

Voting System Qualification Test Report
Dominion Voting Systems, Inc.
GEMS Release 1.21.6, Version 1

For Publication

March 2012



Florida Department of State
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On November 29, 2011, Dominion Voting Systems submitted the final documentation and source code files required for their requested certification of the “*DVS-GEMS Release 1.21.6, Version 1*” voting system. This system includes AccuVote-OS (AV-OS or OS) and AccuVote-OSX (AV-OSX or OSX) precinct scanners, the AccuVote-TSX Touchscreen (AV-TSX or TSX), AutoMARK Voter Assisted Terminal (VAT) system and the PCS 900, 960, & 960(Model B) central count scanners. Public testing occurred from February 28 through March 9, 2012, in Hillsborough County, Florida.

Background:

This certification activity for GEMS, Release 1.21.6, Version 1 addresses two advisories issued by DVS for one of the currently certified versions of the OSX firmware and also includes evaluation of a new AV-OS memory card and an upgraded model of the central count scanner [PCS 960(Model B)] which has a larger hard drive and additional system memory. A summary of these items follows:

Advisories

- AV-OSX Protective Count - Optical scanners are required to maintain a ‘protective count,’ which is a total count of ballots cast after a scanner’s firmware upgrade. The machines must also have a ‘public count.’ This is a total count of the ballots cast on a scanner for a particular ‘voting session’ - after running the zero tape and up to the time that the last ballot is cast and voting has ended. The protective count on the OSX that was displayed after ballots were cast during a voting session was not being ‘held’ in long term memory until the OSX properly progressed through its prescribed shutdown procedures (i.e. the voting session was ended properly). The result of this was that unplanned shutdowns caused the protective count displayed to revert to the number that was originally displayed when a voting session began. It is important to note that this issue did not affect the ‘public count’ or tabulation of the votes.
- Date Stamp on OSX Results Tapes – Due to the way the 1.2.6 OSX firmware was coded with regard to the time zone setting as it related to Coordinated Universal Time (UTC) and printing the local date, there were instances where the date stamp would appear as the day after the date it was actually printed.

System Enhancements

- Review of a new AccuVote-OS Optical Scan Tabulator MRAM memory card (PN 181-001004) which does not require a battery, as the currently approved memory cards have batteries that fail over time.
- Assessment of an upgraded model of the DRS PhotoScribe PS960 central count scanner. The PS960 (Model A) has a 200GB hard disk drive, with 1GB of system memory. The PS960 (Model B) version, which was considered during this test event, has a 250GB hard disk drive, with 4GB of system memory.

Conduct of Tests:

The test objective was to verify that this voting system met the applicable requirements of Florida Statutes and Rules and Florida Voting Systems Standards (FVSS), that the AV-OSX protective count was updating properly, and that a report date was appropriately printing on the results tape.

The examination began with installation of the appropriate voting system software applications and an audit of the AV-OSX, AV-TSX, and PCS administrative menus, and regression testing of the AV-OS with a new memory card. Next, staff conducted mock elections to ensure that system conformance with the FVSS and applicable Statutes remained unchanged with the modified GEMS software and OSX firmware. In order to achieve this goal, General and Primary Elections, provided by DVS, and a Municipal and Presidential Preference Primary Election, coded by BVSC staff, were tested with various criteria (outlined below)

General Election

- Parties
 - Democratic
 - Non-Partisan
 - Republican
- Languages
 - English
 - Spanish
 - Haitian Creole
- Precincts
 - 999 Precincts
 - One or more split precincts
- Ballots
 - Page length: 18"
 - Coded by Precinct ID
 - One or more 2-sided, 3-column
- Contests
 - One or more precinct only contests
 - One or more universal primary contests
 - One or more 'Vote for x' (<1) with a write in vote contests
 - One or more with a write in vote contests
- Candidates
 - At least one name set at GEMS max field length
- Reporting Groups
 - Absentee (not election day)
 - Absentee (election day)
 - Early Voting
 - Election Day
 - Overseas
 - Provisional (before 7pm)
 - Provisional (after 7pm)
- Precinct Scanners Settings
 - Reject Ballot = 1 or more overvoted contests
 - Reject Ballot = Blank
 - Accept Ballot = 1 or more undervoted contests
- Central Count Scanners Settings
 - Outstack Ballot = 1 or more overvoted contests
 - Outstack Ballot = Blank
 - Accept Ballot = 1 or more undervoted contests

Municipal Election

- Parties
 - Democrat
 - Republican
 - Nonpartisan
 - Green
- Languages
 - English
 - Spanish
- Precincts
 - 3 or more precincts
 - One or more split precincts
- Ballots
 - Page length: 11"
 - Coded by Ballot Style
 - One single-sided, 3-column
- Contests
 - One or more 'Vote for x' (<1) with a write in vote
- Candidates
 - At least one name set at GEMS max field length
- Reporting Groups
 - Absentee
 - Early Voting
 - Election Day
 - Provisional
- Precinct Scanners Settings
 - Reject Ballot = 1 or more overvoted contests
 - Reject Ballot = Blank
 - Accept Ballot = 1 or more undervoted contests

Presidential Preference Primary Election

- Parties
 - Democrat
 - Republican
- Languages
 - English
- Precincts
 - 10 or more precincts, distributed among 3 congressional districts
 - Two or more split precincts
- Ballots
 - Page length: 11"
 - One single-sided, 3-column
- Contest
 - Presidential contest only
- Candidates
 - At least one name set at GEMS max field length
- Reporting Groups

- Absentee
- Early Voting
- Election Day
- Provisional
- Precinct Scanners Settings
 - Reject Ballot = 1 or more overvoted contests
 - Reject Ballot = Blank
 - Accept Ballot = 1 or more undervoted contests
- Central Count Scanners Settings
 - Outstack Ballot = 1 or more overvoted contests
 - Outstack Ballot = Blank
 - Accept Ballot = 1 or more undervoted contests

Primary Election

- Parties
 - Democrat
 - Republican
 - Nonpartisan
- Languages
 - English
 - Spanish
 - Haitian Creole
- Precincts
 - 999 Precincts
 - One or more split precincts
- Ballots
 - Page length: 14"
 - Coded by Precinct ID
 - One or more 2-sided, 3-column
- Contests
 - One or more precinct only
 - One or more universal primary
 - At least one set at GEMS max field length
- Candidates
 - At least one name set at GEMS max field length
- Reporting Groups
 - Absentee
 - Early Voting
 - Election Day
 - Provisional
- Precinct Scanners Settings
 - Reject Ballot = 1 or more overvoted contests
 - Reject Ballot = Blank
 - Accept Ballot = 1 or more undervoted contests
- Central Count Scanners Settings
 - Outstack Ballot = 1 or more overvoted contests
 - Outstack Ballot = Blank
 - Accept Ballot = 1 or more undervoted contests

All voting system software and equipment included in this system was tested with one or more of the elections identified above. These tests included physical and functional audits, pre-election, election, and post-election activities, such as creating election definitions, importing previously coded test elections, preparing media for use with the voting equipment, scanning ballots, uploading results to the database server, running administrative and election results reports and reviewing those for accuracy.

Systems Setup & Configuration:

- Installation, validation, and verification of voting systems software
- Installation, validation, and verification of necessary commercial off the shelf (COTS) applications
- Installation, validation, and verification of upgraded OSX firmware (Version 1.2.7) on as many scanners as needed for testing
- Hardware Identification Record (serial numbers, PC descriptions, state and/or county property tags, etc.)

Physical Audits:

- AccuVote-OSX
- AccuVote-TSX
- DRS PCS 960B
- AutoMARK VAT

Functional Audits (Calibration and Administrative menus – other menu/machine functions reviewed in association with mock elections):

- AccuVote-OSX
- AccuVote-TSX
- DRS PCS 960B
- AutoMARK VAT
- AccuVote-OS (basic review to determine that new memory card did not affect functionality)

Mock Elections Testing (General, Primary, Presidential Preference Primary, and Municipal):

Pre-Election Activities:

- Importing previously created election definitions for a General and Primary Election with previously identified parameters designed to assess the system's compliance with Florida laws, rules, and standards
- Preparing media for elections' testing: PCMCIA cards, compact flash cards, new OS memory cards
- Preparing pre-audited test decks for elections, including patterned machine marked and hand marked ballots with over voted, under voted, and blank ballots

Election Activities:

- Coding a Municipal and Presidential Preference Primary election with previously identified parameters designed to assess the system's compliance with Florida laws, rules, and standards
- Using AIMS software to create election files with audio capability
- Conducting mock elections for General, Municipal, Presidential Preference Primary, and Primary Elections using all voting equipment included in certification (OSX, TSX, AutoMARK, and DRS PCS960B):
 - Installing election definitions into voting equipment
 - Printing zero report
 - Casting pre-audited 'pattern marked' ballots (ballots marked with AutoMARK included)
 - Ending election
 - Printing election results tape
 - Uploading election results to GEMs server
- Performing activities on the TSX and AutoMARK VAT, including audio only ballot – using number touchpad, combined audio & visual ballot, and ballots with contrasted text and/or large text

Post-Election Activities:

- Running GEMs results reports and comparing reports to both scanner results tapes and vote totals as determined in pre-audited test decks.
- Creating and verifying the election night results file and precinct level results file exports from the GEMS database.
- Modeming election results using the AccuVote-OSX to verify the accuracy/functionality of transferring vote totals by modem into the GEMS 1.21.6, Version 1 database: This test was conducted at the Leon County Supervisor of Election's office, using their Digiboard modem and phone bank. Municipal Election memory cards were created, including vote centers: Mail Absentee, Early Voting, Provisional, and two precincts (Miccosukee and Ft. Braden). Results from each memory card were successfully uploaded to the GEMS server.

Mass Ballot Counts

- AV-OSX Precinct Scanner – This voting device underwent a mass ballot count (MBC) test, on a single unit, with the casting of a little over 13,000 ballots. The General Election was used for this effort.
- PCS 960, Model B Central Count Scanner – A “mini” mass ballot count was conducted using this scanner. A “full” central count scanner MBC, of 192,000 ballots, was not required for this scanner because it was merely an update to the previously certified PCS 960, meaning that there was no change to the firmware. Approximately 12,000 Primary Election ballots were scanned.

Additional Items Reviewed:

- AV-OSX Protective Count - Explanation above in “Background” section.
- AV-OSX Date Stamp (on Results Tapes) – Explanation above in “Background” section.
- AV-OS PCMCIA Memory Card – Because the currently approved memory cards have batteries that fail over time, DVS requested that BVSC examine a new memory card, which does not require a battery, for inclusion in their Voting System Certification as an optional memory card for use with the AV-OS version 1.96.14.
- AV Validator, Version 1.0.1 – Evaluated DVS’ tool for extracting the firmware contents from an OSX and a TSX.
- Electronic Adjudication – Dominion staff demonstrated this functionality on the PCS 960, Model B and DOE staff had an opportunity to perform various test scenarios and document the outcome of those activities.
- Mock Contest Recount (PCS & OSX) – Individual tests were done using both an AV-OSX and a PCS960B scanner: One contest was isolated on a Primary Election ballot, so that only that contest’s votes were counted. Staff installed the media, ran zero reports (i.e. opened the polls), scanned audited, marked ballots that had been manually tallied, closed the polls, uploaded election results to the GEMS server, ran the appropriate reports, and compared the vote totals in the election database to the manually audited outcome.
- PCS Catastrophic Failure – Simulated complete failure of PCS during scanning of marked ballots to determine the system’s capability to retain ballot images so that they could be extracted in the event of catastrophic failure, caused by an event such as a sudden power outage.
- Underline and Strikethrough Testing – Legislative changes that take effect in 2013, mandate that ballots can accommodate full text amendments, with edit marks (i.e. strikethrough and underlined text). While the system does not yet have to have this functionality, it was reviewed to determine whether the database and voting devices were capable of fulfilling this mandate.
- Voter Card Encoder Tool, Version 1.3.3 – Application was installed and Security Key Cards, Central Administrator Cards, and Supervisor Cards with the DVS default programmed number were re-programmed with ‘new’ access numbers and then were reverted to default numbers.
- Ballot Sensitivity Test on the OSX – The test deck used to evaluate the AV-OSX scanner’s ballot sensitivity was created by marking blank ballots from the Presidential Preference Primary Election that was previously used in this initiative. The test was performed on one OSX with ballots marked in such a way as to determine the capability of the scanner to read marks made by various marking devices. The table below illustrates the specific instruments utilized to mark the 25 ballots scanned for this activity. The test included a baseline scan of the ballots with selected ovals fully marked as

indicated; and then incorporated scanning of a test deck, with the same ovals, but marking a 1 millimeter line through the center of the oval. Also included in the table, in the column labeled ‘Finding,’ are the results obtained for each scanned ballot.

Marking Device	Device Type	Color	Finding [A=Accepted; UM=Unreadable Marks]	
			Fully Marked Oval [Baseline]	1 mm Horizontal Line thru Center of Oval
Office Depot Pencil	#2	Gray	A	A
Steadler Pencil	#2B	Gray	A	A
Steadler Pencil	#B	Gray	A	A
Steadler Pencil	#HB	Gray	A	A
Steadler Pencil	#F	Gray	A	A
Steadler Pencil	#H	Gray	A	A
Steadler Pencil	#2H	Gray	A	A
Steadler Pencil	#3B	Gray	A	A
Steadler Pencil	#4H	Gray	UM: Ambiguous mark detected	UM: Ambiguous mark detected
K-Dent	Ball Point (med. pt.)	Blue	A	A
“Hotel” Ink Pen [Renaissance Hotel]	Ball Point (med. pt.)	Light Blue	A	A
Pilot G2 Ink Pen	Ball Point (med. pt.)	Red	UM: Blank Ballot Detected See Election Official	UM: Blank Ballot Detected See Election Official
Papermate	Ball Point (med. pt.)	Green	A	A
EF Felt Pen (Vendor Recommended)	Felt Tip (med. pt.)	Black	A	A
Sharpie	Highlighter	Orange	UM: Blank Ballot Detected See Election Official	UM: Blank Ballot Detected See Election Official
ES&S Recommended Pen		Black	A	A
Vendor Pen- “X” mark EF Felt Pen	Felt Tip (fine pt.)	Black	n/a	A
Vendor Pen- “√” mark EF Felt Pen	Felt Tip (fine pt.)	Black	n/a	A
Vendor Pen- “\” mark EF Felt Pen	Felt Tip (fine pt.)	Black	n/a	A
Vendor Pen- “O” mark on oval line EF Felt Pen	Felt Tip (fine pt.)	Black	n/a	A
Steadler Pencil	#4B	Gray	A	A
Steadler Pencil	#5B	Gray	A	A
Steadler Pencil	#6B	Gray	A	A

Steadler Pencil	#3H	Gray	A	UM: Ambiguous mark detected
Vendor Pen- “●” mark oval center, w/o filling oval completely EF Felt Pen	Felt Tip (fine pt.)	Black	n/a	A

NOTE: Items marked ‘n/a’ were special markings (such as ‘X’ or ‘\’) and, therefore, the ballot with ovals fully marked with the ‘vendor’ pen sufficed for these criteria.

This test shows that the OSX scanner is able to detect a wide variety of marks made by several different marking devices, including ink pens, markers, highlighters, and pencils. It is important to note; however, that marks made by some ‘ball point pens’ and the harder pencil grades were not always detected. As such, the vendor should clearly document its recommended marking device(s).

▪ **Test Results and Findings of Compliance**

There were no unexpected outcomes resulting from any of the test activities conducted in the examination of the voting system. Neither the regressed protective count, nor the future date stamp on AV-OSX results tapes was encountered with this version of the AV-OSX firmware (1.2.7). In addition, other ancillary evaluations as identified above were all satisfactorily tested. The only area worthy of note is with regard to the catastrophic failure of a PCS960B central count scanner. When this scanner encountered an immediate shut down, the work space was saved, but the ballot images were lost for the deck that was being scanned at the time of the catastrophic failure, which is expected behavior as the scanner does not save the ballot images of a deck until the deck has been closed. This anomaly does not in any way affect vote tallies and, depending on the individual style of the scanner's user, may not be an issue, as many users would choose to 'start over' with the ballot deck to be scanned in the event of such an occurrence.

The voting system under test was further reviewed to ascertain whether upcoming mandated Legislative changes with regard to a 'full text' amendment being presented on the ballot, to take effect in 2013, can be fulfilled with the 1.21.6 version of GEMS. The GEMS database can accommodate this functionality and the precinct scanner and central count scanner are not affected by these font characteristics. However, the AutoMARK and the TSX do not currently support this requirement.

A copy of the firmware and software provided for this certification effort has been reproduced (OSX firmware, Version 1.2.7 and GEMS Software, Release 1.21.6, Version 1) and provided to Dominion Voting Systems so that they can make copies [referred to by the Division as the 'Bronze Disks']. As usual, DVS will create duplicates of the Bronze Disks and return those to the Division. The Division will verify that the contents of the media matches the firmware and software which were certified and will then forward same to a county as needed. The voting system under test is listed below.

“GEMS Release 1.21.6, Version 1”

[Redacted pursuant to section 282.318, Florida Statutes, and to the U.S. Department of Homeland Security's designation of elections as a critical infrastructure.]

[Redacted, continued]