Certification Test Report
For Oregon Secretary of State
Of the
Hart InterCivic 6.2.1:
Ballot Now Release 3.3.11
BOSS Release 4.3.13
Rally Release 2.3.7
Tally Release 4.3.10
SERVO Release 4.2.10
eScan, version 1.3.14
JBC, version 4.3.1
eSlate/DAU, version 4.2.13
VBO, version 1.8.3
eCM Manager 1.1, Release 1.1.7

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TR: OR070325_Hart, Rev 1.1

1. Executive Summary:

Hart InterCivic requested Oregon Certification for the Hart Voting System, Version 6.2.1. The major components for the Hart Voting System 6.2.1 submitted were:

a. Ballot Now Rel. 3.3.1.
b. Ballot Origination Software System (BOSS) Rel. 4.3.1.3
c. eConfiguration Manager (eCM) Rel. 1.1.7 and eCM USB Key.
d. eScan Rel. 1.3.14.
e. eSlate Ver. 4.2.3
f. eSlate/Disabled Access Unit (DAU) 5000 Ver. 4.2.3
g. Judges Booth Controller (JBC), Ver. 4.3.1.
h. Rally Rel. 2.3.7. (not tested in this session)
i. System for Election Records and Verification of Operations (SERVO) Rel. 4.2.10
j. Tally Rel. 4.3.10.
k. Verifiable Ballot Option (VBO) Ver.1.83

Supporting Ballot Now, two commercial high-speed document scanners were tested within this configuration:

l. Kodak i660 Scanner.
m. Kodak i830 Scanner.

CIBER, ITA Practices, a NASED Independent Test Agent (ITA), provided Witnessed Build installation files created during the Voting System Standard Qualification Test performed on these components to FCMG. We installed the Witnessed Build files for the PC based applications (BOSS, Ballot Now, eCM Manager, Rally, SERVO, Tally) on two laptops provided by Hart in Tallahassee, FL on 21-23 February 2007. At that time, electronic hash files were created for the purpose of verifying the installed files during the State certification testing conducted in Salem, OR, on 26-30 March 2007.

We installed the remaining Witnessed Build files provided by CIBER during the 26-30 March testing on test units for the eSlate system and eScan components but currently have no method for verification of the installed files after installation.

Once we verified the installed software matched the ITA certified version and specified commercial software, testing was conducted using three test elections: a Primary and General derived from actual Oregon elections, and special ballot test election.

The testing indicated that the system specified was capable of supporting an election within Oregon's requirements with the following exceptions:

1. One voter's cast votes failed to print so the voter could verify which votes were recorded on the voter verification paper ballot (on the VBO printer) during the Primary test election.

2. The Kodak i830 Scanner was unable to perform sustained operations due to an unresolved problem reading the test ballots.

Other observed issues which may have an impact on implementation are listed below.

2. System Configuration and Certifications:

2.1. Background Overview

[Reference App B for fuller description of each component.]
The Hart InterCivic design is based on precinct polling place operations with each polling place having one or more paper ballot based eScans per precinct or a Direct Recording Electronic (DRE) based "eSlate Precinct Voting System (PVS)", with up to twelve voting booths per PVS. One or more of the eSlate booths may be a specially modified Disabled Access Unit (DAU) which provides assistance to voters with disabilities to vote independently and privately. The eSlate voting machines also has an optional printing device (the Verifiable Ballot Option (VBO)) that prints a paper copy of the voter's ballot which the voter can verify before the ballot is cast. A limited tally report function is provided to produce a polling place precinct for posting of results at the polling place but the tally is not forwarded or used to consolidate results through the central reporting site. Instead, digital images of the actual voter's ballots (called Cast Vote Records (CVR)) are stored on Mobile Ballot Boxes (MBB).

The MBB, a PCMCIA memory card, is transferred after the polls are closed to the tallying site where the CVRs are interpreted and tallied. Rally, another optional module, provides support to forward results from multiple precincts or regional collection locations to the Tally operation (Rally was not tested in this session).

SERVO is a utility to service the eScans and PVS units at a warehouse to recover backup copies of the CVRs and reports from the eScans or PVS for archive or audit use and to reset the PVS for the next election.

The Ballot Now application supports a mode of operation where voters from many precincts may come to vote at a common location. It provides a capability to print the ballots from many precincts as they are needed should there be a low turnout rather than stockpiling unneeded ballots to be ready for an unknown number of voters. Whether the voter receives the ballot or just drops a voted ballot off to be counted, the Ballot Now component can process batches of ballots, digitally scanning to store and forward the CVR digital images of the ballot to the central tallying location. Unlike the precinct voting machines, Ballot Now can not produce a local tally report as the ballots are not tallied in Ballot

Now. The Ballot Now with a high speed scanner is also used for central scanning of absentee ballots.

2.2. Application for Oregon

For use in Oregon, Hart InterCivic proposes to use the Ballot Now, with a high-speed document imaging scanner, to process all the mail-in ballots. One or more eScan units may also be used as an alternative or supplement to centrally count the mail-in ballots where the slower, one ballot at time, operation is not burdensome. For larger counties, multiple eScan units or networked Ballot Now workstations may be needed to process all the ballots in a timely manner. The eSlate PVS, with one or more eSlate/DAU with VBO system, could be used at one or more locations to provide compliance with the Help America Vote Act (HAVA) requirement to provide disabled voters more freedom to vote independently and in privacy. Either the eScan or the PVS will need to be configured to support voting in multiple precincts, if not all precincts. Because of the limited use of fewer eScan or eSlates in a central location, Rally was not tested in this application but may need to be revisited if a need develops.

This test was supported by two different models of high-speed document scanners, the Kodak i660 and i830 digital imaging scanners. Hart InterCivic has obtained NASED Qualifications for six commercially marketed digital scanners that support the Image and Scanner Interface Specification (ISIS) including the Kodak i660 and Kodak i830 presented for this test for use in Oregon but none of the other models were tested for Oregon.

2.3. Certifications

2.3.1. NASED Qualification

Hart InterCivic 6.2.1 received NASED Qualification Number N-1-04-22-22-006 on Aug 7, 2006 based on independent lab reporting of compliance to Federal Election Commission (FEC) Voting System Standards (VSS) of 2002. NASED test reports are listed in Appendix A.

2.3.2. Oregon Certifications

Hart InterCivic is a new system for Oregon and has no previous certification in Oregon.

2.3.3. California Certification

Hart InterCivic 6.2.1 was certified in California on Sep 22, 2006. This certification was based in part on California Volume Reliability Testing (reference [CAVolume] for the test protocol) of the eScan 1.3.14, JBC 4.3.0, and eSlate 4.2.13 The certification and test reports may be referenced on line at

http://www.ss.ca.gov/elections/elections_vs.htm. The Ballot Now and BOSS/Tally applications were not tested in the California Volume Reliability Test.

2.4. Test Conditions.

2.4.1. Test Elections.

The test election was based on a stylized Oregon 2004 Test Primary and General designed to support more consistent testing between vendors. The test election consists of five precincts, one with a split, and samples of typical races for different levels of districts that occur in Oregon with basic race logic variations. For the Primary, partisan party ballots were created for Democratic Party, Republican Party, and non-partisan contests. For the General Election, candidates were selected from the Primary candidates of each party and additional candidates added to represent minor party and independent candidates. (See Attachment C for a summary of the test deck).

All ballots were folded in accordion fashion as they would be in a typical mail-in envelope. After folding they were opened up and about a third were back folded to create double creases as occurs in actual mail-in ballots.

A special election was generated using the election definition and ballot layout software to check sensitivity to common marking variations and the use of pens of different colors of ink for paper ballots. There are no defined criteria for pass/fail on this test; the test is a screening test to check if there are indications of specific problems which may require further testing or advisories for the election officials using the system.

2.4.2. Equipment Configuration for the Tests.

The test configuration consisted of:

two laptop/workstations,
one laser printer,
two different models of the Kodak digital document scanners,

one JBC with
two eSlate/DAU/VBO units
one eScan.

The Ballot Now laptop and the eScan were used as central count scanners. The eSlate system was set up for Election Day for disabled voters and last minute voters coming into a voting station rather than submitting mail-in ballots using two eSlate voting booths configured as DAU units to both the operations for both disabled and non-disabled voters. Only the Tactile Switches were used to test the binary switch option for voters with disabilities restricting use of the standard function button and dial. The Kodak i660 and i830 were setup, adjusted, and checked with the Kodak System Validation Tool by a Kodak field representative before use.

2.4.2.1. Clean Install and Verification of PC Applications

The two Dell laptops were sent to the Freeman, Craft, McGregor Group (FCMG) in Tallahassee, Florida prior to the Oregon test. The laptops were cleared of all existing software. Standard commercial software specified for the Hart System was reinstalled in a controlled environment. Electronic hashes (MD5 and SHA-1) were generated on the commercial base installed files. The Hart InterCivic applications modules were added using the ITA Witnessed Build install disks and the electronic hash files were regenerated so that a comparison could be made to identify program and other executable files added or changed by the Hart applications installations. A verification set of electronic file hashes was created to use for verification in the Oregon test site and at different points in the test.

Additional drivers had to be added at the Oregon test site to support the laser printer and document scanners, but a check against the verification hash files showed no changes to the Hart installed files. Additional hash files were collected to check for other changes.

BOSS, Ballot Now, Rally, SERVO, and Tally were placed on one laptop while Ballot Now and Tally were placed on the other to support testing with networked copies. eCM Manager was installed with BOSS, and then removed after the encryption keys were established and the two eCMs were keyed to the election.

2.4.2.2. **JBC, eSlate, and VBO firmware installs**.

Earlier versions of the firmware were installed (for example, Ver. 1.1.9 for the eScan). , copies of the Witnessed Build files were installed and the version identification information from the power up, diagnostic and election version reports were checked to see that the new version was installed. Currently, there is no validated method to independently verify the contents of the memories of the JBC, eSlate and VBO firmware (a Voluntary Voting System Guideline for 2005 (VVSG-2005) requirement).

2.5. Major Observations:

2.5.1. Election Preparation.

2.5.1.1. Ballot Printing

Ballot Now can produce a Postscript image of the ballots which may be used by a printing service to print the ballots or can be produced directly from the Ballot Now module using a laser printer. The ballots produced for the test, except for the ballots for the Special election, were printed from Ballot Now by Hart who provide a ballot printing service using commercial, high-volume printers. The Special election ballots were printed in the Ballot Now on demand printing from the laser printer used in the certification test. The Ballot Now feature allows the unit to be used to generate ballots on demand at the polling location. If the polling location is a central location supporting several or all precincts, the ballot on demand operation allows the jurisdiction to avoid stockpiling preprinted ballot and create just the ballots needed.

During the test, problems were experienced on some of the ballots due to what was identified as imperfections in the barcodes printed on the ballots. Some of the ballots could not be read as originally printed and had to be reprinted using the ballot on demand operation. Whether the ballots are printed by a commercial printer, in-house on a laser printer, or on-demand, the printer needs to be clean and well maintained to reduce the risk of unreadable ballots.

2.5.1.2. Ballot serial numbers.

Each ballot has three identification barcodes:

a. Serial Number Barcode
b. Election ID Barcode
c. Ballot Style Barcode

The Election ID Barcode and Ballot Style Barcode are required on all ballots. The Serial Number barcode is optional and has two sub options. One option allows the location of the barcode to be on the ballot, on a stub, or on both. The second option is whether a human readable label showing the serial number should be printed on the ballot. The ballot stub option supports [OSR06] **254.145 Design and contents of official ballots** section (5) for polling places. For mail-in ballots, the serial barcode printed on the ballot may be used as a method to identify the ballot after the ballot is returned and removed from the secrecy envelope. The CVR images of the ballot, if the serial number barcode is used, will also allow the ballots to be located or identified through out the tallying process and from the archive copy of the election records. Although it is not explicitly restricted by [OSR06] **246.560 Requirements for approval of equipment, section (1) (a)** for the secrecy of the voter**,** the serial number barcode and human readable label should not be printed on the ballot. For the

certification testing, ballot serial numbers were either turned off or recognition in the Tally operation was turned off.

2.5.2. Voting

2.5.2.1. BOSS supports generating an MBB to generate sample ballots. The MBB produced can not be used for any other purpose until reset. The Sample MBB was not tested in this certification.

2.5.2.2. BOSS supports generating an MBB for the pre-election test required by 254.235 Testing of voting machines and vote tally systems at the polling place, prior to the tally operation required by 254.485 for mail-in ballots and for the post-tally required by 254.525. A different MBB will need to be generated for each test.
BOSS includes an option to designate the MBB as a Test MBB so the ballots printed and tally they produce are kept separate from the official election ballots. Although the separation of the Test ballots and counts is attractive to avoid mixing them in with the official results, the test mode operation uses sufficiently different program code that the test is not considered by some election and voting system certification officials as adequate to test the Logic and Accuracy for election certification of the actual code and definition to be used in the election. For this state certification test, the Logic and Accuracy tests were conducted in official election mode rather than the test mode.

2.5.2.3. If a post-election test certification is conducted against the eScan or PVS, SERVO should be used to recover the backup files which remain on those devices before the test certification is run.

2.5.2.4. The eScan is very sensitive towards how the ballot is fed into it. If the ballot is slightly skewed, the bar code is not read properly and the machine rejects it. Re-inserting the ballot in alternate orientations (top edge first, bottom edge first, ballot front up, ballot back up) may be necessary to get the ballot read.

2.5.2.5. Write-ins. If a write-in is cast with a blank or empty entry on the eSlate, the VBO copy and the CVR show only the contest name without indicating the blank is a write-in. (See additional comment for ADA voters). On resolution, the blank write-in is rejected and reported as an under vote.

2.5.2.6. Contest titles are truncated to 22 characters on the VBO. In the test, the House of Representatives contest labels was cut off so that the House seat was not identified and could not be verified by the voter. This can be corrected by suitable abbreviating of the contest title Candidate names are limited to 16 characters which can result in a problem where “Jr.” or “the III” are needed. This problem should be worked out in a training exercise and the choice of titles and names documented for actual elections.

2.5.2.7. Missing Ballot on the VBO. One ballot failed to print out the voter choices on the voter verified paper ballot. The VBO printer advanced to clear the prior ballot from the VBO window, the voter choices to be verified were not printed out The VBO did

print out the BALLOT ACCEPTED message and barcode (see copy of that section of the VBO tape in App D, Exhibits). The ballot was correctly stored as a CVR and the barcode correctly record the voter choices.

[OSR06] **246.560 Requirements for approval of equipment, Section (1) (e)/(h)/(i),** requires a paper ballot be produced and the ballot should allow the voter to verify the choices shown**.** The missing ballot places the eSlate in non-compliance for approval and indicates that the VBO ballots may not be reliable as the official record of voting. However, this problem has not been reported before and was not noticed in the ITA 163 hour reliability test nor in the California Volume Test reported involving hours of testing and thousands of voted ballots. As a single incident without a verified cause, the degree of risk is not known and does not necessarily invalidate the ITA results (which allow for 95 percent confidence factor that problems were identified) but the implication that such an error can exist would require a revision of the OSR and procedures to handle it if it occurred in an official election.

2.5.3. DAU operation.

2.5.3.1. Audio ballot.

The instructions for using the ballot in audio mode is given immediately after the previous audio ballot has been cast and before the next voter can get to the voting station. The instructions are given only once and there is no way to recall or replay it. Hart recommends that voters with visual or language difficulties requiring the audio ballot be given the instructions by a poll worker.

Some additional instructions are available with the help button but it is only available once and, if pressed a second time, the message is not replayed but the JBC poll-worker is signaled that the voter needs assistance.

While entering the access code, there is no indication if the wheel is positioned correctly or what value may be under the wheel if that cell of the access code already been selected.

On a write-in, the audio ballot voter has no way to confirm the write-in is correct. There is no review of the write-in before the write-in is cast. In the summary review, the audio only identifies a write-in was cast without reporting what the write-in was.

When the cursor is on the instructions at the beginning of the ballot or the name of a contest, pressing the enter button will cause the audio to repeat but, when the cursor is on a candidate name, the same action results in casting a vote. There is no way to repeat the candidate name without going through the entire list.

The headsets on the audio ballot have a volume control, but there is no way to vary the speed of the text (a requirement of the VVSG-2005).

If there is only one character selected for the write in ballot and that character is deleted, the audio ballot does not indicate that the field is blank.

2.5.3.2. Tactile Switch.

The tactile switch is a variation on a class of devices that are binary switches, e.g. the device only supports two conditions. Another device is the sip-n-puff straw which uses the same interface (a yes/no signal) which was not tested at this time.

There is no way to backtrack through the ballot or the write in menu. If a change needs to be made on a previous race, it is necessary to proceed through the ballot review screen to make each correction.

Users of the binary switches are accustomed to such restrictions and may find this level of service acceptable. The routing through the ballot review screen provides a minimal satisfaction of the requirement to allow the voter to return to previously voted contest and correct it.

2.5.4. Tally

2.5.4.1. Tally databases.

The BOSS election database is used by BOSS, Ballot Now, and to install the election definitions in the PVS or eScans but must be locked down to start the tally operation. The tally is conducted in a copy of the election database. To complete the tally certification tests, separate copies will be required to perform the pre-tally test and the post-tally test. The naming of the databases is logical and consistent but may not be easy to remember until experience is gained; for audit and good control, a manual log sheet recording the name, time, and location of each database may be a help.

2.5.4.2. Polling place tally reports.

The eScan and PVS (JBC) allow a tally report to be generated when the polls are closed. The tally reports are not stored and forwarded for consolidation with other tally reports but are regenerated from the CVRs. If the eScan or PVS are used as single polling place voting machines in Oregon, the tally report produced must go through all the precincts. If the jurisdiction requires multiple copies of the report, one to post at the polling place and one as a record copy for election canvass and audit, the report can take a long time even if few voters use the voting machines. If local procedures require a zero total report, the time should be shorter as there should be no CVRs to process but it may still be lengthy. For this reason, it may be desirable to use more than one eScan or PVS with the precincts distributed between the voting machines. Note that the zero report does not show that totals have been reset to zero but only that there were no CVRs to process.

If the eScan is used to supplement central counting, a tally report is not required by current election code but a tally report is recommended as part of the election canvass documents to support audit of the results.

2.5.4.3. Ballot Now scanning and tallying.

Ballot Now has no tally capability beyond some basic reporting of the number of ballots scanned. To get a machine level tally, the ballots are scanned by a document scanner controlled by Ballot Now and CVR created for each ballot and stored in batches on the MBB for the Ballot Now. Hart recommends the batches are organized by precinct to make subsequent audit actions easier and we tested it that way.

During the test, several batches failed to read all ballots. Ballot Now operations allowed the batch to be reviewed through status reports and a viewer for the CVR records. It was fairly easy to finding the ballots which could not be read correctly. The batch could then be deleted and replaced by a rerun after the problem ballots were adjusted appropriately. On the Kodak i660, the scanner needed to be adjusted before reliable reading could occur but once calibrated worked well. On the Kodak i880, we could not get it adjusted and testing on the i880 was terminated as unsuccessful. .

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2.5.4.4. High speed scanning problems.

The problems seen with the i880 and to a lesser extent with the initial i660 scanner are typical of results experienced when testing other vendors COTS high speed scanner solutions. Until the i660 scanner, none of the previous scanners were able to support the large scale mail-in ballot count as setup for the Oregon certification test. The problem is likely to be more in the maintenance and operation of the commercial scanners than the actual voting system although support features to identify the individual ballot issue is an important factor. The problem has two aspects:

a. The scanners have been moved into the testing location and require serious testing and adjustment before they may be relied upon. Many of the vendors, including Hart, do not necessarily have the technical experience to perform the fine tuning, especially if multiple models are supported. An election office using one of the systems should be sure they can establish a connection with local representative of the scanner manufacturer who can be available before and during the election to maintain the scanner in proper operation. The ability to swap out a difficult system with a replacement or backup units could be a plus. The earlier system test preparing for the election needs to be done in advance with ballots from the same printing process as will be used by the voters and a record made of the testing and adjustments made to ready the scanner.

b. The Hart Ballot Now ballots are fairly robust in ignoring minor flaws and smudges on the voting part of the ballot but the barcodes used to identify the ballot proved in the testing to very sensitive and testing experience with other tests of the Hart system have indicated ballots from multiple sources may not be read consistently. The i660 did not work reliably until the scanner was adjusted for the ballots printed for the test election. That is one reason that the Test MBBs are not recommended as the ballots as the ballots used should be from the same printing source and definition as those used by the voters. We can not tell if ballot samples should be taken from early,

middle, and later printed ballots in a run. At least one of the ballots that could not be read had 'dirty' specks in the bar code that could barely be seen without magnifying (a feature that the CVR views support). If the printing is done in house with mid range laser printer, maintenance and cleaning may be almost as critical as the maintenance of the scanner.

Although I suspect that other scanners certified under the NASED testing could be used with similar care, the high speed scanners have not been documented as having the same volume of testing as the precinct eScan and PVS units. Before accepting an alternate scanner, ballot test runs using significant numbers of mail-in folded ballots should be conducted. Whether that is in the form of additional certification testing or more aggressive acceptance testing should be resolved in separate actions from this report.

2.5.4.5. Ballot resolution

The Ballot Now functions include the ability to perform basic ballot resolution for under votes, over votes, blank ballots, and some problem ballots with the CVRs before they are finalized and transferred to the Tally operation. Multiple Ballot Now stations can be networked so that a several workstations set up for ballot resolution can be working on the batches at the same time. Batches are checked out to a single workstation and are not accessible to other workstations while checked out. As we only had one effective scanner, we were not able to verify that multiple Ballot Now workstations can also be setup to scan ballots at the same time. The resolution is reasonably robust and well supported but took a little practice to avoid common non-fatal errors.

Write-in resolution should be done on the Tally unit as well as the eScan and PVS MBB resolutions. The Write-in resolution process supports identifying and adding the names of qualified write-ins to the tally database. The write-in resolution process had more operator errors initially than the basic resolutions but improved with practice. The test election ballots had far more samples of write-ins than would be experienced in most elections and should not be a major problem in an actual election.

2.5.5. Reporting

No problems were noted with the reports used: precinct at the machine level, cumulated ballot summary and precinct reports, canvass reports, and several status reports used to monitor and track the identification of MBBs, ballot batches, and CVRs.

2.5.6. Security

The Hart InterCivic Voting System was initially designed with high security included. The design includes many security features that block unauthorized changes but, as these features lock down the system, it becomes difficult to impossible to go back and correct and adjust an earlier stage without going back and rebuilding the election database. The ballots created from the election database are keyed with a unique identifier that will not

be recognized by another election database or the tally databases generated from the election database.

The eCM USB Key provides protected cryptographic keys to control access to by authorized users to the election and tally databases. Without the USB Key installed the basic applications making up the Hart Voting System and MBBs used to transfer data can not be read. Loss and recovery of the eCM pins and keys can result in loss of access to the encrypted and protected files and need to be recorded and stored securely for the life of the protected files. Multiple unique eCM USB keys may be created by the eCM Manager but Hard recommends limiting the number of unique pins for each election to reduce the complexity of recovering access.

As part of the testing, an attempt was made to reproduce and configure the Windows operating system more secure profile that has been used by Hart to configure delivered systems. An earlier copy of the profile is documented in the California Use Procedures The full profile was not available for this test; what could be installed and configured provided no problems for the operation of the system. Future tests should be done with a full profile and anti-virus detection software as well as any other security tools recommended for use by Hart to ensure that the applications work as intended within the delivered environment.

[redact] Validation from the Witnessed Build Installation disk provided the Wyle was successful for Windows workstation units running BOSS, eCM Manager, Ballot Now, Rally, Tally and Servo. Validation of the firmware installation for the eScan, eSlate, VBO, and JBC is limited to changing the installed firmware to prior version, then reinstalling the Witnessed Build Installation files. There is no way currently to independently verify the installed files once they are installed. The installation software program used to insert the firmware files are undocumented and untested in-house software. An attempt was made using low-level tools such a hex editor to alter the Witnessed Build Installation copies on the installation memory media but the attempt failed when the file corrupted the operating system installation of the target unit. This does not verify the installation process is secure but suggests it may be more difficult than it appears. Independent verification is a requirement of the VVSG 2005 for which the Hart 6.2.1 is not yet certified.

Overall the security appears reasonable but is not completely verified and has some risks if careful records and logs are not kept of locking election officials out the existing or archived election files.

2.6. Recommendations:

Overall the Hart 6.2.1 was fairly robust but had some areas where procedures and records need to be carefully followed or it could cause problems within the election. A major recommendation is that any election office acquiring this system should careful walk through the manuals and procedures and document where, under Oregon election code or the local election parameters, critical configuration options or records are needed.

A training or test election should be conducted to validate the procedures and identify where problem points may be. Among these are:

a. Encryption keys, pins, and security codes by election database,

b. What MBBs need to be created during a typical election and to cover potential needs after the MBBs can no longer be created.

c. Ballot printing options and printing maintenance procedures.

d. What reports need to be captured at each stage to meet Oregon requirements for certifying and supporting the canvass.

e. Size and timing issues for producing precinct reports and processing the MBBs from Ballot Now, eScans, or PVS units.

In addition, use of the high speed document scanners and laser printed ballots should be supported with local technicians qualified to make adjustments and maintenance before, during, and after the election during the canvass process.

The use of PVS (JBC and eSlates) is not recommended until some further resolution of the missing ballot problem can be made and procedures developed that would satisfy the Election Code if such an incident occurs.

2.7. Disclaimer

These test results are valid only for the configuration tested and to the extent that the test plan was completed as described in this report. The application of these results to State certification are based on a presumption that the election system delivered for use in an election match the systems used on this test and that the test represented a reasonable demonstration that the specified voting system can correctly present, record, and report the voting results required under the state laws and procedural rules. Changes to the hardware, its operation, versions of proprietary and commercial software, and their setup and choice of options for a given election may result in different outcomes for an actual election.

Counties electing to use the system tested in this report should conduct acceptance testing on the delivery of all equipment and after major repairs or maintenance to the system. In addition, before each election, appropriate diagnostic and readiness tests should be performed on all hardware and software to ensure it is operating correctly for that election. Logic and Accuracy and, for some scanning devices, calibration tests should be conducted before and, as required by state or local rules, after the election to ensure that the equipment, software, and the election definition, ballots, and setup are operational and valid for that election.

3. Conclusions:

The testing indicated that the system specified was capable of supporting an election within Oregon's requirements with the following exceptions:

1. One voter's cast votes failed to print a paper copy of the voter's choices on the VBO during the Primary test election.

2. The Kodak i830 Scanner was unable to perform sustained operations due to an unresolved problem reading the test ballots.

Other observed issues which may have an impact on implementation are listed below.

Signature

Appendices:

A. References and Definitions.
B. Description of the System
C. Test Election Cases
D. Exhibits.

App A: References and Definitions

Election Laws and Rules

a. [OSR06]. 2005-2006 Oregon Election Laws: Constitutional and Statutory Provisions. Reprinted from the Oregon Revised Statutes. Dated 2006
b. [VSS-2002], VSS-2002, Federal Election Commission Voting Systems Performance and Testing Standards, Apr 2002.
c. [VVSG-2005], VVSG-2005, United States Election Assistance Commission Voluntary Voting System Guidelines Ver. 1.0, Mar 2006.

Test Reports

b [CIBER1] (no id#) *Hart InterCivic Software Qualification Test Report (5.0), Oct 17, 2005 [accepted for N 1-04-22-22-003]*
Includes accuracy test using ballot with 185 options contests, one on each side. 1,574,350 vote positions scanned without errors. No indication if all positions run on eScan and ballot now scanners (i260 and i660.).
c [CIBER2], (no id#) *Hart InterCivic Software Qualification Test Report (6.0), Rev 1, Jan 30, 2006*
d [CIBER3], (no id#) *Hart InterCivic Software Qualification Test Report (6.0), Rev 2, Mar 3, 2006 [accepted for N-1-04-22-22-004 (2002)]*
e [Wyle1], 53097-01, Hardware Qualification Test of the Polling Place System 6.0l, Mar 31, 2006. Includes the eScan Firmware Ver. 1.0.10, JBC/eSlate Ver. 4.0.19, VBO Printer Firmware Ver 1.7.5.
f [CIBER4], (no id#) *Hart InterCivic Software Qualification Test Report* (6.2) Jun 16, 2006. (Draft)
g [PerceptLtr], Letter to Hart, (No subject title), Jun 28,2006. *This letter was not an ITA report but does record a professional opinion that modifications to the eSlate booth did not invalidate an earlier EMI test conducted in Nov/Dec 2005 for Hart.*
h [Wyle2], Letter 53097B-009, Changes to Hart eSlate Voting System Booth, Jun 30, 2006.
i [CIBER5], (no id#) *Hart InterCivic Software Qualification Test Report, Rev 1*, Jul 12, 2006. (Draft)
j [CIBER6], (no id#) *Hart InterCivic Software Qualification Test Report for Hart InterCivic System 6.2.1, Rev 2*, Aug 2, 2006 (Draft)
Correction to JBC for precinct tally report
k [CIBER7], (no id#) *Hart InterCivic Software Qualification Test Report (6.2.1), Rev 3*, Aug 11, 2006.
NASED Certification N-1-04-22-22-006 (2002) issued. Minor typo correction
l [Percept1], ECO-191-Booth Hardware, Oct 5, 2006.
Review of Engineering Change to validate use of booth on all prior eSlate systems.
m [Percept2], ECO-296-VBO, 10/5/2006.

Review of Engineering Change of power connector change for VBO on booth mounting for all 6.0 eSlate versions.

n [CAVolume], (no id#), *Volume Reliability Testing Protocol,* Jan 31, 2006.

Vendor Manuals and Specifications

o. [SERVOMan**].** 6100-102 Rev. 42-62B**,** *System for Election Records and Verification of Operations Manual*, ***undated***.

p. [SupportMan]. 6300-006 62C**,** *Hart Voting System Support Procedures Training Manual, **undated***.

q. [ED Reference]. 6300-134 6XA, *eSlate™ Polling Place System Election Day Desk Reference (System Version 6.X).* undated.

r. [ProdDesc]. 6000-060 Rev. 62A, *Hart Voting System Product Description, undated*.

s. [eCMMan]. 6100-080 Rev. 11-60B, *Hart Voting System eCM Manager Operations Manual Software V.1.1*, undated.

t. [BOSSMan]. 6100-019 Rev 43-62B, *Hart Voting System BOSS Ballot Origination Software System Operation Manual*, undated.

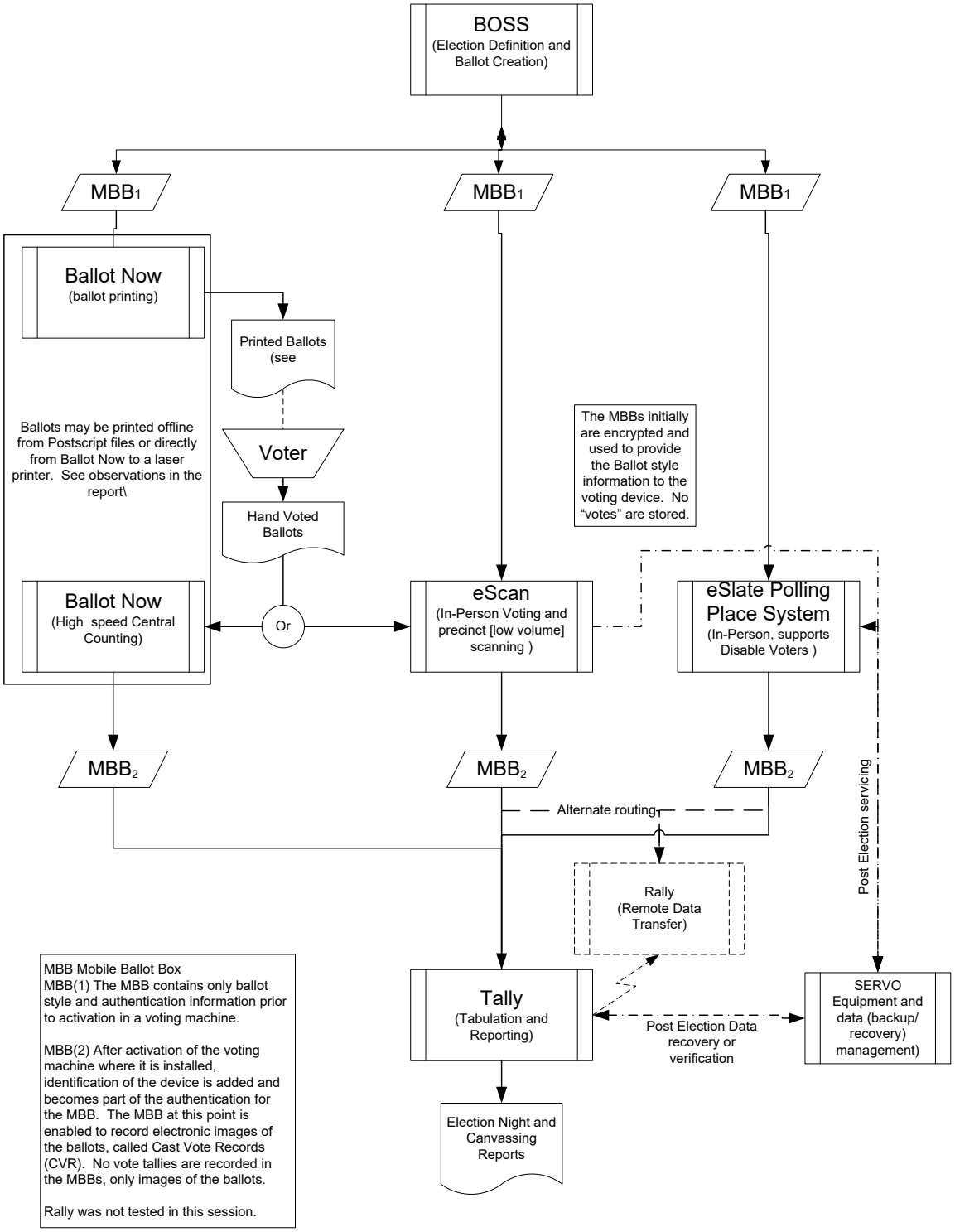
u. [RallyMan], 6100-114 Rev. 23-62A, *Hart Voting System Rally Operations Manual Software V.2.3*, undated.

v. [TallyMan], 6100-049 Rev. 43-62b, *Hart Voting System Tally Operations Manual Software V.4.3,* undated.

w. [BallotNowMan], 6100-067 Rev. 33-62B*, Hart Voting System Ballot Now Operations Manual Software V.3.3,* undated.

App B: Description of System.

1. System Overview.



1.1. Description of Components.

The election management system components, consisting of BOSS, Ballot Now, Rally, and Tally may be placed in one or more server/workstations consisting of PC-compatible units supported with appropriate printers and peripheral devices.

1.1.1. Mobile Ballot Box (MBB).

The MBB (Mobile Ballot Box) (picture above) is a proprietary PCMCIA memory card that is used in the JBC devices and eScan units for storage and which is also used to move data between other components of the system. In the initial stages of the election when the ballot information is loaded to the voting machines, the MBBs contain only ballot style and authentication information for the election. When the machine device is enabled, the MBB is loaded with additional identification information to identify the MBB with only that device. Once the polls open, the only information written to the MBB is the digital images of the ballots called Cast Vote Records (CVR). No tally information is stored in the MBB. (See SERVO below).

The Audio card is a special version of the MBB. It contains the audio recordings for the DAU audio ballot operation. The Audio card is installed in a PCMCIA slot on the DAU equipped eSlate and secured with a numbered security seal.

Two other special forms of MBB are described in the user manuals: the Solo and Demo. Neither of these was included in this certification test.

1.1.2. eSlate Cryptographic Module (eCM) and eCM Manager

eCM is a physical USB security key (based on a Rosetta USB Key) prepared by Hart InterCivic that is required for access to secure functions in the BOSS, Tally, Rally, Ballot Now, and SERVO applications. To operate any of these in multiple units such as the network operation of Ballot Now, multiple keys may be initialized for the election.

eCM Manager is a software application that can create, save or copy crypto module tokens and can validate a token. The eCM Manager initializes the eCM key or keys for an election.

1.1.3. Ballot Origination Software System (BOSS).

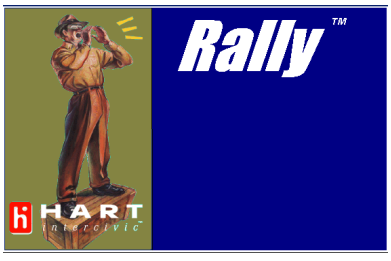
BOSS is a software application installed on a workstation or laptop. BOSS supports the election definition management and provides support for programming the other components of the system. BOSS requires an MBB reader/writer as a peripheral as well as access to a printer for various review and audit reports.

1.1.4. Ballot Now.

Ballot Now is a software application installed on a desk or laptop workstation. Ballot Now provides a ballot-on-demand ballot printing service, can generate Postscript files for offline printing of ballots, and supports the scanning of the paper ballots. It can use a variety of compatible high-speed scanners and laser printers. It can be configured in either a stand-alone or networked configuration. In the stand-alone mode, all of the Ballot Now processing is done on a single processor. In the networked configuration, one or more Ballot Now workstations can be attached to the Ballot Now server for multiple scanning and ballot resolution workstations. As part of the functionality, Ballot Now supports resolution of the Cast Vote Record images (to resolve undervotes, overvotes, and write-ins). In addition to the high-speed scanner, Ballot Now requires access to a PCMCIA reader/writer (to read and write to the MBB) and a hard drive of sufficient size to store the ballot images captured by the scanner**.** Note: Ballot Now was not tested in a networked configuration in this set of testing.

1.1.5. **Rally**.

Rally is a software application installed on laptops or workstations separate from and, typically, remote from the Tally operation. Rally supports reading the MBBs produced by the precinct JBC and transferring the ballot images, called Cast



Voter Records (CVRs), to the Tally subsystem. Rally requires access to a PCMCIA card reader/writer and a connection to the Tally subsystem using a modem or network. Note: Because of the low volume of JBC and eScan units under a centralized counting operation, Rally is not expected to be needed in Oregon and was not included in the test.

1.1.6. Tally

Tally is a software application installed on a laptop or workstation. Tally receives all the CSV results from either MBBs or from Rally, allows an authorized user to resolve ballot problems such as overvotes, undervotes, write-ins, retrievable ballots, and provisional ballots. Tally consolidates the ballot counts for final counting, generates voting result reports including audit logs, and archives the election results. The Tally election database is a separate copy of the BOSS election database. Tally requires access to a MBB reader/writer and a printer.

1.1.7. System for Election Records and Verification Operations (SERVO)

SERVO is a software application that is used to prepare eSlates, JBCs and eScan units for an election and to harvest backup copies of cast vote records and audit logs from flash memory which remains with the equipment. SERVO is usually run on a laptop so it can be easily moved from one device to the next in the elections warehouse. It uses a hard-wired connection to the devices.

1.1.8. eSlate Precinct Voting System (PVS).

The PVS consists of a JBC connected to at least one and up to twelve eSlate units.

a. Judges Booth Controller (JBC)

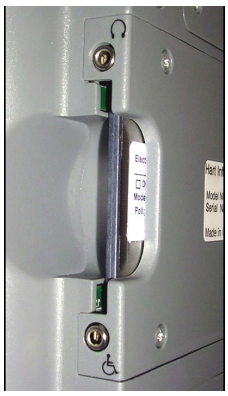
The JBC is used by the poll worker to initialize the eSlates connected to the election, open the election, and to select the ballot style (including identifying if a DAU ballot is needed for the voter) and to print authorization codes for each voter. As each voter casts their ballot, the CVR for the ballot is stored in the MBB installed in the JBC. The JBC prints status reports such as identification when powered up, Election Identification, Network Configuration, Zero Total reports when polls are opened. Since the access codes are torn off for each voter, the initial reports are torn off and set aside. After polls close, the JBC prints a Polls Closed report and

Access Code report as well as, if authorized, a Print Tally report (by precinct) or Write-in report. The Print Tally report is not stored to the MBB, but audit logs are.

b. eSlate.

The eSlate is the DRE voter interface unit for the PVS (eSlate with VBO in picture to left). It is mounted in a voting booth unit which provides privacy screens and support for the voter. It allows voters to make selections (including a choice of supported languages) and cast ballots using a set of push buttons and a revolving wheel. Once the voter has is ready to cast the ballot, it gives the voter a chance to review the votes on the screen before committing to casting the ballot. The unit is powered through a daisy chain or, on loss of power, from a backup battery.

c. eSlate/Disability Access Unit (DAU) 5000.



The back of a specially modified eSlate known as a DAU provides three ports (in picture to left) to support an audio headsets (top port), Audio card (card slot), and adaptive devices (bottom port) such as tactile switches, sip and puff devices, or others. Note: Only the tactical switches were presented in the state testing. The sip and puff unit is not provided by Hart but is expected to be provided by the voter. To use the audio ballot option, an Audio card must be installed with the recorded voice for each text element of the ballot and for each language supported.

d. Verifiable Ballot Option (VBO)

As configured for use in Oregon under OSR 246.560 (1) (e) & (h), each eSlate must be equipped with a VBO (Verifiable Ballot Option) device which displays a thermal paper printout of each voter's selections, which the voter can examine before the final step of casting their ballot. The record is known as a voter verified paper audit trail (VVAPT) record. The voter may reject the ballot two times. The VVPAT record is marked with a REJECTED label and advanced out of sight of the voter. After the second rejection, the ballot is accepted automatically and can only be cast when the voter completes their review. The Cast and Rejected records, along with Power Up reports, Polls

Open Report, Connection Reports, and Polls Closed Report are stored sequentially on a roll of paper which is wound on to a reel within the VBO unit. The VBO is sealed into the eSlate booth with numbered security seals and may be removed and replaced as a unit.

1.1.9. eScan.

The eScan is a precinct based paper ballot digital scanner (upper picture on the left). Voters insert their ballots into the eScan unit. It digitally scans the ballots, storing a CVR in a MBB, and feeds the ballots into the ballot box (lower picture to the left) which serves as the base for the unit. It is configured to reject ballots with over voted contests and ballots which are blank. The eScan prints a continuous log tape with event audit information as well as storing an electronic audit log. In addition to the automatic audit records, options exist for additional reports such as the Print Tally report which is a precinct by precinct vote tally. The tally report is not stored to the MBB and is provided only as an audit record.

Under operation in Oregon, the eScan has been presented as an alternative or supplement to the Ballot Now central count operation. Because of its slower speed (each ballot is hand-fed, one at a time), the eScan may not be appropriate for larger counties or use in high volume count applications.

2. Details of Tested Configuration

2.1. CERT1 Server Configuration

2.1.1. Dell Inc. Latitude D610, Service Code 86T4L81

a. 1.73 Gigahertz Intel Pentium M
b. 60.00 Gigabytes Hard Drive
c. 1016 Megabytes Installed Memory
d. CDRW/DVD: (TSSTcorp TSL46C)
e. USB 2 Controller (four connections)
f. PCI Cardbus Controller
g. Conexant D110 MDC V.92 Modem (built-in)
h. Broadcom NetXtreme 57xx Gigabit Controller #2
i. Dell Wireless 1470 Dual Band WLAN Mini-PCI Card
j. Alps Touch Pad [Mouse]

k. USB ATA Flash Card Reader/Writer

2.1.2. Operating System and Drivers

a. Windows 2000 Professional Service Pack 4
b. Microsoft Corporation - Internet Explorer Version 6.00.2800.1106
c. No virus protection
d. Cinematronics - 3D Pinball Version 5.00.2134.1
e. Microsoft (r) Windows Script Host Version 5.6.0.6626
f. Microsoft Corporation - Windows Installer - Unicode Version 3.1.4000.1823
g. (turn off) Microsoft Corporation - Windows® NetMeeting® Version 3.01
h. Microsoft Data Access Components Version 3.525.1022.0
i. Microsoft Windows Media Player Version 6.4.09.1125
j. Microsoft(R) Windows Media Player Version 9.00.00.2980
k. Microsoft® .NET Framework Version 2.0.50727.42
l. Modem Helper (Windows Picture and Fax Viewer)

2.1.3. Dell Installed Utilities

a. Alps Pointing-device Driver Version 5.5.101.156
b. Dell Inc - QuickSet Version 7, 0, 12, 0
c. Dell Inc. - NicConfigSvc Version 7, 0, 12, 0
d. Dell Wireless WLAN Card Wireless Network Tray Applet Version 4.10.47.3
e. Dell Wireless WLAN Tray Service Download Driver ?
f. dvdplay Application Version 1, 0, 0, 1 ?
g. Intel Corporation - iWrapper Application Version 10, 1, 1, 0 ?
h. Intel Corporation - ZeroCfgSvc Application Version 10, 1, 1, 0 ?
i. Intel(R) Common User Interface Version 7.0.0.4410 ?
j. Intel(R) Corporation - SSO Service Version 10, 1, 1, 0 ?
k. Intel(R) PROSet/Wireless Event Log Version 10, 1, 1, 0 ?
l. Intel(R) PROSet/Wireless Registry Service Version 10, 1, 1, 0 ?
m. Intel(R) PROSet/Wireless Service Version 10, 1, 1, 0 ?
n. Intel(R) PROSet/Wireless Version 10, 1, 1, 0 ?
o. Macrovision Corporation - InstallShield (R) Version 10.50 *
p. Wave Systems Corp.
q. Document Manager Version 05.03.00.006
r. Private Information Manager Version 5.1.0.018 ?
s. ServicesManager Application Version 2.2.1.000 *
t. Wave Systems Corp. - Authentication Manager Version 2.7.1.14 *
u. Wave Systems Corp. - AutoUpdate Version 5.1.0.004 *
v. Wave Systems Corp. - DocMgr Version 05.03.00.006 *
w. Wave Systems Corp. - EMBASSY Security Center Version 2.0.0.36 *
x. Wizards to adjust .NET Framework security, assign trust to assemblies, and fix broken .NET applications. Version 1.0.5000.0 *

2.1.4. Hart InterCivic Modules

The following version references are based on unverified registry and system level information and may not reflect actual installed software. The verified installed version is placed in brackets [ ] after the module name

a. Ballot Now Version 1.0.0.0 [3.3.11, suspect obsolete registery entry]
b. Hart InterCivic - Ballot Now Release 6.2.[3.3.11, suspect this a reference to the Hart Intercivic Voting System Release 6.2.1]
c. Hart InterCivic - Rally Release 2.3.7
d. Hart Intercivic – SERVO Release 4.2.10
e. Hart InterCivic - eCM Manager Version 1.0.0.0 [1.1.7] (Deleted after use)
f. Hart Intercivic – Tally Release 4.3.10

2.1.5. Hart Installed Commercial Applications

a. [no anti-virus]
b. AcroTray - Adobe Acrobat Distiller helper application. Version 6.0.0.0
c. Adobe Acrobat Version 6.0.0.2003051900
d. Adobe Systems Incorporated. - Acrobat ® Distiller ® for Windows Version 6.0.0.0
e. Crystal Reports /Decisions (embedded in Hart application and not a separate install)

2.2. LP2000 Server Configuration

2.2.1. Dell Inc. Latitude D610, Service Code 282DV71

a. 1.60 Gigahertz Intel Pentium M
b. 60.00 Gigabytes Hard Drive
c. 760 Megabytes Installed Memory
d. CDRW/DVD: (Samsung SN-324F)
e. USB 2 Controller (four connections)
f. PCI Cardbus Controller
g. Conexant D110 MDC V.92 Modem (built-in)
h. Broadcom NetXtreme 57xx Gigabit Controller #2
i. Dell Wireless 1470 Dual Band WLAN Mini-PCI Card
j. Alps Touch Pad [Mouse]
k. USB Smart Card Reader

2.2.2. Operating System and Drivers

a. Windows 2000 Professional Service Pack 4
b. Microsoft Corporation - Internet Explorer Version 6.00.2800.1106
c. Cinematronics - 3D Pinball Version 5.00.2134.1
d. Microsoft (r) Windows Script Host Version 5.6.0.6626

e. Microsoft Corporation - Windows Installer - Unicode Version 3.1.4000.1823
f. (turn off) Microsoft Corporation - Windows® NetMeeting® Version 3.01
g. Microsoft Data Access Components Version 3.525.1022.0
h. Microsoft Windows Media Player Version 6.4.09.1125
i. Microsoft(R) Windows Media Player Version 9.00.00.2980
j. Microsoft® .NET Framework Version 2.0.50727.42
k. Modem Helper (Windows Picture and Fax Viewer)

2.2.3. Dell Installed Utilities

a. Alps Pointing-device Driver Version 5.5.101.156 [req]
b. Dell Inc - QuickSet Version 7, 0, 12, 0
c. Dell Inc. - NicConfigSvc Version 7, 0, 12, 0
d. Dell Wireless WLAN Card Wireless Network Tray Applet Version 4.10.47.3
e. Dell Wireless WLAN Tray Service Download Driver ?
f. dvdplay Application Version 1, 0, 0, 1 ?
g. Intel Corporation - iWrapper Application Version 10, 1, 1, 0 ?
h. Intel Corporation - ZeroCfgSvc Application Version 10, 1, 1, 0 ?
i. Intel(R) Common User Interface Version 7.0.0.4410 ?
j. Intel(R) Corporation - SSO Service Version 10, 1, 1, 0 ?
k. Intel(R) PROSet/Wireless Event Log Version 10, 1, 1, 0 ?
l. Intel(R) PROSet/Wireless Registry Service Version 10, 1, 1, 0 ?
m. Intel(R) PROSet/Wireless Service Version 10, 1, 1, 0 ?
n. Intel(R) PROSet/Wireless Version 10, 1, 1, 0 ?
o. Macrovision Corporation - InstallShield (R) Version 10.50 *
p. Wave Systems Corp.
q. Document Manager Version 05.03.00.006
r. Private Information Manager Version 5.1.0.018 ?
s. ServicesManager Application Version 2.2.1.000 *
t. Wave Systems Corp. - Authentication Manager Version 2.7.1.14 *
u. Wave Systems Corp. - AutoUpdate Version 5.1.0.004 *
v. Wave Systems Corp. - DocMgr Version 05.03.00.006 *
w. Wave Systems Corp. - EMBASSY Security Center Version 2.0.0.36 *
x. Wizards to adjust .NET Framework security, assign trust to assemblies, and fix broken .NET applications. Version 1.0.5000.0 *

2.2.4. Hart InterCivic Modules

The following version references are based on unverified registry and system level information and may not reflect actual installed software. The verified installed version is placed in brackets [ ] after the module name

a. [Hart Intercivic – BOSS 4.3.13]

b. Hart Intercivic - Ballot Now Version 1.0.0.0 [3.3.11, suspect obsolete registery entry]
c. Hart InterCivic - Ballot Now Release 6.2.[3.3.11, suspect this a reference to the Hart Intercivic Voting System Release 6.2.1]
d. Hart InterCivic - eCM Manager Version 1.0.0.0 [1.1.7] (Deleted after use)
e. Hart Intercivic - Tally 4.3.10

2.2.5. Hart Installed Commercial Applications

a. [No anti-virus package]
b. AcroTray - Adobe Acrobat Distiller helper application. Version 6.0.0.0
c. Adobe Acrobat Version 6.0.0.2003051900
d. Adobe Systems Incorporated. - Acrobat ® Distiller ® for Windows Version 6.0.0.0
e. Crystal Reports /Decisions (embedded in Hart application and not a separate install) (Version is undocumented)l

2.2.6. Document Digital Scanners

2.2.6.1. Kodak i660 Scanner Serial No.: 4168

a. Adaptec DuoConnect™ AUA-1411 (Firewire and USB 2.0 CardBus)
b. Kodak i610/i620/i640/i660 Scanner Install Disk V3.11 (provides ISIS drivers)
    - ISIS driver
    - Scanner Validation Tool (SVT)

2.2.6.2. Kodak i830 Scanner Serial No.: 3902K051

a. Wide Ultra SCSI-2 Adapter with LVDS (Model not known)
b. Kodak i800 series Scanner Install Disk (version not known)
    - ISIS driver
    - Scanner Validation Tool (SVT) Note: different version than for i660.

2.3. eSlate System

2.3.1. JBC

a. Model No. JBC 1000B
b. Ser. No.: C0011B
c. S/W Ver. 4.3.1
d. MBB

2.3.2. eSlate/DAU (Booth #1)

a. Model No. eSlate/DAU 3000
b. eSlate Ser. No.: A000C6
c. S/W Ver. 4.2.13
d. VBO Printer Ser. No: V00171
e. VBO Printer S/W Ver. 1.8.3
f. Headphones
g. Tactile switches (binary)
h. Audio Card

2.3.3. eSlate/DAU (Booth #2)

a. Model No. eSlate 3000
b. eSlateSer. No.: A00040
c. S/W Ver. 4.2.13
d. VBO Printer Ser. No: V00000
e. VBO Printer S/W Ver. 1.8.3
f. Headphones
g. Tactile switches (binary)
h. Audio Card

3.2.6. eScan

a. Ser. No.: 6779FE
b. S/W Ver. 1..1.9
c. Microsoft Windows CE 5.0. The eScanProgrammer identifies the operating system version as 1.03 but this probably the Hart version identification of the Windows CE implementation.
d. eScanProgrammer, Ver 1.05

App C: Test Election Cases.

1.1. Primary Election:

PRECINCT	1	2/1	2/3	3	4	5
CONTEST						
PRESIDENT DEM	x	x	x	x	x	x
US SEN. DEM	x	x	x	x	x	x
US REPR. CONG DIST. 2 DEM	x	x	x			
Governor DEM				x	x	x
STATE SENATE DISTRICT 01 DEM	x	x	x	x	x	x
STATE SENATE DISTRICT 02 DEM	x			x		
HOUSE OF REPRE DISTRICT 01 DEM		x	x			
HOUSE OF REPRE DISTRICT 02 DEM	x					x
HOUSE OF REPRE DISTRICT 03 DEM				x		
HOUSE OF REPRE DISTRICT 04 DEM		x			x	
PRESIDENT REP			x			
US SEN. REP	x	x	x	x	x	x
US REPR. CONG DIST. 1 REP	x	x	x	x	x	x
US REPR. CONG DIST. 2 REP	x	x	x			
GOVERNOR REP				x	x	x
STATE SENATE DISTRICT 01 REP	x	x	x	x	x	x
STATE SENATE DISTRICT 02 REP	x			x		
HOUSE OF REPRE DISTRICT 01 REP		x	x			
HOUSE OF REPRE DISTRICT 02 REP	x					x
HOUSE OF REPRE DISTRICT 03 REP				x		
HOUSE OF REPRE DISTRICT 04 REP		x			x	
SUPREME COURT JUDGE POS 1			x			
DISTRICT ATTORNEY	x	x	x	x	x	x
COUNTY COMMISSION 8901234567890123456789O	x	x	x	x	x	x
(long label test)						x
MAJOR OF TEST CITY		x	x			
BOARD FOR MULTIPLE VOTES					x	
STATE MEASURES	x	x	x	x	x	x

POLITICAL PARTY	ABBREV.	MAJOR	MINOR
C = CONSTITUTION	CON		X
D = DEMOCRAT	DEM	X	
I = INDEPENDENT	IND		X
L = LIBERTARIAN	LIB		X
P = PACIFIC GREEN	PAC		X
R = REPUBLICAN	REP	X	
S = SOCIALIST	SOC		X

The test election was modified from the 2004 Oregon elections from several counties by combining various districts and races and to provide a broader set of candidates in larger races than some of the original races.

Testing was completed using a pre-marked Logic and Accuracy deck. The test deck was used to verify basic election definition and to initially verify the readiness of the test ballot counters.

Additional ballots were marked to test response to common voter errors and variations in voter marking devices.

The test deck exercised the following ballot logic and conditions:

Primary party ballots for Democratic and Republican parties
Non-Partisan races
Split precinct
Vote for 3 of 9 candidates,
Write-in votes (including potential over-vote conditions)
Blank ballots
Long names in candidate fields. (tested the election definition/programming setup)
Turn-out statistics on final summary reports
Measures
Report printing.
Review of audit logs
Consolidation of results from multiple counters.

Oregon uses a random alphabet rotation in the ballot layout, but it was verified that the order could be set manually within BOSS layout.

1.2. General Election:

PRECINCT	1	2/1	2/2	3	4	5
CONTEST						
PRESIDENT/VICE PRESIDENT	x	x	x	x	x	x
US SENATE	x	x	x	x	x	x
US REPR. CONG DIST. 1	x	x	x			
US REPR. CONG DIST. 2				x	x	x
GOVERNOR	x	x	x	x	x	x
STATE SENATE DISTRICT 01	x			x		
STATE SENATE DISTRICT 02		x	x			
HOUSE OF REPRE DISTRICT 01	x					x
HOUSE OF REPRE DISTRICT 02				x		
HOUSE OF REPRE DISTRICT 03		x			x	
HOUSE OF REPRE DISTRICT 04			x			
JUDGE OF THE OREGON TAX COURT	x	x	x	x	x	x

POLITICAL PARTY	ABBREV.	MAJOR	MINOR
C = CONSTITUTION	CON		X
D = DEMOCRAT	DEM	X	
I = INDEPENDENT	IND		X
L = LIBERTARIAN	LIB		X
P = PACIFIC GREEN	PAC		X
R = REPUBLICAN	REP	X	
S = SOCIALIST	SOC		X

The test election was modified from the 2004 Oregon elections from several counties by combining various districts and races and to provide a broader set of candidates in larger races than some of the original races.

Testing was completed using a pre-marked Logic and Accuracy deck. The test deck was used to verify basic election definition and to initially verify the readiness of the test ballot counters.

The test deck exercised the following ballot logic and conditions:

Split precinct
Write-in votes (including potential over-vote conditions)
Blank ballots
Turn-out statistics on final summary reports
Report printing.
Review of audit logs
Consolidation of results from multiple counters.

Oregon uses a random alphabet rotation in the ballot layout, but it was verified that the order could be set manually within BOSS layout.

1.3. Special:

The test election uses a ballot with all or nearly all voting positions active and capable of registering a mark. Contests are defined to provide to be vote for n where n is the number of candidates. The value of n is selected to allow eight to twelve sample marks with contests laid out check regions of the ballots such as upper left corner, back right center side, and so on. On the Hart ballot, we used n=11.

The marks are manually drawn (a ruler is used to reduce excessive variation) and include hand filled target, x-cross, check mark, front slash, back slash, horizontal line, vertical line, circled target (just outside), dot (about the size of a period), and a blank. For this test an eleventh mark was used: a small circle just slightly larger than the dot (see App D: Red- Ballot) Six ballots are used in each set with different inks or markers: 3 blacks, 1 red, 1 blue, and 1 dark green. Where the vendor recommends specific pens as marking devices, the recommended pen(s) are used as one or more of the black samples as a control. The six ballots were run four times in the same sequence to help support comparisons between multiple runs of the same hand. We expect outcomes in the following three categories: consistently read ('legal' marks), consistently missed ("un-marked"), and marginal where some minor differences in the mark will result in it being read or skipped.

Within this test, only the outside circle and the dot were in the marginal category. The outside circle was read on only one ballot in the front upper right for three of the four passes (< 0.7 percent). The dot is typical of 'hesitation marks or tap' where the spot may be tapped by the voter going through the ballot but not deliberately marked. The dot was counted 76 percent of the total dot marks.

Under the 'voter intent' practice of determining whether a vote should count in a recount or audit review, this test is of limited value. The determination whether a

particular mark should be counted needs to include all factors that may suggest a mark is or is not intended by the voter on a specific ballot. The results do suggest that Hart ballots will tend to read a slight mark as a valid vote. As such procedures should be defined on how such ballots will be processed to avoid or handle false votes. It is not known how common such marks may be in an actual election.

App D: Exhibits.

Exhibit 1. Missing VBO Voter Choices.

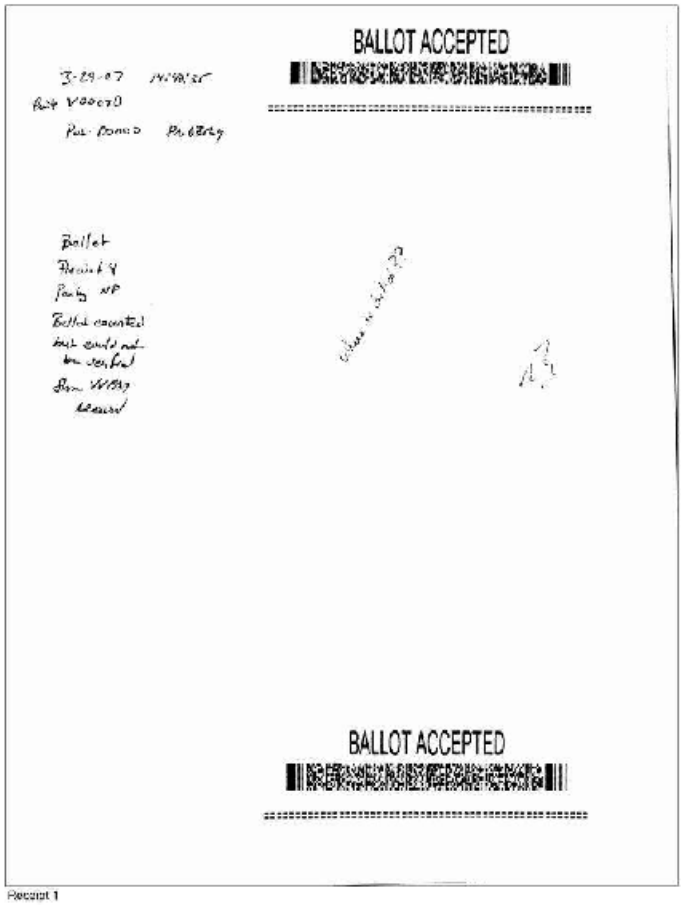


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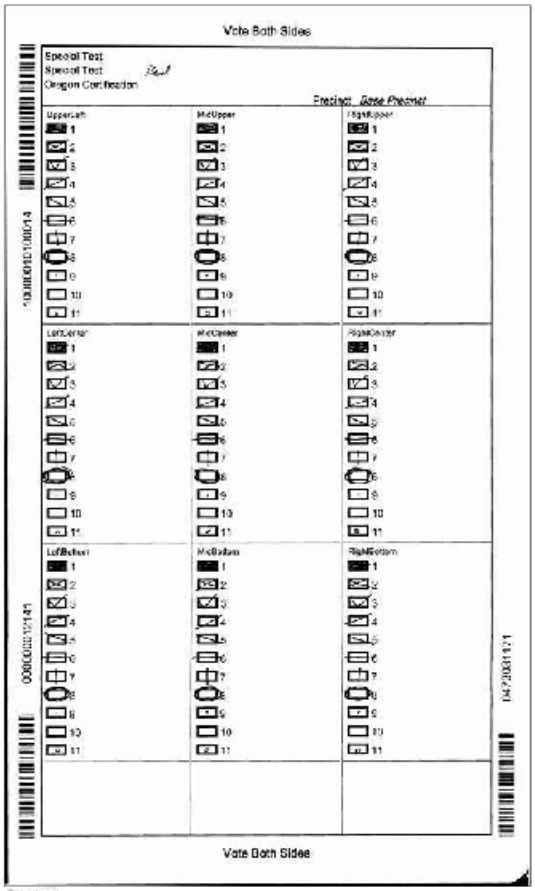
Exhibit 2: Red Ballot



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