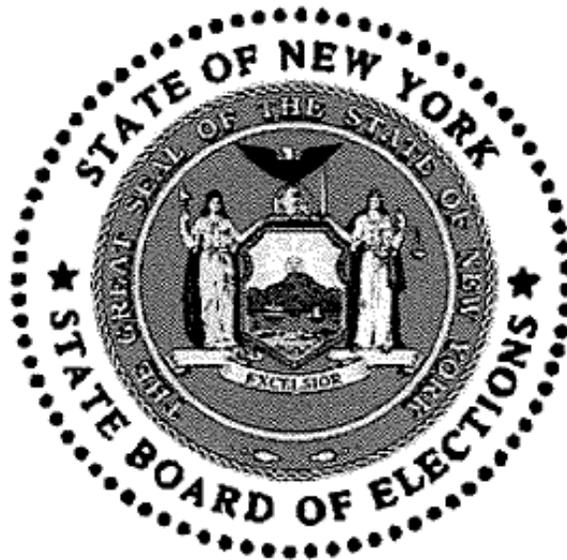


STATE OF NEW YORK
STATE BOARD OF ELECTIONS

NYSBOE Functional Test of ES&S DS 200 and AutoMark Voting System

5.0.0.1 upgrade



Prepared by the Elections Operations Unit
Presented at the December 10, 2012 Meeting of the
New York State Board of Elections

1. INTRODUCTION

1.1 Project Overview

This Document is a report on the Functional Testing conducted on the upgrade of the previously certified software and firmware, as submitted by Election Systems and Software (ES & S), for their voting system and ballot marking device. The corresponding trusted build version consists of the EMS EVS (ES&S Voting System) version 5.0.0.1. The EVS 5.0.0.1 suite consists of the following components: ElectionWare (EW) v 4.1.0.1, Election Reporting Module (ERM) v 8.6.0.2, Event Log Service v 1.5.0.1, Removable Media Service v 1.4.0.11.2.0.0, RMCOBOL (COTS), and VAT Preview 1.8.1.1. These new versions, if certified, will replace the current versions of the NYS Certified System (see table below):

Module	New Version	Current Version
EMS Unity Suite	5.0.0.1	3.0.2.0
Election Data Manager (EDM)	Removed	8.4.0.0
ElectionWare (EW)	4.1.0.1	3.0.0.0
Election Reporting Module (ERM)	8.6.0.2	8.4.0.0
Event Log Service	1.5.0.1	1.3.0.0
Removable Media Service	1.4.0.1	1.2.0.0
RMCOBOL (COTS)	12.06	11.01
VAT Previewer	1.8.1.1	1.8.0.1
DS200 Scanner	2.7.0.1	2.4.0.0
DS200 Scanner Board	2.24.0.1	2.23.0.0
AutoMARK VAT firmware	1.8.1.1	1.8.0.1
DS200 Power Management Firmware	1.2.6.1	1.2.5.0

The upgrades submitted are intended to address, inter alia, the ES&S system's change notes, screen changes identified through usability studies, and the necessary

conversion to a new operating system compliance with the new version of Windows (Windows 7).

1.2 System Enhancements

This upgrade includes the following updates and enhancements to the ES&S voting system:

- Elimination of EDM (Election Data Manger). This module's functionality has been merged into Electionware for better usability.
- Ability to function under the new Windows 7 operating system
- Improved voter screens for overvote warning messages and double vote warning messages.
- A fix to eliminate the DS200 from locking up if left running without a memory stick inserted into the system
- Enhanced Write-In functionality to allow for write-in's to be identified even when the oval is not filled in.
- EMS Functionality for the Central Count DS850 (source code review) to be fully certified at a later date.

1.3 Purpose

The purpose of this functional testing was to verify that the upgrade to the software and firmware still perform the required functions of its certified predecessor and addressed the previously identified open issues as well as change requests.

This document describes:

- The overall Test Plan and approach implemented, to thoroughly test the upgraded software and firmware
- The overall results and findings from the functional testing performed

2. APPROACH AND PROCEDURES

2.1 Requirements

Testing verifies that the upgrades did not disrupt, disable or otherwise disaffect the required functions of the certified build, therefore multiple variations of elections were generated to test the upgrade. The following ballot variations were used in the functional testing performed by SBOE staff. Both comprehensive and standard test decks were used as part of the logic and accuracy testing required by the test plan:

- **General Elections of 17 inch ballots in length were created from scratch using the EVS 5.0.0.1 EMS suite. These elections were required so that testing would accommodate both landscape and portrait layouts.**
- **Primary Elections of 17 inch ballots in length were created from scratch using the EVS 5.0.0.1 EMS suite. These elections were required so that testing would accommodate both landscape and portrait layouts.**
- **General Elections of both 17 inch and 19 inch ballots in length will be imported from a previously-created election using the EVS 5.0.0.1 EMS. These elections were required so that testing would accommodate both landscape and portrait layouts.**
- **Primary Elections of both 17 inch and 19 inch ballots in length will be imported from a previously created election using the EVS 5.0.0.1 EMS. These elections were required so that testing would accommodate both landscape and portrait layouts.**

These requirements resulted in nine separate test cases that would test each variation:

- **Test Case #1 – Created General 17 Inch Landscape**
- **Test Case #2 – Created General 17 Inch Portrait (Grid)**
- **Test Case #3 – Created Primary 17 Inch Landscape**
- **Test Case #4 – Created Primary 17 Inch Portrait (Column)**
- **Test Case #5 – Imported General 19 Inch (70 Timing Marks) Landscape**
- **Test Case #6 – Imported General 19 Inch (91 Timing Marks) Landscape**
- **Test Case #7 – Imported General 17 Inch Portrait (Grid)**
- **Test Case #8 – Imported Primary 17 Inch Landscape**
- **Test Case #9 – Imported Primary 19 Inch (70 Timing Marks) Portrait (Column)**
- **Test Case #10 – Imported Multi-Page General 19 inch Landscape**
- **Test Case #11 – Imported Multi-Page Primary 17 inch Portrait (Coulumn)**

Test case 12 was created to verify any functionality or feature that did not appear in the previous nine test cases, such as testing each button option, multi page ballot, etc.

- **Test Case #12 – Button Test and New Features Not Identified in Previous Test Cases.**

Test Case 13 was created to verify the trusted build of the software. In addition, test decks used in this test case 13 were redesigned to verify the behavior and screen messages for double votes and overvotes.

- **Test Case #13 – Trusted Build TestCase**

These Test Cases were tested over 2 different Hardware Configurations:

- **Standalone System – Single workstation containing the EVS 5.0.0.1 EMS**
- **Client/Server – 2 systems networked (Server which contains the SQL database and a Client which utilizes the SQL database on the Server through a network)**

Test Cases 1-11 were required to be verified on each system configuration.

Each Test Case requires a Test Deck marked in a predetermined fashion. Some Test Cases used multiple ED's while others used only one. The majority had smaller 6 or 7 Ballot Test Decks consisting of multiple ballot styles, while others had full Comprehensive Test Decks created based on SBOE Standards. The following table lists the Test Decks built for the functional testing:

Test Case Title	Type of Election	Number of Ballots
Created General 17 Inch Landscape	General	7
Created General 17 Inch Portrait (Grid)	General	2 Ballot Styles (7 ballots per style)
Created Primary 17 Inch Landscape	Primary	2 Ballot Styles (6 ballots per style)
Created Primary 17 Inch Portrait (Column)	Primary	2 Ballot Styles (6 ballots per style)
Imported General 19 Inch (70 Timing Marks) Landscape	General	4 Ballot Styles (7 per Style) = 28
Imported General 19 Inch (91 Timing Marks) Landscape	General	1 st Style = 151
		2 nd Style = 106
Imported General 17 Inch Portrait (Grid)	General	7
Imported Primary 17 Inch Landscape	Primary	3 Ballot Styles (7 ballots per style)
Imported Primary 19 Inch (70 Timing Marks) Portrait (Column)	Primary	1 st Style = 51
		2 nd Style = 19
Imported Multi-Page General 19 Inch Landscape	General	1 st Style (Page 1) = 7
		2 nd Style (Page 2) = 7
Imported Multi-Page Primary 17 Inch Portrait (Column)	Primary	2 ballot Styles (Page 1 – 7 Ballots per Style)
		2 ballot Styles (Page 2 – 7 Ballots per Style)
Trusted Build – Created Primary 17 Inch Landscape Created General 17 Inch Portrait (Grid) Imported General 19 inch (70 Timing Marks) Landscape	Primary	2 Ballot Styles (6 ballots per style)
	General	2 Ballot Styles (7 ballots per style)
	General	2 Ballot Styles (7 per Style) = 14

3. Test Plan

The Test Plan was designed to work in several phases:

Phase 1 – Planning and Test Case Development

- **Verify requirements and draft designs of the Test Cases**
- **Prepare Test Case Procedures**
- **Imported Elections from previously created elections on EVS 5.0.0.1.**
- **Create Elections from scratch using the EVS 5.0.0.1 EMS Suite.**

Phase 2 – Implementation

- **Receive and Install the testing workstations and the upgraded software**
- **Receive training on the upgrades by ES&S representatives**
- **Perform the Dry Run on each of the initial 11 Test cases**
- **Correct and amend Test cases to accommodate the upgrades**
- **Perform the Official Run For Record of the initial 11 Test Cases**
- **Archive the results and data from the Official Run for Record**
- **Perform the Official Run for Record on the Test case 12.**
(Due to the nature of Test Case 12, no dry run was required)

Phase 3 –Finalizing Documentation and Records

- **Perform final formatting adjustments to Test Cases**
- **Collect Test Materials(Marked Ballots, Tape Results) and Records for Final Archive**
- **Prepare finalized reports on project**

Adjustments were made to the test plan to address several scenarios. Some of the adjustments made were as follows:

- **Performing only one Dry Run instead of two**
- **Test cases were divided across the 2 configurations (Stand Alone and Client Server)**
- **Test cases were selected to verify that the following functions performed correctly:**
 - **Creating a general Election (Landscape and Portrait)**
 - **Creating a Primary Election (Landscape and Portrait)**
 - **Ability to import previously created elections (from EVS 5.0.0.1 only)**

- Producing both Primary and General Election ballots in both orientations
 - Scanner tabulation performed correctly
 - Results were read into EMS and accurate reports were produced
- The page 1 ballots for the MPG1991LIm were not being recognized by the AutoMARK or DS200. This was due to no timing marks being printed on the back of the page 1 ballots. The default setting to omit timing marks on ballot faces where there were no votable positions had to be reset. To obtain new ballots quickly, the election layout was modified to a 14 inch landscape layout and printed at the NYSBOE.
 - A Trusted Build Test Case was added which provided a final verification of the software and verified behavior and messages for double vote and overvote processing.

3.1 Procedure

The procedures performed are detailed in the supplemental Test Case documents. The first two Test Cases required creating an election from scratch on each system configuration, utilizing the new Capture module. The next two Test Cases required creating an election from scratch on each system configuration, utilizing importable text files and ballot styling templates. The next five Test Cases required importing the election backup files created earlier. The General Functionality Test Case involved creating election scenarios to verify the general functionality of each software module and the items not addressed by the previous Test Cases. The Final Test Case involved utilizing created, imported, and restored elections to verify the trusted build. This test case provided extensive testing on the behaviors and messages for double vote and overvote functionality to ensure that ES&S had developed the screens and functionality consistent with the court order.

Twenty-nine (29) test decks were run in the twelve test cases to verify that the upgrades did not affect the logic and accuracy of the voting machines. The Test Decks were marked in a pre-determined pattern to verify the logic and accuracy of the system. The majority of the ballots were marked by hand while at least one ballot in each Test Deck was marked using the BMD. The Test Decks Consisted of the following elections:

Test Case Name	Test Deck	Election Type	# of Ballots	# of Contests	Contests Vote For
Created General 17 Inch Landscape	Test Deck 1	General	7	6	2 vote for 1, 1 vote for 2, 3 Propositions

Created General 17 Inch Portrait (Grid)	Test Deck 2	General	7	6	2 vote for 1, 1 vote for 2, 3 Propositions
	Test Deck 3	General	7	5	2 vote for 1, 3 Propositions
Created Primary 17 Inch Landscape	Test Deck 4	Primary	6	1	1 vote for 2
	Test Deck 5	Primary	6	1	1 vote for 1
Created Primary 17 Inch Portrait (Column)	Test Deck 6	Primary	6	1	1 vote for 1
	Test Deck 7	Primary	6	1	1 vote for 1
Imported General 19 Inch (70 Timing Marks) Landscape	Test Deck 8	General	7	9	5 vote for 1, 1 vote for 4, 3 Propositions
	Test Deck 9	General	7	9	5 vote for 1, 1 vote for 4, 3 Propositions
	Test Deck 10	General	7	9	5 vote for 1, 1 vote for 4, 3 Propositions
	Test Deck 11	General	7	9	5 vote for 1, 1 vote for 4, 3 Propositions
Imported General 19 Inch (91 Timing Marks) Landscape	Test Deck 12	General	151	9	5 vote for 1, 1 vote for 4, 3 Propositions
	Test Deck 13	General	106	8	5 vote for 1, 3 Propositions
Imported General 17 Inch Portrait (Grid)	Test Deck 14	General	7	9	5 vote for 1, 1 vote for 4, 3 Propositions
Imported Primary 17 Inch Landscape	Test Deck 15 (Republican)	Primary	7	3	3 vote for 1
	Test Deck 16 (Democratic)	Primary	7	2	1 vote for 1, 1 vote for 4
	Test Deck 17 (Democratic)	Primary	7	2	1 vote for 1, 1 vote for 4
Imported Primary 19 Inch Portrait (Column)	Test Deck 18 (Republican)	Primary	19	3	3 vote for 1
	Test Deck 19 (Democratic)	Primary	51	2	1 vote for 1, 1 vote for 4
Imported Multi-Page General 14 Inch Landscape	Test Deck 20	General	7	4	4 vote for 1
	Test Deck 21	General	7	5	1 vote for 1, 1 vote for 4, 3 Propositions
Imported Multi-Page Primary 17 Inch Portrait (Column)	Test Deck 22 (Democratic)	Primary	7	1	1 vote for 1
	Test Deck 23 (Democratic)	Primary	7	1	1 vote for 4
	Test Deck 24 (Republican)	Primary	7	2	2 vote for 1
	Test Deck 25 (Republican)	Primary	7	1	1 vote for 1
Trusted Build – Imported General 19 inch (70 Timing Marks) Landscape	Test Deck 26	General	7	9	5 vote for 1, 1 vote for 4, 3 Propositions
	Test Deck 27	General	7	9	5 vote for 1, 1 vote for 4, 3 Propositions
Trusted Build – Created General 17 inch Portrait	Test Deck 28	General	7	6	2 vote for 1, 1 vote for 2, 3 Propositions

(Grid)	Test Deck 29	General	7	5	2 vote for 1, 3 Propositions
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Once all of the Test Cases were completed and results were verified, backup files were made of the 13 Test Case elections. Along with the reports, these files were saved to a DVD. All of the Test Decks, results tapes, and associated materials were collected and organized for filing and archiving.

4. Results

4.1 Overall

The twelve base test cases performed as expected. The created elections were able to be created and run without issue as were the imported elections.

Test Case Name	Test Deck	# of Ballots	# of Contests	Contests Vote For	Pass/Fail
Created General 17 Inch Landscape	Test Deck 1	7	6	2 vote for 1, 1 vote for 2, 3 Propositions	Pass
Created General 17 Inch Portrait (Grid)	Test Deck 2	7	6	2 vote for 1, 1 vote for 2, 3 Propositions	Pass
	Test Deck 3	7	2	2 vote for 1	
Created Primary 17 Inch Landscape	Test Deck 4	6	1	1 vote for 2	Pass
	Test Deck 5	6	1	1 vote for 1	
Created Primary 17 Inch Portrait (Column)	Test Deck 6	6	1	1 vote for 1	Pass
	Test Deck 7	6	1	1 vote for 1	
Imported General 19 Inch (70 Timing Marks) Landscape	Test Deck 8	7	9	5 vote for 1, 1 vote for 4, 3 Propositions	Pass
	Test Deck 9	7	9	5 vote for 1, 1 vote for 4, 3 Propositions	
	Test Deck 10	7	9	5 vote for 1, 1 vote for 4, 3 Propositions	
	Test Deck 11	7	9	5 vote for 1, 1 vote for 4, 3 Propositions	
Imported General 19 Inch (91 Timing Marks) Landscape	Test Deck 12	143	9	5 vote for 1, 1 vote for 4, 3 Propositions	Pass
	Test Deck 13	98	8	5 vote for 1, 3 Propositions	
Imported General 17 Inch	Test Deck 14	7	9	5 vote for 1, 1 vote for 4, 3 Propositions	Pass

Portrait (Grid)					
Imported Primary 17 Inch Landscape	Test Deck 15 (Republican)	7	3	3 vote for 1	Pass
	Test Deck 16 (Democratic)	7	2	1 vote for 1, 1 vote for 4	
	Test Deck 17 (Democratic)	7	2	1 vote for 1, 1 vote for 4	
Imported Primary 19 Inch Portrait (Column)	Test Deck 18 (Republican)	11	3	3 vote for 1	Pass
	Test Deck 19 (Democratic)	43	2	1 vote for 1, 1 vote for 4	
Imported Multi-Page General 14 Inch Landscape	Test Deck 20	7	4	4 vote for 1	Pass
	Test Deck 21	7	5	1 vote for 1, 1 vote for 4, 3 Propositions	

Imported Multi-Page Primary 17 Inch Portrait (Column)	Test Deck 22 (Democratic)	7	1	1 vote for 1	Pass
	Test Deck 23 (Democratic)	7	1	1 vote for 4	
	Test Deck 24 (Republican)	7	2	2 vote for 1	
	Test Deck 25 (Republican)	7	1	1 vote for 1	
Trusted Build – Imported General 19 inch (70 Timing Marks) Landscape	Test Deck 26	7	9	5 vote for 1, 1 vote for 4, 3 Propositions	Pass
	Test Deck 27	7	9	5 vote for 1, 1 vote for 4, 3 Propositions	
Trusted Build – Created General 17 inch Portrait (Grid)	Test Deck 28	7	6	2 vote for 1, 1 vote for 2, 3 Propositions	Pass
	Test Deck 29	7	5	2 vote for 1, 3 Propositions	

The Button Test and New Features Not Identified in Previous Test Cases (Test Case #12) verified the functionality of all the button options presented in each software module along with any feature not previously tested in the EVS 5.0.0.1 Suite (, ElectionWare, ERM). Functions not tested are not functions utilized by the State of New York. These functions were identified in the test case as either "Not Applicable" or "No Longer Supported". However, all the necessary functions were verified that are utilized by the State of New York.

All changes presented in the ES&S System Change Notes were either verified by Test Cases #1-11 or by Test Case #12.

Any changes that were not functionally tested due to the nature of the change were identified and reviewed by SLI (NYSBOE's Independent Testing Lab) during source code review.

4.2 Findings/Workarounds

The following are findings/workarounds that became apparent in the test cases:

- Due to database changes elections created in prior versions cannot be imported into EVS 5.0.0.1

5. Conclusion

During our functional testing we did not encounter any issues that would be considered show stoppers and otherwise jeopardize the voting integrity of the election process. The logic and accuracy of the DS200 scanner functioned as intended and the voting results obtained with all of the Test Decks used matched the pre-determined expected vote results. The upgrade changes made to the EMS enabled the SBOE testing team to create ballots from scratch in both Landscape and Portrait orientations. The functional testing team was able to restore the election definitions from backup files generated in EVS 5.0.0.1.

Based on NYSBOE functional testing and all source code reviews of the ES and S submission of EVS 5.0.0.1 EMS Suite upgrade, DS200 firmware upgrade, and AutoMARK firmware upgrade, we recommend that the ES&S voting system upgrades described herein be certified for use in New York State.