	<b>\$2,540</b>	<b>\$9,881</b>	<b>\$13,013</b>	<b>\$9,506</b>	<b>\$14,157</b>	<b>\$13,236</b>	<b>\$12,470</b>	<b>\$7,176</b>	<b>\$81,979</b>
DRE Technology-Dependent O&M Costs (FY2006-FY2010)				\$2,143	\$6,461	\$5,168	\$5,849	\$2,167	\$21,788

<sup>a</sup> For the 2008 presidential election, SBE leased an additional 1,191 DRE units for the expected spike in voter registration and voter turnout.

Note: This table lists some individual line-item costs that are not considered to be affected by choice of technology (i.e., project management and absentee ballot printing). This table serves to inform the General Assembly of the overall cost experience under the DRE technology, not as a direct comparator to the modeled optical scan costs, which are directly affected by technology choice.

**Table 3-8. Projected DRE Voting System O&M Costs (thousands, \$2010), FY2011-FY2020**

DRE, Operations and Maintenance Expenses	Estimated Annual Lease Payments (through 2020 only)										FY2011-FY2020 Total	
	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020		
Supplies	\$302	\$302	\$302	\$302	\$302	\$302	\$302	\$302	\$302	\$302	\$302	\$3,024
Training	█	█	█	█	█	█	\$86	\$86	\$86	\$86	█	█
Technical Support	█	█	█	█	█	█	\$2,149	\$1,000	\$1,791	\$1,699	█	█
DRE Software License	\$658	\$658	\$658	\$658	\$658	\$658	\$658	\$658	\$658	\$658	\$658	\$6,580
Acceptance Testing	—	—	█	—	█	—	\$36	—	—	—	█	█
L&A Testing	█	█	█	—	█	█	\$250	—	\$500	\$250	█	█
Transportation and Warehousing	█	█	█	█	█	█	\$1,068	\$219	\$1,068	\$1,068	█	█
DRE Maintenance	\$2,148	\$2,148	\$2,148	\$2,148	\$2,148	\$2,148	\$2,148	\$2,148	\$2,148	\$2,148	\$2,148	\$21,481
DRE Ballot Preparation	\$5	\$31	\$31	—	\$31	\$31	\$31	—	\$31	\$31	█	\$225
<b>Total</b>	<b>\$7,878</b>	<b>\$6,493</b>	<b>\$6,760</b>	<b>\$4,413</b>	<b>\$6,729</b>	<b>\$6,493</b>	<b>\$6,729</b>	<b>\$4,413</b>	<b>\$6,585</b>	<b>\$6,493</b>	<b>\$62,985</b>	

**Table 3-9. Optical Scan, BMD and BOD Capital Costs (thousands, \$2010), FY2013-FY2020**

	Units	Estimated Cost	Estimated Annual Lease Payments (through 2020 only)								
			FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	
Optical Scans <sup>a</sup>	2,083	\$14,439	\$1,607	\$1,607	\$1,607	\$1,607	\$1,607	\$1,607	\$1,607	\$1,607	\$1,607
Ballot Marking Devices <sup>a</sup>	2,083	\$10,708	\$1,192	\$1,192	\$1,192	\$1,192	\$1,192	\$1,192	\$1,192	\$1,192	\$1,192
Ballot on Demand Printers <sup>b</sup>	71	\$2,840	\$838	\$838	\$838	\$838	—	—	—	—	—
Booths and Carts <sup>a</sup>		\$7,760	\$864	\$864	\$864	\$864	\$864	\$864	\$864	\$864	\$864
<b>Total</b>		<b>\$35,747</b>	<b>\$4,501</b>	<b>\$4,501</b>	<b>\$4,501</b>	<b>\$4,501</b>	<b>\$3,663</b>	<b>\$3,663</b>	<b>\$3,663</b>	<b>\$3,663</b>	<b>\$3,663</b>

<sup>a</sup> Amortized at 2 percent over 10 years,  
<sup>b</sup> Amortized at 7 percent over 4 years  
 Note: all dollar values are in 2010 terms

**Table 3-10 SBE Expectations of Additional Services Needed to Implement an Optical Scan System**

Quality Assurance Manager	Plan and implement acceptance testing of all new equipment and general oversight of project implementation	██████████
Documentation Specialist	Provide assistance on all documentation updates required by the new system (estimated need for one and a half positions)	██████████
Quality Assurance Testing Team	Acceptance testing team (20 testers for 1 month)	██████████
Business Analyst	Additional resource for project implementation management	██████████
Warehouse Manager	Management of warehouse to receive and dispose of old DRE units and for receipt, staging, and testing of new OS system	██████████
Transportation	Transportation of old DREs to warehouse	██████████
Election Management System Interface	Programming interface between optical scan software systems and elections management system	\$150,000
Subtotal		\$1,341,800
Public Relations and Voter Outreach Coordinator	Plan and execute campaign for new voting system voter education campaign	██████████
Voter Outreach Labor	Creative work, advertising materials, and outreach events to educate voters on new system	██████████
Voter Outreach Production	Costs to produce PSAs and media buys	██████████
Trainers	Additional trainers for all aspects of training key stakeholders about new voting system (local election staff, election judges, county technicians, etc.) 24 trainers at 800 hours each	██████████
Subtotal		\$4,080,000
SBE Estimated Total		\$5,421,800 <sup>a</sup>

<sup>a</sup> If the implementation were to occur before the 2012 presidential election, additional team members will be required for Baltimore City (which will not be done with the city election until December 2011) at a cost of ██████████.

As we discussed in the modeling approach section, we have modeled the optical scan operations and maintenance cost in such a fashion as to present a realistic comparison under equivalent conditions. FY2006–FY2010 was selected as the period for comparison because during that time all counties came to use DREs, historical expenses for DREs have



been booked, and early voting was not implemented.<sup>30</sup> This treats the optical scan system as having been implemented in FY2006. The optical scan operations and maintenance cost vary significantly by fiscal year because the number of elections held within a fiscal year varies (Table 3-11).

**Table 3-11. Modeled Optical Scan O&M Cost (thousands, \$2010), FY2006-FY2010**

<b>Optical Scan, Operations and Maintenance Expenses</b>	<b>FY2006</b>	<b>FY2007</b>	<b>FY2008</b>	<b>FY2009</b>	<b>FY2010</b>	<b>FY2006-FY2010 Total</b>
General Ballots	—	\$1,037	\$128	\$1,191	—	\$2,355
Primary Ballots	—	\$1,037	\$1,293	—	—	\$2,330
Supplies	■	■	■	■	■	■
Training <sup>a</sup>	\$4	\$53	\$59	\$63	■	■
Technical Support	\$666	\$666	\$700	\$707	■	■
OpScan Software License	\$144	\$148	\$155	\$155	\$155	\$757
Acceptance Testing	\$34	—	—	—	—	\$34
Transportation and Warehousing	—	\$848	\$867	\$867	—	\$2,582
OpScan Maintenance	\$336	\$346	\$361	\$365	\$380	\$1,788
BMD Maintenance <sup>b</sup>	\$682	\$703	\$733	\$739	\$771	\$3,628
OpScan Ballot Preparation	—	■	■	■	—	■
Voter Outreach	\$213	\$116	—	—	\$33	\$362
<b>Total</b>	<b>\$2,523</b>	<b>\$5,487</b>	<b>\$4,850</b>	<b>\$4,645</b>	<b>\$2,691</b>	<b>\$20,196</b>

<sup>a</sup> Training cost based on DRE historical cost experience.

<sup>b</sup> BMD devices were not certified during this time period. The maintenance expense is presented here for illustrative purposes, and the final O&M cost comparison shows DRE vs. optical scan costs with and without the BMD maintenance charge.

The future operations and maintenance cost for optical scan technology maintain a similar trend line as that of the FY2006–FY2010 period, with year-over-year variance dominated by ballot printing cost and with variations associated with differences in the number of elections falling within a fiscal year and the timing of the purchase of supplies (Table 3-12). Note that we did not model O&M costs for FY2011-FY2012 because the earliest an optical scanning system would be procured is for implementation in FY2013, assuming an 18-month transition period.

<sup>30</sup> Early voting was implemented in FY2011.

**Table 3-12. Modeled Optical Scan O&M Cost (thousands, \$2010), FY2013-FY2020**

<b>Optical Scan, Operations and Maintenance Expenses</b>	<b>FY2013</b>	<b>FY2014</b>	<b>FY2015</b>	<b>FY2016</b>	<b>FY2017</b>	<b>FY2018</b>	<b>FY2019</b>	<b>FY2020</b>	<b>FY2013-FY2020 Total</b>
General Ballots	\$1,234	—	\$1,253	\$132	\$1,273	—	\$1,293	\$136	\$6,663
Primary Ballots	—	—	\$1,253	\$1,385	—	—	\$1,293	\$1,429	\$7,917
Early Voting Ballots	\$317	—	\$322	\$34	\$327	—	\$332	\$35	\$1,713
Supplies	████	████	████	████	████	████	████	████	████
Training <sup>a</sup>	████	████	████	████	████	████	████	████	████
Technical Support	████	████	████	████	████	████	████	████	████
OpScan Software License	\$158	\$160	\$161	\$162	\$164	\$165	\$166	\$167	\$1,617
Transportation and Warehousing	████	—	████	████	████	████	—	████	████
OpScan Maintenance	\$389	\$392	\$395	\$398	\$401	\$404	\$408	\$411	\$3,964
BMD Maintenance	\$789	\$795	\$801	\$808	\$814	\$821	\$827	\$834	\$8,042
OpScan Ballot Preparation	████	—	████	████	████	—	████	████	████
<b>Total</b>	<b>\$5,788</b>	<b>\$2,750</b>	<b>\$7,317</b>	<b>\$5,643</b>	<b>\$5,726</b>	<b>\$4,082</b>	<b>\$5,903</b>	<b>\$5,835</b>	<b>\$43,044</b>

<sup>a</sup> Training cost based on DRE historical cost experience.

### 3.5 The amount, if any, by which voting system operations and maintenance costs would be reduced if an optical scan voting system were implemented

**Summary:** If an optical scan system had been in place for FY2006-FY2010, we estimate that O&M expenses would have been \$5.2 million less than a DRE system if BMDs that satisfied the requirements of Maryland law not been available (Table 3-13). If BMDs that satisfied Maryland law had been available, then the \$3.7 million in maintenance costs for these devices would reduce overall optical scan cost savings to \$1.6 million. O&M expenses for the DRE system totaled \$21.8 million, but would have been \$20.8 million with an optical scan system (including BMD Maintenance costs). FY2006-FY2010 was selected as the period for comparison because all counties used DREs, historical expenses for DREs have been booked, and early voting, which affects the cost variables, was not implemented. The cost savings under the optical scan system were predominantly in technical support, maintenance, logic and accuracy testing, and needed software.

**Table 3-13. DRE O&M versus Optical Scan Modeled O&M Costs (thousands, \$2010), FY2006-FY2010**

Operations and Maintenance Expenses	FY2006	FY2007	FY2008	FY2009	FY2010	FY2006- FY2010 Total
DRE	\$2,143	\$6,461	\$5,168	\$5,849	\$2,167	\$21,788
OpScan <sup>a,b</sup>	\$1,840	\$4,784	\$4,118	\$3,906	\$1,902	\$16,568
O&M Costs Savings, before BMD Maintenance Costs	\$302	\$1,647	\$1,051	\$1,943	\$247	\$5,220
BMD Maintenance Costs	\$682	\$703	\$733	\$739	\$771	\$3,628
OpScan <sup>a</sup>	\$2,523	\$5,487	\$4,850	\$4,645	\$2,691	\$20,196
O&M Cost Savings (Increase)	(\$380)	\$975	\$318	\$1,203	(\$524)	\$1,592

<sup>a</sup> Training cost based on DRE historical cost experience.

<sup>b</sup> Savings before accounting for BMD maintenance expense, given that BMDs were not compliant with Maryland law during this time period.

### 3.6 Current and projected operations and maintenance costs for the state's current voting system

**Summary:** Table 3-14 presents projected O&M expenses for Maryland's DRE system alone, excluding all other services, programs, and systems maintained by SBE. Projected O&M for the state's current voting system are expected to continue along the same trend as the FY2006-FY2010 period. Expenses for FY2011-FY2012 are projected to be \$14.4 million. If the state were to continue to vote using DREs and replace fully depreciated units beginning in FY2013, O&M costs

for FY2013-FY2020 would be \$48.6 million. The total O&M expense for the FY2011-FY2020 period would be \$63.0 million.

**Table 3-14. Current and Projected DRE Voting System O&M Costs (thousands, \$2010), FY2011-FY2020**

<b>DRE, Operations and Maintenance Expenses</b>	<b>FY2011</b>	<b>FY2012</b>	<b>FY2013</b>	<b>FY2014</b>	<b>FY2015</b>	<b>FY2016</b>	<b>FY2017</b>	<b>FY2018</b>	<b>FY2019</b>	<b>FY2020</b>	<b>FY2011-FY2020 Total</b>
Supplies	\$302	\$302	\$302	\$302	\$302	\$302	\$302	\$302	\$302	\$302	\$3,024
Training	█	█	█	█	█	█	█	█	█	█	█
Technical Support	█	█	█	█	█	█	█	█	█	█	█
DRE Software License	\$658	\$658	\$658	\$658	\$658	\$658	\$658	\$658	\$658	\$658	\$6,580
Acceptance Testing	—	—	█	—	█	—	█	—	—	—	█
L&A Testing	█	█	█	█	█	█	█	█	█	█	█
Transportation and Warehousing	█	█	█	█	█	█	█	█	█	█	█
DRE Maintenance	\$2,148	\$2,148	\$2,148	\$2,148	\$2,148	\$2,148	\$2,148	\$2,148	\$2,148	\$2,148	\$21,481
DRE Ballot preparation	\$5	\$31	\$31	—	\$31	\$31	\$31	—	\$31	\$31	\$225
<b>Total</b>	<b>\$7,878</b>	<b>\$6,493</b>	<b>\$6,760</b>	<b>\$4,413</b>	<b>\$6,729</b>	<b>\$6,493</b>	<b>\$6,729</b>	<b>\$4,413</b>	<b>\$6,585</b>	<b>\$6,493</b>	<b>\$62,985</b>

### 3.7 The projected life span of the state's current voting system

**Summary:** The AccuVote TS voting machines now in use by the state of Maryland are rapidly approaching the end of their expected lifespan. The manufacturer's estimated lifespan of 10 years can be extended through additional investment in maintenance and repair, and the machines performed adequately in 2010, with approximately 1.4 percent requiring repair. Continuing to use the system beyond 2012 comes with increased risk of equipment malfunctioning. The nature and frequency of equipment failure beyond the manufacturer's life expectancy cannot be predicted.

The AccuVote TS DRE voting machines used by Maryland were once among the most widely deployed in the country. Election Data Services found in 2010 that 15.9 million voters (8.6 percent) used the AccuVote TS, while an additional 2.2 million voters (1.2 percent) used the AccuVote TSX model. Many more may be in use for ADA compliance. As many as 5 million registered voters, primarily in Maryland and Georgia, continue to rely on the AccuVote DREs, and as many as 31 percent of all voters in the United States would have used some form of DREs for the 2010 election.

Establishing a lifespan for the machines is complicated. Diebold, the manufacturer of the AccuVote TS, stated in its 2002 product manual that the product lifespan is 10 years. The useful lifespan of the machine depends on the quality of maintenance, and the conditions in which it operates and is stored. Frequent moving, especially over extended distances, the storage environment, and other factors can affect lifespan. Therefore, a voting machine can last indefinitely if one is willing to make necessary repairs, ensure maintenance, and transport the machines carefully. The state of Georgia, which has identical machines to Maryland, has no plans at present to abandon its DRE voting system which it acquired in 2002. Interviews with officials in Georgia indicate that the state continues to use the Windows 2000-based, 1990 federally certified software.

The Georgia local election officials with whom we spoke voiced uncertainty about the reliability of the equipment beyond the 10-year lifespan. These officials told us that the approach was to assume that the vendor would go out of business and the state would assume responsibility for upkeep of the voting system. In Georgia, local election officials decide whether to buy into statewide agreement for ongoing warranty repairs or provide for their own repair. The warranty agreements are purchased by local election agencies on one year terms that have risen in price to current price of \$150 per machine. A difference with the experience in Maryland is that Georgia assumed near-total responsibility for maintaining its machines upon acceptance, through a long-term relationship with the Center for Election Systems at Kennesaw State University. Under this contract with the Georgia Secretary of State, the Center provides training, testing, auditing, troubleshooting, and related services. A summary of the services provided by the Center is found at <http://elections.kennesaw.edu/history/>.

Merle King, Executive Director of the Center informed us that the contractual relationship between Georgia's Secretary of State and the Center began in 2002, when the state procured and installed a uniform, statewide DRE voting system. Georgia purchased the same DRE model, the Diebold R-6, which is currently installed statewide in Maryland. Georgia provides a fair point of comparison to Maryland. Georgia has approximately 5.2 million registered voters in 3,300 voting precincts using 27,000 DREs. Maryland, including the City of Baltimore, has approximately 3.4 million registered voters, 1,800 voting precincts, and 20,000 DREs.

In addition to Georgia's 27,000 DREs, 661 optical scan ballot readers are deployed for counting paper absentee ballots. Because the Diebold DRE model R-6 originally purchased in 2002 is no longer produced, whenever Georgia counties purchase additional equipment the state acquires the newer TSX model. Both the R-6 and TSX models are loaded with the same software—the 1990 federally certified software with Windows 2000 operating system. Mr. King said the software for both models is compatible, including interchangeable disability kits (headphones, etc.). He said Georgia is continuing to make this older software work despite the challenges, noting that upgrading to a later version would require purchasing and installing it for all 27,000 units.

Mr. King explained that Georgia plans to continue to operate the same hardware and software for elections in 2010, 2012, and into the foreseeable future. Georgia's DRE equipment failure rate has remained at 1.5 percent. Maryland's DRE failure rate is similar to the Georgia experience. After the 2010 primary elections, 197 of Maryland's 18,810 (1.0 percent) DREs were in need of significant repairs, according to SBE. This was in addition to 57 that underwent repairs before the election (total 254, or 1.4 percent).<sup>31</sup> Mr. King said the DRE voting equipment in Georgia has consistently maintained this failure rate during the past 8 years.

The state of Maryland needs investment in maintaining its current DREs, or it risks machine failures on an election day in the future. SBE has not sent Maryland's DREs for repair recently due to the uncertainty about whether they would be used in the future. Maryland's LBEs, however, do perform post-election evaluations of each unit and identify repair needs. It is not possible to anticipate a failure rate for future use of equipment that has surpassed its expected lifespan. If the DREs are to remain in service, Maryland may need to make significant investments in ongoing maintenance, repair, and upgrade capacity. Given the scope of this initial and ongoing expense, the state may wish to proceed with its purchase of replacement DRE equipment or initiate phase-in of the optical scan units.

---

<sup>31</sup> Email from Ross Goldstein to Conny McCormack, "Other information," dated October 26, 2010.

### **3.8 A comparison of the overall cost of continuing to use the state's current voting system as opposed to implementing an optical scan voting system**

RTI has augmented the results from Questions 3.4 and 3.5 with information on one-time capital and equipment expenses. These are as follows:

1. Optical scan units, BMDs, BODs, and associated equipment and supplies, which are amortized over a period of 10 years as major equipment expenses (Our analysis assumes that these units would be purchased in FY2013.);
2. Ongoing lease payments for DRE units, which extend through 2014 (see Table 3-4); and
3. Replacement expenses for the DRE units, which are nearing the end of their useful life, or long-term annual maintenance agreements and equipment rentals.

Implementing an optical scan voting system will require significant capital cost outlays as well as one-time implementation support to carefully plan and implement the transition, including raising voter awareness of the change. In addition to the capital costs required for procuring the optical scan system, the outstanding lease payments for the current DRE system will still need to be paid.

However, it is expected that beginning in FY2013 through FY2016, at least some part of the existing fleet of DRE units would need to be replaced. The capital outlay required for complete replacement is significant. The manufacturer states that DREs have an expected useful life of 10 years, and there is no information available about failure rates and maintenance expenses for these units outside of their useful life. While the advisory panel agrees that with proper maintenance and refurbishment, existing Phase I units may be used for the 2012 Presidential election, using these units beyond this date may present a significant risk, primarily in terms of service levels for Maryland's voters and secondarily in terms of cost. ES&S's proposal to SBE indicates that the life expectancy for a properly maintained optical scan system is "at least 10 years." The central counter has shown it is able to last approximately 11 years. The M100, the other precinct optical scan counter, is said to have a 15-year life.

Table 3-15 summarizes the cash payments for FY2013-FY2020 under both voting systems inclusive of all O&M and capital expenses. Relative to a scenario in which DREs continue to be used and DRE units are replaced at the end of their useful life, a transition to optical scan units (including BMDs and BODs) would be more cost effective.

Maryland would spend \$9.5 million less on an optical scan system than it would on a DRE system. Both O&M and capital costs are expected to be lower over the long term under an optical scan system, even when considering BMDs for the disabled and (\$9.5 million in capital lease payments and \$6.5 million in maintenance expense over FY2013 to FY2020) and BODs to support early voting (\$3.4 million in capital lease payments). The certification



of BMDs and the transition to early voting (which requires BODs) greatly increases the capital expense of the optical scan system overall; however the system remains more cost-effective than the DRE system over time.

The principal sources of O&M cost savings are:

- Technical support,
- Maintenance agreements,
- Logic and accuracy testing,
- Software systems and maintenance, and
- Transportation and warehousing.

SBE has indicated that it may request one-time optical scan implementation support for project management, DRE disposal, documentation, and quality assurance for a total cost of \$1.3 million, which would lower cost savings to \$8.2 million. SBE may also request funds for an extensive voter outreach campaign (\$2.4 million) and comprehensive training for local elections staff, judges, and technicians (\$1.5 million). It is unclear whether such extensive outreach and training would be necessary given that optical scan systems are currently used for absentee and provisional voting and were used for all elections in 19 counties before the introduction of the DRE system. When implementing the DRE system, SBE expended \$409,000 on training and \$1.5 million on outreach for a more complicated technology with which voters were unfamiliar.

**Table 3-15. Overall Cost Comparison of DRE vs. Optical Scan Voting Systems (thousands, \$2010), FY2013-FY2020**

Voting System	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2013- FY2020
<b>DRE</b>									
DRE (P1-3 Capital Costs)	\$3,539	\$3,494	—	—	—	—	—	—	\$7,033
Capital Costs (DRE Replacement)	\$1,588	\$1,588	\$5,002	\$5,002	\$5,863	\$5,863	\$5,863	\$5,863	\$36,632
O&M	\$6,760	\$4,413	\$6,729	\$6,493	\$6,729	\$4,413	\$6,585	\$6,493	\$48,615
Total	\$11,886	\$9,495	\$11,731	\$11,495	\$12,592	\$10,276	\$12,448	\$12,356	\$92,279
<b>Optical Scan</b>									
DRE P1-3 Capital Costs	\$3,539	\$3,494	—	—	—	—	—	—	\$7,033
Optical Scan, BOD, BMD Capital Costs	\$4,501	\$4,501	\$4,501	\$4,501	\$3,663	\$3,663	\$3,663	\$3,663	\$32,656
O&M <sup>a</sup>	\$5,788	\$2,750	\$7,317	\$5,643	\$5,26	\$4,082	\$5,903	\$5,835	\$43,475
Total	\$13,828	\$10,745	\$11,818	\$10,144	\$9,389	\$7,745	\$9,566	\$9,498	\$83,163
Cost Difference From Optical Scan Implementation	(\$1,941)	(\$1,250)	(\$87)	\$1,351	\$3,203	\$2,531	\$2,882	\$2,858	\$9,547

Note: SBE estimates of one-time implementation support services ranging from a low of \$1.2 million to a high of \$5.4 million and offset cost savings.

<sup>a</sup> Training cost based on DRE historical cost experience.

Recall that this analysis reviewed only the voting system technology for casting ballots, and the results do not include the many other services, capital equipment (such as electronic pollbooks), and supplies SBE procures in executing its mandate. That there are fewer pieces of equipment under an optical scan system does not equate to a need for lower service levels from vendors in cost categories unaffected by the question of DRE versus optical scan. These include, for example, election management systems, voter registrations systems, campaign financing systems, project management, voter outreach, and training for pollworkers.

Under the alternative scenario *not* recommended by the advisory panel in which the existing DRE units continue in service indefinitely and beyond the manufacturer's expected useful life of 10 years, procurement of an optical scan system is no longer cost-effective. If SBE were to continue using the existing DRE units beyond the 2012 Presidential election, the capital expenses for the optical scan units, BMDs, and BODs would exceed the hypothetical costs for implementing a more comprehensive maintenance program for the DRE units and renting additional units as needed. No information is available on failure rates for DREs beyond the 10-year estimated useful life specified by the manufacturer. In addition, in response to legislation specifying the transition to optical scan technology, SBE transitioned to a time and materials contract for maintenance of the DRE units. Under this scenario SBE would have to negotiate a resumption of a maintenance agreement covering the existing stock of units and is likely not to receive pricing equivalent to other jurisdictions that have held continuous coverage.

Over the medium to long term, it is our opinion that this presents unacceptable risk to Maryland's voting infrastructure. If failure rates are between 11 percent and 18 percent from FY2016 through FY2020, the cost advantage of "limping along" with the current DRE system would evaporate.

**Table 3-16. Alternative Scenario Overall Cost Assessment (Not Recommended) (thousands, \$2010), FY2013-FY2020**

Voting System	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2013-FY2020
<b>DRE</b>									
DRE (P1-3 Capital Costs)	\$3,539	\$3,494	—	—	—	—	—	—	\$7,033
O&M	\$8,628	\$6,027	\$8,851	\$8,615	\$8,597	\$6,027	\$8,707	\$8,615	\$64,067
Total	\$12,166	\$9,521	\$8,851	\$8,615	\$8,597	\$6,027	\$8,707	\$8,615	\$71,099
<b>Optical Scan</b>									
DRE P1-3 Capital Costs	\$3,539	\$3,494	—	—	—	—	—	—	\$7,033
Optical Scan, BOD, BMD Capital Costs	\$4,501	\$4,501	\$4,501	\$4,501	\$3,663	\$3,663	\$3,663	\$3,663	\$32,656
O&M <sup>a</sup>	\$5,788	\$2,750	\$7,317	\$5,643	\$5,726	\$4,082	\$5,903	\$5,835	\$43,044
Total	\$13,828	\$10,745	\$11,818	\$10,144	\$9,389	\$7,745	\$9,566	\$9,498	\$82,732
Cost Difference From Optical Scan Implementation	\$1,661	\$1,224	\$2,967	\$1,529	\$792	\$1,718	\$859	\$883	\$11,633
Number of Elections per Year	1	—	2	2	1	—	2	2	
Additional Rental Cost per Election	\$1,661	—	\$1,483	\$764	\$792	—	\$429	\$441	
Number of Additional Units to be Rented (\$270 per unit)	6,154	—	5,494	2,831	2,934	—	1,590	1,635	
Failure Rate at Which Optical Scans Become Cost-Competitive	34%		32%	18%	17%		11%	11%	

<sup>a</sup> Training cost based on DRE historical cost experience.

### 3.9 Recommendations for procuring and implementing an optical scan voting system in a cost-effective manner

Maryland voters enjoy a state-of-the-art election system, and elections over the past decade in Maryland have generally gone smoothly. The challenge now facing Maryland's election system is substantial and double-faceted: first it must maintain a high level of service during a transition to a wholly different balloting technology, and second it must do so during a period of fiscal austerity. As an agency, SBE appears to have the capacity to manage this challenge successfully, but important decisions related to financial allocations need to be made, and made soon.

***Recommendation 1: Maryland should move quickly to initiate a phased implementation of optical scan systems if it intends to use them for the 2012 Presidential election, or delay implementation entirely until after the 2012 election cycle.***

The first order of business is to decide whether and when an optical scan system should be put into operation. Maryland is facing an investment in its voting equipment, regardless of whether the state buys new optical scan machines or relies on its current DREs for another election cycle. With a firm decision in place, SBE can plan to service the DRE machines, extend lease agreements, or buy replacements for worn-out units in time for the 2012 elections. At the same time, preparations should be initiated for transitioning to more modern equipment. Beyond 2012, the existing DREs will need increasing amounts of maintenance and repair, as replacement parts will become scarcer. Already, the hesitation by elected officials to fund a new voting system has caused SBE, by its own admission, to forgo its usual repair and maintenance on many of its DREs. There is some evidence that the aging technology is becoming less mechanically reliable. Johns Hopkins University computer science Professor Avi Rubin, an expert on voting technology, wrote about his observations of Maryland's DREs while serving as an election judge in Baltimore County in 2008:

*Some of the machines have housings that are starting to wear. On one of them the screen had broken off the rest of the machine and was barely hanging together by some wires. On another one of the machines there was a gap next to the section where the smartcard is supposed to be inserted, and a couple of voters inserted their cards into the gap. The final one got it stuck so badly that we were unable to remove it and we had to issue [the voter] a different card. My overall impression is that these machines are showing the wear and tear of several election cycles, and that they will require some pretty serious maintenance and upkeep if they are to be used again.<sup>32</sup>*

<sup>32</sup> From "My Day at the Polls," November 4, 2008, posted on Avi Rubin's Blog, <http://avirubin.blogspot.com/>. Professor Rubin is a critic of the Maryland DRE system. We cite his experiences only to illustrate the potential mechanical shortcomings of the aging DRE machines, not to question the ability of those machines to provide accurate and reliable tallies of Maryland votes.

To minimize the risk of machine failures, policy makers will need to commit to the maintenance of the DRE system, replace the devices, lease replacements, or some combination of these options. There are alternatives to replacing or repairing DREs that have outlived their normal lifespan. SBE has in the past used lease agreements for comparable DRE machines, and this should be considered for 2012. When trying to extend the life of an old system it is important that (1) its software is as up-to-date as possible and (2) plans are made to cover the system when the vendor stops actively maintaining the software.

In addition, any security vulnerabilities present in the system will remain. Assessing the security vulnerability of the present DRE system is beyond the scope of this research, but we point out that the inability to upgrade the current software limits the ability to address any current or future security concerns.<sup>33</sup> It is a common misconception that removing connections to the internet or web will thwart hacking. For example, one of the findings of California's *Top to Bottom Review* was that a virus could easily be installed that would propagate to the entire voting system after the voting systems were cleared for subsequent elections.<sup>34</sup> This kind of virus does not use the internet or web (two distinct things, of course) to propagate, but uses the election media itself. This kind of vulnerability was evident in multiple places in the version of software that Maryland is using.

***Recommendation 2: Maryland should use a phased approach to implementing an optical scan voting system.***

Our research team is confident that a phased approach would reduce the risk of disruptions by allowing election officials, poll workers, and the voting public to make the change gradually. Though an un-phased, statewide change for the 2012 general election is possible, a phased transition would permit SBE and its contractors to identify and remedy obstacles without widespread disruption to voting. The timing of this transition and implementation should be considered carefully. For a smooth transition, several steps would need to be in place. These include the acquisition and testing of equipment, printing of ballots, the preparation and execution of training poll workers on the proper use and troubleshooting of the new devices, and providing the public outreach to inform voters of the use of a system. It is expected that it would take 18 months to prepare training and public outreach needed for a smooth transition.

---

<sup>33</sup> The long literature on the debate over the security and reliability of the Maryland DREs includes, among other works, a 2004 paper by Kohn, Stubblefield, Rubin and Wallach, "Analysis of an Electronic Voting System," published first as a Johns Hopkins Information Security Institute technical report and later in *IEEE Symposium on Security and Privacy, 2004*; SAIC's 2003 report, *Risk Assessment Report, Diebold AccuVote-TS Voting System and Processes*, available on the SBE website; the Department of Legislative Services' 2004 report to the legislature, *A Review of Issues Relating to the Diebold AccuVote-TS Voting System in Maryland*; and RABA Technologies' 2004 report *Trusted Agent Report, Diebold AccuVote-TS Voting System*. This is by no means an exhaustive list.

<sup>34</sup> <http://www.sos.ca.gov/voting-systems/oversight/top-to-bottom-review.htm>.

It would be an impractical goal to implement a new system in time for the fall 2011 Baltimore municipal elections. It may be feasible to implement a new system in time for the 2012 primary elections in selected counties if the funding issue is resolved promptly. It would be more feasible to plan on implementing optical scanning systems in selected locations in time for the 2012 general elections and then more broadly in time for the 2014 midterm elections. Although the DRE system is showing its age, we share SBE's confidence that a successful election can be conducted in 2012 with the current DREs, assuming proper maintenance. A hurried deployment of a new technology during a high-turnout election, and without proper planning would be disruptive. Completing a rollout to all parts of the state through the midterm elections in 2014 would provide time to manage the transition to new technologies.

***Recommendation 3: The state should review and improve SBE's purchasing capabilities.***

Our research identified a clear need for SBE to improve its procurement capacity. In our discussions with state officials it became apparent that SBE would benefit from more in-house expertise in managing solicitation process and contract administration for essential equipment and service purchases of this kind. This is not a criticism of SBE or its personnel *per se*; rather, it is to say that the agency would benefit from additional resources to support its purchasing and contract management capabilities. As evidence of this need, SBE's total budget has increased dramatically from less than \$5 million until FY2003 and has remained higher than \$21 million since FY2005. The administrative staffing for SBE was 32.5 regular full-time equivalents, slightly higher than the 29.5 full-time equivalents on staff in 2003. In other words, the SBE budget grew by more than four times, but the staff size increased by 10 percent (see Table 3-17).

Lack of capacity may have been a factor in SBE's decision to issue two large solicitations rather than multiple, smaller requests. This may have been an administrative convenience for the SBE. With greater capacity to administer large contracts such as the purchase of voting equipment, SBE would be in a better position to reap the benefits of more highly competitive bidding processes (see Recommendation 4, below).

Similarly, SBE should consider its service contracts in light of whether contracting what are essentially full-time, permanent employees is the best model for managing costs. Without a clear line between regular, permanent staff and contracted positions, it is difficult to make budgeting decisions in a transparent and accountable manner. If SBE is adding contracted positions because it is easier than adding the same positions to the state payroll through the appropriations process, it runs the risk of wasting money on a needlessly large managerial staff.

RTI recommends that SBE staff be augmented with a voting technology procurement and project manager and administrative support to supplement existing resources and enable more effective and innovative procurement design, vendor management, and cost accounting to enhance their ability to be dutiful stewards of public funds.

**Table 3-17. SBE Headcount and Budget History, 1999-2010**

Fiscal Year	Regular FTE Positions	Contractual FTE Positions	SBE General Administration Budget	Total SBE Budget	Total Budget - GA Budget	GA Budget/ Total Budget
FY1999	24	—	\$4,586,794	\$4,586,794	—	100.00%
FY2000	30	2.5	\$3,135,948	\$3,135,948	—	100.00%
FY2001	27.5	2	\$3,997,369	\$3,997,369	—	100.00%
FY2002	27.5	2	\$4,570,414	\$4,570,414	—	100.00%
FY2003	29.5	4	\$5,396,811	\$6,857,128	\$1,460,317	78.70%
FY2004	32.5	11	\$3,844,544	\$11,042,922	\$7,198,378	34.81%
FY2005	32.5	12	\$4,167,153	\$22,084,643	\$17,917,490	18.87%
FY2006	32.5	6	\$3,874,612	\$27,519,222	\$23,644,610	14.08%
FY2007	32.5	6	\$4,848,196	\$23,357,640	\$18,509,444	20.76%
FY2008	32.5	5	\$4,155,460	\$24,437,686	\$20,282,226	17.00%
FY2009	32.5	2.1	\$3,988,863	\$24,975,277	\$20,986,414	15.97%
FY2010	30.5	<sup>a</sup>	\$3,993,472	\$21,401,993	\$17,408,521	18.66%

<sup>a</sup> FY2010 Contractual position counts are not yet available.

***Recommendation 4: The state should review and improve SBE’s purchasing processes.***

The fact that the two solicitations attracted only single bidders is a warning sign that the state may not be receiving the full benefits of competitive bidding processes. Parts of both solicitations could be put out for bid in pieces. This contract structure may be the consequence of SBE’s capacity (see Recommendation 3), and as a consequence the process may have been simplified.

Though not evident on the face of the RFPs, the SBE has indicated that some equipment purchases would have been bid separately. SBE may find it helpful to work with other state administrative agencies to better divide contracts into component parts and allow greater competition for products and services. The state may also benefit from giving vendors advance warning of this intention to re-bid many of these components. Bidding contracts by their component parts should facilitate more meaningful naming of requests for proposals. This is important, because as SBE indicated, the naming of contracts did not pique the interest of some likely providers who saw the contract as specialized to voting



only. With better naming conventions, suppliers of goods and services may be more likely to compete and therefore give the state government greater confidence that it is receiving the most favorable combination of price, product, and service.

Finally, Maryland should consider issuing a master agreement for election products other than the voting system itself. Since local units share in the expense of these supplies, local units would enjoy discretion to determine which combination of price and quality items (i.e., booths, or table-top voting screens, or the array of services) best suits their needs. At the same time, the local election agencies would benefit from the state's larger buying power.

***Recommendation 5: Maryland should replace the DRE units with optical scanning systems for long-term cost-effectiveness and cost control.***

Adopting an optical scan system will result in short-term expenses for the state. These are expected to primarily include the capital equipment (optical scan units, BMDs, BODs, and related equipment) as well as transition planning, public outreach, and training of personnel in the new technology. Our analysis indicates that these costs will be recouped over the long term and that the optical scan system would be the most cost-effective choice for Maryland.

The state's current DRE units are nearing the end of their useful life. To maintain service levels to Maryland's voters, these units would eventually have to be replaced. Very little information is available about whether SBE could continue to operate these units for more than 2 years following the end of their useful life.

We estimate that continuing to operate the existing DRE system and replenishing depreciated units would cost \$92.3 million over the period from FY2013 through FY2020. On the other hand, transitioning to an optical scan system would cost \$82.7 million. Installation of an optical scan system would save the state \$9.5 million (Table 3-15).

SBE said that it may request between \$1.2 million and \$5.4 million for one-time implementation support of an optical scan system. The upper-bound amount may be high. Optical scan systems have been used in Maryland for absentee and provisional voting, and 19 counties were using optical scan systems before the transition to DREs. As such, the amount is not included in the cost analysis, but rather to show the minimum level of savings that should be realized if Maryland adopts the optical scanning systems. We agree that some level of voter outreach and training would be necessary as would drafting training materials used for election workers, DRE unit disposal, and planning and implementation support.

These estimates are the best forecast possible; in actuality many SBE agreements are time and materials contracts. Depending on work requested by SBE, costs could be more or less than those included in this analysis.

***Recommendation 6: Maryland should proceed with its plans to acquire ancillary equipment such as voting booths and carts.***

Changing to an optical scan voting system will require the acquisition of ancillary equipment, including voting booths, to meet privacy requirements, and carts for the transportation of the voting equipment.

Alternatives to the purchase of standing voting booths have been considered. One proposal included converting DREs to voting booths. This is a scenario that does not lend itself to the DREs the state is now using and in any case would degrade the voting experience of individual Maryland voters. A second alternative, the use of tabletop screens, would require delivery of tables and chairs, which local election boards generally do not own or control. Maryland should consider using both booths and screens, depending on the local polling place configuration. Local governments should have discretion to choose which is optimal to their own situations (while still being required to rely on the same optical scan voting technology and to rely on state-approved vendors).

The acquisition of carts is a reasonable expense and facilitates transportation and storage of new optical scanning machines. Although the carts are expensive, our research suggests that the actual, negotiated cost to the state would be more reasonable than the initial quote and would be a reasonable investment in the long-term usability of the new equipment.

***Recommendation 7: The SBE should reconsider, over the longer term, whether its current level of election support is sustainable in a changed state budget climate.***

The support services contract, in particular, reflects a level of funding that may not be sustainable given the immediate and longer term fiscal outlook for the state. Beyond the question of whether this level of election services is desirable, there is the question of whether excellent election services can be provided at some lower level of expenditures. It was our impression that SBE has a tendency to make its decisions based on optimizing the state's election system rather than taking into account the fiscal realities the state currently faces.

Finally, the state should consider whether SBE's practice of hiring full-time, permanent staff through the procurement process, rather than as state appropriations, is the most efficient way to staff state election services. Many of the contracted personnel could be scaled back after a transition, rather than maintained over the course of the contract's life. In other instances, it may be more cost-effective and efficient for regional

managers and other selected full-time contract positions to be state employees to avoid payment of fees, overhead, and administrative expenses paid to vendors for long-term positions that support Maryland's voting system. This research reaches no conclusions on that issue, but recommends it for further study.