

## Concept for Proposal

# Utah Voting & Elections System (UVES)

A proposal concept for research and development by Utah's Higher Institution Researchers (UHIR) and deployment by an Open Source Voting Group (OSVG) of the Utah Voting and Election System (UVES), an open-source voting system featuring an accessible voter-verified paper ballot. This system uses a *paper* ballot with an *electronic* audit trail that is always reconciled against the paper. Our approach will maintain *Utah's excellent reputation for honest, accurate elections.*

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# 1 Executive Summary

*George Santayana, the famous American poet and philosopher, said about a century ago, “Those who cannot remember the past are condemned to repeat it.” Let’s not repeat the mistakes made by other states. Rather than adopting a warmed over system, something patched after a failure in another state, let’s design and build a system that works for the people of the state of Utah. Let’s build a “public system for public elections” for Utah.*

Voting is a foundation of democracy, and trustworthiness of the election process is critical. Solutions to existing problems should be conservative and not completely left to market forces. Investing HAVA funds directly in R&D can **facilitate widespread improvements by making the results of the R&D available to current election vendors as well as new ones** that are formed to deploy and support the **UVES**. Making the designs, source code, and processes public will enable the development of a viable solution for commercial use, and provide public agencies with research and recommendations on voting systems. Such a project is underway right now being coordinated by the Open Voting Consortium (**OVC**).<sup>1</sup> Collaborating in this development project will be an opportunity to enhance the reputation of Utah technology and Utah’s reputation as a policy leader.

Costs of training, support, maintenance and upgrades are problematic when they are provided by a “sole source” election vendor that won the bid contract to provide the hardware. The **UVES** proposal will instead enable competition among vendors for support, maintenance, and upgrades, to keep operating costs low while the support continues to be available. **UVES will cost less to purchase, cost less to administer, and because of competition, cost less to maintain and upgrade.**

**UVES** will provide **jobs and revenue** to Utah because one or more of the vendors providing services to Utah counties will be Utah-based.

## 1.1 Organizational Model

**UHIR** will study the needs for modern election systems for the State of Utah and collaborate with research teams in other states in the development a voter-verified, trustworthy, secure and reliable voting system, where trustworthiness is built into the entire operational system. **UVES** will use industry standard computers using the open source software design by the Open Voting Consortium (**OVC**). This system will design in such a dramatic improvement in reliability, security, cost-effectiveness and usability that it can be used as a model for a universal voting system.

**UHIR**, nor any collaborating university, can not be in the position of administering the licensing, distribution and maintenance of a production system.

The **OVC** will coordinate the efforts of the **UHIR** and the other state university teams towards the development of a production-quality open-source voting system. **OVC** will arrange for federal certification of this system.

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<sup>1</sup> The Open Voting Consortium has already developed and publicly demonstrated a prototype system. A web-based version of this system is available at [http://www.openvotingconsortium.org/web\\_demo.html](http://www.openvotingconsortium.org/web_demo.html)

The **OSVG**, an affiliate of the **OVC**, will coordinate Utah's development and perform Utah's deployment of the **UVES** system (or work with other entities for deployment); act as liaison with various national, state and local entities, voting rights activists and others; coordinate with other states' efforts; perform or assist with testing, manage state approval processes and deployment of a licensing, distribution and training channel for the commercial version. **OSVG** will be a group of third-party vendors of election services that are members of the **OVC** and authorized by the State of Utah to provide election services in Utah.

OSVG or other independent **third-party vendors** will deliver hardware, customization, training, distribution and support of **UVES** for specific counties and elections. Reduced barriers to entry will enhance competition among vendors that are already providing information technology hardware and services to counties.

## **1.2 UVES Features**

**UVES will be easy to use for voters in multiple written and auditory languages and easy to administer for poll workers and election officials** with a minimum of special training. User-Centered Design method of development involves users, including members of the disabled community, poll workers, and election officials, in all phases of design. Usability applies to voting machines, procedural instructions, and documentation.

**UVES will address the needs of wheelchair voters and voters who are visually or reading impaired.** Computers will use headphones and computer-assisted voice to enable the sight-impaired to both privately create and verify their paper ballots.

**Recount-ability and Verifiability** – Open voting printed paper ballots will also be machine-readable using bar codes and may be verified and tabulated either by computer or by hand. The voter may validate that the ballot properly reflects their choices, by hand, in the language they selected, or by using other, independently programmed, computers at ballot reconciliation stations. The paper ballot is cast by placing it into a ballot box.

Optical-scan ballots can be used for **absentee and manually cast polling-place ballots** similar to existing optical scan ballot systems. **Provisional ballots** can be cast on machine and then placed into an envelope.

**Improvements over existing paper voting systems** may include cost, speed of voting and tabulation, suitability for use by citizens with physical impairments. Computerized reconciliation using digital signatures can detect ballot box stuffing. Computers can prevent over-voting, give warnings of under-votes, provide voting and verifying in multiple languages, and speed up canvassing.

**UVES will fix key weaknesses of DRE computerized voting systems.** **UVES** software will be **openly inspect-able, use lower-cost off-the-shelf components to lower the total cost of ownership, maintain an electronic audit, allow all voters, even those with disabilities, to verify their votes, and be more secure and trustworthy.** Even computer failures will not interfere with maintaining a paper ballot in the ballot box and an electronic audit trail on the voting machine.

A publicly available database of **Voting System Rules & Procedures for Election Officials and Poll Workers in each county** will be created with links to election laws, instructions for use and storage of voting system components before, during, and after elections, etc. This

database will contain statistics on accuracy and voter disenfranchisement in order to help counties improve rules and procedures over time.

Ballot reconciliation will read the paper ballot and reconcile paper ballots against the electronic ballot images to **ensure accuracy & security**. Separate independently maintained and contemporaneously generated audit trails will make it difficult to hide errors or penetrations. In advance of the election, software, ballot definition files, and machine identification information will be written to CD-R's, a write-once, append-only medium. A log will be maintained on the CD-R during Election Day, and the electronic ballot images will be added in random order to CD-R at the end of voting on Election Day.

Failure of an electronic voting machine will still allow for **the reliable tabulation of all the votes properly cast** because an electronic copy of each ballot will be gathered on a flash RAM card during voting and paper ballots will be placed into a ballot box.

Counties will not be locked into receiving **instruction and training** from one source since UVES will use open source software and commodity hardware. The OSVG will train and supervise the trainers.

UVES will provide improvements over other VVPAT voting systems, including Paper Audit Trail Under Glass and Paper Receipts systems.

**Summary:** Let's maintain the principle that votes are cast in secret and tallied in public. To ensure that votes are tallied in public, we need an open source system for casting and tallying votes. Let's make sure we do it right the first time, so we don't have to do it over. Let's build a system for the people of Utah, one that supports the blind and the disabled, those who cannot read and those who cannot read English. Let's show the country what Utah can do.

**Proposed Schedule:**

Sep 2004 Project start  
May 2005 OVC Pilot Test — Advisory or Unofficial Election  
July 2005 Evaluation of Pilot Test 1  
July 2005 Decision: OVC model vs. updated DRE/Release RFP  
Nov 2005 Utah Pilot Test— Local Election  
Dec 2005 Certification — County Canvassing System  
Jun 2006 Utah State-Wide Production Use — Primary Election  
Nov 2006 Utah State-Wide Production Use — General Election

## 2 Project Description

This project will create and deliver **UVES**:

- A production-quality, fully functional, fully documented, and fully supportable reference system of hardware, software, and procedures appropriate for use in Utah elections by all voters, including those with physical and reading disabilities.
- A deployment infrastructure that will distribute this system and — using independent third parties — provide ongoing support and maintenance to counties.
- Technical expertise and experts on election technology that may be used to the benefit of the Utah government, at both the State and local levels.

A prototype system has already been developed and publicly demonstrated.<sup>2</sup> The San Jose Mercury News referred to the OVC system in an editorial as a “touch screen holy grail,” and said “Open Voting Consortium appears to have what it takes to inspire faith in electronic voting. Its system can’t come to market soon enough.”<sup>3</sup> This proposed project will ensure that an effective reliable, secure, and trustworthy alternative is ready for widespread production use in time for the 2006 primary and general elections.

### 2.1 Accessible Voter-Verified Paper Ballot

The **UVES** is not merely a voter verified system; it is also a system that is highly resistant to errors, including intentional and accidental errors.

Voter verification is necessary, but not sufficient. Even if voters are given the opportunity to inspect paper audit records there still is a chance that software or procedural errors will occur that result in incorrect vote counts, errors that may only be detected if the paper audit records are, in fact, tallied. In the absence of other indications, such a tally may not occur. In other words, in a typical voter verified system, voting irregularities might not be detected unless the paper audit records are actually counted; and such counting might not occur unless there is a suspicion of irregularities. The **UVES** system avoids that kind of circular logic by using voter-verified paper ballots that are *always* counted, and always reconciled against the *electronic* audit trail.

A typical Direct Recording Electronic voting machine (DRE) system that produces a voter-verified audit trail might generate errors in the vote counts that could potentially remain undetected unless the audit trails are, in fact, used. This consideration means that, unless a jurisdiction chooses to risk the integrity of the election, such a system necessarily requires the processing of the paper audit records. The current designs for DREs that produce accessible voter-verified paper audit trails do not make it easy to automate the tabulation of the paper audit trail and compare it with the electronic ballot. The natural question to ask is, “If it is necessary to count the paper audit records, why not streamline the system and have the voting stations produce paper ballots rather than paper audit trails?” This idea, the concept of using computers to help voters generate paper ballots that can be validated by the voter and read by other computers, lies at the heart of the **UVES**.

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<sup>2</sup> See <http://www.mercurynews.com/mld/mercurynews/business/8328014.htm> and others.

<sup>3</sup> See <http://www.mercurynews.com/mld/mercurynews/news/opinion/8383100.htm>

## 2.2 Business Model and Market Plan

The OSVG proposes to create and test a production-quality reference voting system in collaboration with the Open Voting Consortium<sup>4</sup> (OVC) and other state university projects. The purpose of the project is to develop a voter-verified, trustworthy, secure and reliable voting system, where trustworthiness is not only built into the machinery, but into the entire operational system. Rather than adding incremental improvements to historically flawed voting systems, this system will design in from the start such a dramatic improvement in reliability, security, cost-effectiveness and usability that it can either be, or be the model for, *a universal voting system*.

Delivering the system does not guarantee business success. For the system to be adopted by jurisdictions requires *commercial* availability. In addition to developing the expertise and the UVES system, we also propose to develop a deployment infrastructure, using a sales distribution channel and independent third party vendors to commercialize the system.

UHIR and other universities cannot be in the position of administering the licensing, distribution and maintenance of a production system. For UVES to be successful commercially, it must be licensed or sold to vendors who will customize it, sell it to county election officials, and provide training and support. The Open Voting Consortium (OVC), a non-profit trade association,<sup>5</sup> will arrange for federal and state certification of the production system, create a sales distribution channel, and be a middle tier between the UVES development and the vendors who provide it. In addition, the middle tier is needed to manage the continued development and maintenance of the system once the UVES project is completed. The middle tier can also provide master “train the trainer” courses to vendors (and election officials). Third-party independent vendors from Utah’s OSVG will provide customization, training, distribution and support of the system for specific counties for specific elections. This model makes it possible for other vendors (including small local consulting firms) to provide training and support.

The systems of current DRE vendors have, in general, been demonstrated to contain numerous security flaws when exposed to independent scrutiny (either public inspection or inspection by other than the election officials and Independent Testing Authorities). No wonder most of these vendors<sup>6</sup> have been reluctant to publish their software. Note that opening e-voting software to public inspection does not eliminate intellectual property ownership. VoteHere’s software is still protected under copyright rules even though it is publicly inspectable.

What is needed is “public systems for public elections.” By using an open source model, UHIR and the other universities developing this project do not intend to garner royalties. But rather, the objective is to lower the total cost of ownership to jurisdictions that use the system UHIR and other state university teams develop. We fully expect the UHIR system to cost less to purchase, cost less to administer, and because of competition, cost less to maintain and upgrade than comparable systems based on DREs. Widespread adoption of the UHIR system will result in restored faith in the voting process — faith that has been shaken by DRE failures — because the UHIR system is designed from the beginning to be secure and auditable, our software development process and source are open, and therefore publicly inspectable.

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<sup>4</sup> <http://www.openvotingconsortium.org>

<sup>5</sup> See Section 3.6.1 for more details on the choice of subcontractor.

<sup>6</sup> VoteHere published its proprietary source shortly after OVC’s demo of open source software. See <http://www.oreillynet.com/pub/a/policy/2004/04/26/ovc.html>

These are great ideals, and our proposal is to develop such a system. However, merely delivering the results does not guarantee *business* success. We also propose to develop a deployment infrastructure, using this middle tier and independent third party vendors to commercialize the system. For the system to be adopted commercially requires several things:

1. It requires commercial availability: customization, distribution and support of the system for specific elections
2. It requires customers who are motivated and able to buy it.

### **2.2.1 Commercial Availability**

There are two scenarios for commercial distribution of the reference system. One is a free market model, in which the reference system is licensed to multiple vendors that can license, improve, modify, and customize it for commercial use. These multiple independent third party vendors could compete through cost competitiveness, service, and additional features and innovation. These vendors can include:

- Current voting systems vendors, such as ES&S, Sequoia, and Diebold.
- New startup companies that are members of **OSVG**.
- System integrators, including those approved and used by counties for other IT functions, as a new, additional revenue stream.

As the **UVES** project proceeds, vendor interest may be naturally spurred by both their growing awareness of the project and its technology. In addition, vendors with whom the project works as sources of system components may naturally develop into third-tier distribution channels. In these cases, the potential distribution vendors will create commercial pull on the project.

Vendor interest may also be spurred by decisions from a change in law or public policy by a jurisdiction such as the state of Utah. Changes in law or policy may for all practical purposes declare the **UVES** reference system to be a standard. This may occur either from a direct change in law or policy or indirectly by changing what the jurisdiction requires of its election system vendors, such as requiring vendors to provide publicly inspectable software source code.

For the purposes of this proposal, we are assuming an open market model. In this scenario **UHIR** and other state university teams creates the reference system and the Open Voting Consortium is the co-development partner, responsible for certification, sales distribution and maintenance of the system. This middle tier will be responsible for developing the channels for distribution through independent third tier vendors, like **OSVG**.

### **2.2.2 Motivating Customers**

It is not enough to have even a universally recognized superior product that meets all customer needs and requirements in order for customers to be motivated to buy. Additionally, when the customer is a public agency, they are constrained by the realities of their budgets. The **UVES** project and its partners will need to evangelize the system to the marketplace by a variety of means. Some traditional marketing activities that are appropriate for **UHIR** and other state university teams to pursue with their partners include:

- Public demonstrations
- Demonstrations to and focus groups of potential customers
- Publicizing endorsements

- Writing and publishing papers and reports
- Speaking publicly about the system

Most county voting officials are reluctant to change an existing system for a variety of reasons. These include cost constraints, difficulty of changing from something that “works” or is at least familiar, existing commercial relationships and the uncertainty of making a difficult decision where complex choices are concerned. Many are only willing to consider change when forced to by law or public policy changes. Additionally, they must be convinced of the viability of the vendor long-term, for training, support and maintenance.

Utah can benefit from this collaborative effort with other states. Utah can monitor the development of this multi-state project. If it is successful, Utah can adopt this model and procure new systems for statewide use through an RFP process. If the process fails, then Utah still has time to issue an updated RFP for DREs or computer-based optical-ballot marking systems that meet HAVA requirements based on the lessons learned from the experiences of other states in the 2004 election cycle.

Utah can make a bulk purchase of voting machines based on the **UVES** design. We expect that multiple vendors will want to bid on the RFP for the bulk purchase.

### **2.2.3 Training and Support**

For election systems to be adopted and effective, there must be adequate training and support. Several factors contribute to this becoming an increasing problem:

- Because elections are held relatively infrequently, institutional memory about administering them is not readily retained.
- Poll worker retention is a problem, resulting in having different poll workers from one election to the next.
- The systems are becoming more technical, requiring more skills from administrators and poll workers.

Lack of training has been shown to lead to failures in election systems.<sup>7</sup> There are several approaches to addressing these problems. One is to develop more “usable” systems, ones whose user interfaces are designed to be easy to learn and use, and which are validated by comprehensive user testing for a variety of demographics of users, all to reduce voter error and confusion. Another is to standardize processes and training for any one system. At present, different cities using the same machines may use different processes and training. Finally, vendors must provide adequate training and support.

Our business model decouples the certified system from the vendor providing the hardware setup. This makes it possible for other vendors (including small consulting firms) to provide training and support. As part of this proposal, OSVG will develop a deployment infrastructure, using independent third parties that can commercialize this system and provide ongoing support and maintenance to counties. We will work with other organizations, such as the Utah Association of Counties (UAC, <http://www.uacnet.org>) to develop and propagate best practices in this area.

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<sup>7</sup> See [http://www.signonsandiego.com/uniontrib/20040307/news\\_mz1e7lets1.html](http://www.signonsandiego.com/uniontrib/20040307/news_mz1e7lets1.html) and <http://www.signonsandiego.com/news/politics/county/20040310-1659-voting-report.html>

### **3 Conclusion**

Now is not the time for Utah to be choosing election systems. Utah should await the experience of others using election systems for the 2004 and develop an RFP based on those experiences. An RFP can be developed that reflects the successes and failures of the electronic election systems of 2004. There is plenty of time to make this decision and still have a system in place for the 2006 primary and general elections.

By waiting, Utah will not only have the opportunity to learn from the mistakes made by other states that have rushed to adopt new systems, but Utah will also have the opportunity to participate in the development of a new reliable, trustworthy and secure open-source election system, and then evaluate whether that system should be deployed in Utah.

If Utah does not rush to judgment, we will have the time to do it right.