

Certification Test Plan - Modification

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Prepared for:

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**Accredited by the Election
Assistance Commission (EAC)
for Selected Voting System Test
Methods or Services**



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1 INTRODUCTION

This Certification Test Plan outlines the test approach SLI Global Solutions will follow when performing Certification Testing on the **Hart Verity Voting 2.0 voting system** against the 2005 Voluntary Voting System Guidelines (VVSG). The purpose of this document is to provide a clear understanding of the work SLI will conduct and a detailed plan outlining the test effort.

When the testing is complete, SLI will submit a Certification Test Report that details all test results and findings from the Certification Test effort, as well as a recommendation to the EAC.

1.1 Description and Overview of the Certified System

This **test plan** contains a description of the previously certified system, the specific modifications to the current system version, and the impact of those modifications on the system and certification testing.

1.1.1 Definition of the Baseline Certified System

This modification project builds upon the foundation established in **Verity Voting 1.0**, which contained the applications: **Verity Build**, **Verity Central** and **Verity Count**, as well as the polling place devices **Verity Scan** and **Verity Touch Writer**.

1.1.2 Modifications

Modifications to **Verity Voting 2.0** include the addition of the ballot setup software application **Verity Data**, the voting center pre-voting ballot printing solution **Verity Print**, as well as the polling place devices **Verity Controller**, **Verity Touch** and **Verity Touch with Access** (DRE implementation). Additionally, a number of source code updates were implemented in order to resolve Verity Voting 1.0 issues. Each update will be reviewed and tested for.

Additionally, all Change Orders applied to **Verity Voting 1.0** will be verified to be incorporated into **Verity Voting 2.0**.

1.1.3 Initial Assessment of Impact of the Modifications

Verity Data will modify the input method to get ballot definition data into **Verity Build**, and will require in depth testing in order to verify that data is of a robust quality that does not introduce issues.



Verity Print introduces a new method of printing ballots and will require that its outputs are run through both **Verity Central** and **Verity Scan** in order to verify that the creation of ballots remains robust.

Verity Controller, Verity Touch and **Verity Touch with Access** introduces a new method of voting in the polling place. It will require that a maximum configuration of daisy chained **Verity Controller/Verity Touch/ Verity Touch with Access** is exercised. **Verity Count** will be used to verify the accuracy of the vote accumulation process.

1.1.4 Regression Testing

All elements of **Verity Voting 2.0** will be regression tested in order to verify continued compliance to (2005) VVSG 1.0.

1.2 References

The following is a listing of all documents that contain material that was used in the preparation of this test plan.

1. Election Assistance Commission Voluntary Voting System Guidelines (EAC VVSG), 2005 Version 1.0. Volumes I and II.
2. NIST NVLAP Handbook 150: 2006.
3. NIST NVLAP Handbook and 150-22: 2008.
4. EAC Voting System Testing and Certification Program Manual, United States Election Assistance Commission, v 2.0, 2015
5. SLI VSTL Quality System Manual, v 2.0, November 2015
6. EAC Notice of Clarification 09-001 Clarification of the Requirements for Voting System Test Laboratories (VSTLs) Development and Submission of Test Plans

1.3 Terms and Abbreviations

The following terms and abbreviations will be used throughout this document:

Table 1 – Terms and Abbreviations

Term	Abbreviation	Description
American Association for Laboratory Accreditation	A2LA	A nonprofit, non-governmental, public service, membership society whose mission is to provide comprehensive services in laboratory accreditation and laboratory-related training.



Term	Abbreviation	Description
Ballot Marking Device	BMD	An accessible computer-based voting system that produces a marked ballot (usually paper) that is the result of voter interaction with visual or audio prompts.
Central Count Scanner	CCS	High Speed Digital Scanner is a ballot scanning device typically located at a central count facility and is operated by an automated multi-sheet feeding capability.
Compact Flash card	CF	This is a type of flash memory card in a standardized enclosure often used in voting systems to store ballot and/or vote results data.
Compact Flash AST	CFAST	A compact flash media based on the Serial ATA bus rather than the Parallel ATA bus, used by the original CompactFlash
Commercial Off the Shelf	COTS	Commercial, readily available hardware devices (such as card readers, printers or personal computers) or software products (such as operating systems, programming language compilers, or database management systems)
Election Assistance Commission	EAC	An independent, bipartisan commission created by the Help America Vote Act (HAVA) of 2002 that operates the federal government's voting system certification program.
Election Management System	EMS	Typically a database management system used to enter jurisdiction information (district, precincts, languages, etc.) as well as election specific information (races, candidates, voter groups (parties), etc.). In addition, the EMS is also used to layout the ballots, download the election data to the voting devices, upload the results and produce the final results reports.
Electromagnetic Compatibility	EMC	The goal of EMC is to validate the correct functioning of different equipment in the same environment and the avoidance of any interference effects between them.
Functional Configuration Audit	FCA	Exhaustive verification of every system function and combination of functions cited in the vendor's documentation. The FCA verifies the accuracy and completeness of the system's Voter Manual, Operations Procedures, Maintenance Procedures, and Diagnostic Testing Procedures.
Independent Test Authority	ITA	This is a test lab that is not connected with the vendor or manufacturer of the voting system.



Term	Abbreviation	Description
Chevron	No Abbreviation	Verity components use workflow chevrons. Workflow chevrons, arranged along the top of the screen, identify the function the user is currently viewing.
Institute of Electrical and Electronics Engineers	IEEE	A non-profit organization, IEEE is the world's leading professional association for the advancement of technology.
National Institute of Standards and Technology	NIST	A non-regulatory federal agency within the U.S. Dept. of Commerce. Its mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.
National Voluntary Laboratory Accreditation Program	NVLAP	A division of NIST that provides third-party accreditation to testing and calibration laboratories.
Physical Configuration Audit	PCA	The testing activities associated with the physical aspects of the system (hardware, documentation, builds, source code, etc.).
Precinct Count Scanner	PCS	A precinct-count optical scanner is a mark sense-based ballot and vote counting device located at a precinct and is typically operated by scanning one ballot at a time.
Request For Information	RFI	A form used by testing laboratories to request, from the EAC, interpretation of a technical issue related to testing of voting systems.
Requirements Matrix	N/A	This is the matrix created by the EAC and maintained by SLI that traces the requirements to the various test modules and test methods.
Standard Lab Procedure	SLP	SLI's quality system documentation is made up of standard lab procedures (SLPs), which are procedures required to ensure a systematic, repeatable and accurate approach to voting systems testing and governing the actual performance of SLI's work.
Technical Data Package	TDP	This is the data package that is supplied by the vendor and includes: Functional Requirements, Specifications, End-user documentation, Procedures, System Overview, Configuration Management Plan, Quality Assurance Program, and manuals for each of the required hardware, software, firmware components of each voting system.



Term	Abbreviation	Description
Test Method	TM	SLI proprietary documents which are designed to group sets of EAC VVSG requirements in a logical manner that can be utilized to more efficiently validate where and how requirements, or portions of a requirement, are met.
Validation	No Abbreviation	Confirmation by examination and through provision of objective evidence that the requirements for a specific intended use or application have been fulfilled (ISO 9000)
Verification -	No Abbreviation	Confirmation by examination and through provision of objective evidence that specified requirements have been fulfilled (ISO 9000)
Voluntary Voting Systems Guidelines Volumes 1 & 2	VVSG	A set of specifications and requirements against which voting systems can be tested to determine if the systems provide all of the basic functionality, accessibility and security capabilities required of these systems.
Voting Center		Typically a convenience voting location that manages multiple ballot styles
Voting System Test Lab	VSTL	This is the lab where the voting system is being tested.
Voting System Under Test	VSUT	The designation for a voting system that is currently being tested.
Voting Test Specialist	VTS	An SLI employee within the Compliance division that has been qualified to perform EAC voting system certification testing.

1.4 Project Overview

This test plan outlines the approach SLI will implement to perform testing of the **Hart Verity Voting 2.0** voting system against the requirements of the federal 2005 Voluntary Voting System Guidelines (VVSG), Volumes 1 and 2. This project is for an EAC modification certification effort.

1.5 Purpose

The purpose of this EAC Test Plan is to create clear and precise documentation of the processes that SLI, as an EAC VSTL, will implement throughout the course of voting system verification testing.

This Test Plan:



- Defines the overall test approach.
- Identifies required voting system hardware and software to be tested, and in what configurations.
- Identifies required hardware, software, and tools to be used to support the testing efforts.
- Defines the types of tests to be performed and against what declared functionality.
- Defines the types of election and vote data required for effective testing.
- Defines the types of voting system threats and vulnerabilities against which the voting system will be tested.
- Serves as a foundation for the **Hart Verity Voting 2.0** test suites
- Identifies and establishes traceability from the Requirements Matrix to SLI Test Methods to **Hart Verity Voting 2.0** specific test modules
- Defines the process for recording and reporting test results.

1.6 Scope of Testing

SLI will provide testing on the **Hart Verity Voting 2.0** voting system based on the guidelines established for voting system verification testing as defined by the EAC's 2005 VVSG. This effort will include all required levels of software, firmware, system and hardware testing required to demonstrate that the **Hart Verity Voting 2.0** voting system is tested against the requirements of the 2005 VVSG, through implementation of SLI's Test Methods and Standard Lab Procedures (Please see Table 1 – Terms and Abbreviations for these terms' definitions).

SLI's major task categories for voting system verification testing, as defined by SLI's NVLAP audited and approved Quality System Manual, as well as the 2005 VVSG, include:

- Physical Configuration Audit (PCA)
 - Iterative documentation review and assessment
 - Iterative source code review
 - Trusted Builds. Identify the Trusted Build process to establish the system version and components being tested and ensure that the qualified executable release is built from the reviewed components.
 - Software and Hardware Configuration Audit. Verification of software and hardware physical and functional configurations.

Note that Documentation and Source Code Review are denoted as "Iterative". When either Documentation or Source Code is reviewed, and items that do not meet the VVSG requirements are found, discrepancy reports are generated and sent to the manufacturer. Next, the manufacturer is allowed to resolve the issue and re-submit



the item in question. SLI then re-reviews to verify that the requirement is met. (SLI also validates that nothing else has been modified; if something else was modified, it is also re-reviewed.)

- Functional Configuration Audit (FCA)
 - Review of relevant state verification testing or risk analysis results.
 - Review of prior hardware testing results.
 - Verification of all Change Orders applied to Verity Voting 1.0 are incorporated into Verity Voting 2.0
 - Testing of voting system components and fully integrated systems to validate functionality, logic processing, system performance, security, and system level integration. This testing includes the formal test execution, utilizing customized iterations of SLI's formal Test Methods for the **Hart Verity Voting 2.0** voting system. Regression testing will be done when issues are found in testing and source code is modified, re-reviewed and re-built.
 - Accuracy testing and validation of a voting system's ability to accurately read and tally a large number of ballot marking positions within the requirements allowed by the 2005 VVSG.
 - Security testing and validation that a voting system is tested against all security related requirements as well as assessing the effectiveness of a voting system's security controls.
 - Verification of every system function cited in the vendor's documentation.
- Management of **Hart Verity Voting 2.0** supplied deliverables, SLI's test artifacts, and software, firmware, hardware and system test configurations.
- Generation of detailed and repeatable test modules based on SLI's formal Test Methods, to ensure the voting system is tested against all applicable requirements of the 2005 VVSG and associated **Hart Verity Voting 2.0** specific requirements in a manner consistent with SLI's Test Methods. Please see section, "1.9.7 – Additional Functionality/Requirements" for additional detail of **Hart Verity Voting 2.0** specific requirements.
- Generation of test data required for all test modules.
- Traceability of test modules to the requirements of the 2005 VVSG.
- Reporting of all test results.

SLI will develop and submit to the EAC a final test report for the **Hart Verity Voting 2.0** voting system.



1.7 Definition of the Hart Verity Voting 2.0 Voting System

This section provides a description of the scope of **Hart Verity Voting 2.0** voting system components:

- The **Hart Verity Voting 2.0** voting system represents a set of software applications for pre-voting, voting and post-voting election project activities for jurisdictions of various sizes and political division complexities. **Verity Voting 2.0** functions include:
 - Defining the political divisioning of the jurisdiction and organizing the election with its hierarchical structure, attributes and associations.
 - Defining the election events with their attributes such as the election name, date and type, as well as contests, candidates, referendum questions, voting locations and their attributes.
 - Preparing and producing ballot for polling place and absentee voting.
 - Preparing media for precinct voting devices and central count devices
 - Configuring and programming the **Verity Scan** digital scanners
 - Configuring and programming the **Verity Touch Writer** BMD devices
 - Configuring and programming the **Verity Controller/Touch/Touch with Access** DRE devices
 - Configuring and programming the **Verity Print** ballot printer devices
 - Producing the election definition and auditing reports.
 - Providing administrative management functions for user, database, networking and system management.
 - Import or manual data entry of the Cast Vote Records from **Verity Scan, Verity Controller** devices and **Verity Central**.
 - Preview and validation of the election results.
 - Producing election results tally according to voting variations and election system rules.
 - Producing a variety of reports of the election results in the desired format.
 - Publishing of the official election results.
 - Auditing of election results including ballot images and log files.
- **Verity Election Management** is software which enables users with the administrative role to import, export, archive, restore, and manage election definitions into the system. Once added, the election can be opened and handled per the features available within the **Verity Voting** system components installed on the workstation. The interface provides features for importing, deleting, and performing archives of the election data and settings within the specific Verity component. Officials can load an election definition for an in-progress election or store an archive election. This interface also allows officials to perform archives of the election definition as-is without changing the state.



Once archived, the election can be restored in that same state at the time of archive. All restored election definitions display in the list of elections within the component.

- **Verity User Manager** is software which enables users with the administrative role to create and manage user accounts within the Verity Voting system. Depending on the component, the user roles may include additional roles. All user accounts are accessible through this feature in all system components. Depending on the role, each user has access to different features and data management, available through tabbed sections with a list of all permissions.
- **Verity Data** is a component of the Verity Voting system used to create election data for contests, contestants, proposition text. **Verity Data** provides the user with controls for proofing of data, layout, and audio created. **Verity Data** also performs validation on the exported information to ensure that it will successfully import into **Verity Build**.
- **Verity Build** *imports elections from a XML file created by Verity Data or another application. Once imported it* opens the election to proof data, view reports, print ballots, configuring and programming the **Verity Scan** digital scanners, **Verity Touch Writer** BMD, **Verity Print** and **Verity Controller/Touch/Touch with Access** DRE devices, **Verity Central**, and **Verity Count** as well as producing the election definition and auditing reports.
- The **Verity Scan** is a digital scan ballot counter (tabulator) that is used in conjunction with an external ballot box. The unit is designed to scan marked paper ballots, interpret voter marks on the paper ballot and deposit the ballots into the secure ballot box.
- The **Verity Touch Writer** is a Ballot Marker Device (BMD) which also includes an Audio Tactile Interface (ATI), which allows voters who cannot complete a paper ballot to generate a machine-readable and human readable ballot, based on vote selections made, using the ATI.
- **Verity Verity Controller** is a polling place device that is used to activate and accumulate results from a range of 1 to 12 **Verity Touch** DREs daisy chained to **Verity Controller**. **Verity Controller** assigns a voter a unique access code that associates the voter to their correct ballot style. The voter is able to select any open **Verity Touch** and enter their assigned access code. **Verity Controller** receives the code entered by the voter, activates their ballot session and allows them to cast their vote in private. **Verity Controller** is used in tandem with **Verity Touch** and accumulates all results from each **Verity Touch** within the **Verity Controller** device.
- **Verity Touch** is a Direct Recording Electronic (DRE) device that allows a voter to cast their vote electronically, via touch screen. **Verity Touch** works in tandem with **Verity Controller**, accepting an access code from the voter and retrieving the appropriate ballot style from **Verity Controller**. Once the voter has cast their ballot, the results are transmitted back to **Verity Controller**,



where all results for the configured daisy chain are retained within the **Verity vDrive** assigned to the **Verity Controller**.

- **Verity Touch with Access** is a Direct Recording Electronic (DRE) device that allows a voter to cast their vote electronically via the **Verity Touch with Access** that utilizes the **Verity Access** audio-tactile interface. **Verity Touch** works in tandem with **Verity Controller**, accepting an access code from the voter and retrieving the appropriate ballot style from **Verity Controller**. Once the voter has cast their ballot, the results are transmitted back to **Verity Controller**, where all results for the configured daisy chain are retained within the **Verity vDrive** assigned to the **Verity Controller**.
- **Verity Print** is a voting center ballot printing solution for paper ballots. Print is paired with a commercial off the shelf printer (COTS) to allow the poll worker to print select and print a ballot style based on the precinct and voter registration information.
- **Verity Central** is a high-speed, central digital ballot scanning system used for processing of absentee ballots (such as vote by mail). The unit is based on COTS scanning hardware coupled with the custom **Hart** developed ballot processing application software. *It can be used to adjudicate write-ins.*
- **Verity Count** is an application that tabulates election results and generates reports. **Verity Count** can be used to collect and store all election logs from every Verity component/device used in the election, allowing for complete election audit log reviews. *It too can be used to adjudicate write-ins.*
- **Verity vDrive** is a required **Verity Voting** component, used as a portable media device generated by **Verity Build**. **Verity vDrive** allows election definitions to be moved from **Verity Build** to **Verity Scan** and **Verity Touch Writer**. **Verity vDrive** supports the transfer of Cast Vote Records (CVRs) in **Verity Scan** and **Verity Central**.
- **Verity Key** is electronic media that is created by **Verity Build** for a specific election. **Verity Key** is a required **Verity Voting** component. **Verity Key** is the electronic media that provides user authentication and configures election security throughout the **Verity Voting** system

1.8 Testing Responsibilities

The following schedule describes the high level tasks and assigned personnel titles that will be involved in the Certification Test effort of the **Hart Verity Voting 2.0** voting system.



1.8.1 Project Schedule

The project schedule consists of the components listed in the following subsections:

1.8.1.1 Owner Assignments

- The System Analysis and Review will be conducted by Source Code Review, Security and Voting Test Specialists, with oversight provided by the Test Manager.
- Source code review is conducted by Source Code Review Specialists, with oversight provided by the Test Manager.
- Documentation review is conducted by Security and Voting Test Specialists, with oversight provided by the Test Manager.
- Test Module Development and Validation will be conducted by Security and Voting Test Specialists (VTS), with oversight provided by the Test Manager.
- Test Suite Development and Validation will be conducted by Security and Voting Test Specialists, utilizing SLI's formal Test Methods, with oversight provided by the Test Manager.
- Formal Test Execution will be conducted by Security and Voting Test Specialists, with oversight provided by the Test Manager.
- 3rd Party testing will be conducted by the subcontracting 3rd Party Hardware Laboratories, with oversight provide by the Hardware Specialist.

1.8.1.2 Test Module Development and Validation

Test Modules will be developed to provide repeatable, detailed test steps. The Modules are defined at a basic/generic level in SLI's formal Test Methods and each one is designed to be used in any test suite that employs its functionality. This re-usability reduces the development time associated with creating Modules. The Modules will be validated prior to Formal Test Execution to ensure accurate testing of the voting system. Test modules are validated by internal review and execution. Once the modules are created, a second person exercises the modules, and suites to confirm that the steps are correct and lead to the correct conclusion. This determination is based on the VVSG requirements, manufacturer documentation, as well as user experience.

Additionally, the Test Modules will provide traceability to SLI's formal Test Methods, as well as the 2005 VVSG requirements. This is done by listing the Test Method name, and any portion of a requirement being met, in the name of the module. The test modules and the test suites that are written by SLI contribute directly to the "Exhaustive verification of every system function and combination of functions cited in the vendor's documentation", as defined by the VVSG's definition



of the Functional Configuration Audit. Under the 2005 VVSG, this portion of the certification is considered to be part of the Functional Configuration Audit (FCA).

1.8.1.3 Test Suite Development

Test Suites will be developed to group and focus testing around key areas of the voting system. Each Test Suite will contain multiple test modules providing clear and traceable test scripts and information. Various system configurations will be identified within the suites. Under the 2005 VVSG, this portion of the certification is considered to be part of the Functional Configuration Audit (FCA).

1.8.1.4 Formal Test Execution

Formal Test Execution of the validated Test Suites will be conducted against the declared voting system, utilizing **the Trusted Build binary executables** and firmware components, in order to test to determine whether or not the system is compliant with the VVSG requirements. Under the 2005 VVSG, this portion of the certification is considered to be part of the FCA.

1.8.1.5 Third Party Hardware Testing

Hardware testing will be conducted by third party, certified hardware test laboratories to verify the voting system hardware devices comply with the VVSG hardware requirements. Under the 2005 VVSG, this portion of the certification is considered to be part of the FCA.

Other Labs Performing Hardware Testing

SLI Global Solutions is responsible for all core voting system tests as identified in NIST NVLAP Handbook 150-22 (2005). The labs listed below will perform non-core hardware testing for this certification test campaign.

Table 2 – Labs Performing Hardware Testing

Laboratory	Address	Test(s)	Date(s)
EMC Integrity, Inc. (NVLAP certified for electromagnetic compatibility and telecommunications)	1736 Vista View Drive Longmont, CO 80504	<u>EMC / EMI Tests:</u> Radiated Emissions, Conducted Emissions, ESD, Electromagnetic Susceptibility, Electrical Fast Transient, Lightning Surge, Conducted RF Immunity, Magnetic Fields Immunity, Electrical Power Disturbance	1/29/16 – 2/5/16
Cascade TEK – Front Range	1530 Vista View Drive Longmont, CO 80504	<u>MIL-STD-810D Tests:</u> Bench Handling,	1/18/16 - 2/1/16



(A2LA certified for mechanical including MIL STD 810)		Vibration, Low Temperature, High Temperature, Humidity, Temperature/Power Variation, and Reliability	
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1.8.2 EAC & Manufacturer Dependencies

The Test Plan will require EAC approval prior to finalization.

Hart InterCivic will be required to provide all source code, documentation, equipment and supporting materials identified as part of the voting system.

The source code must have all resolved discrepancies, successful build, complete installation, and successful completion of Readiness Testing prior to Formal Test Execution.

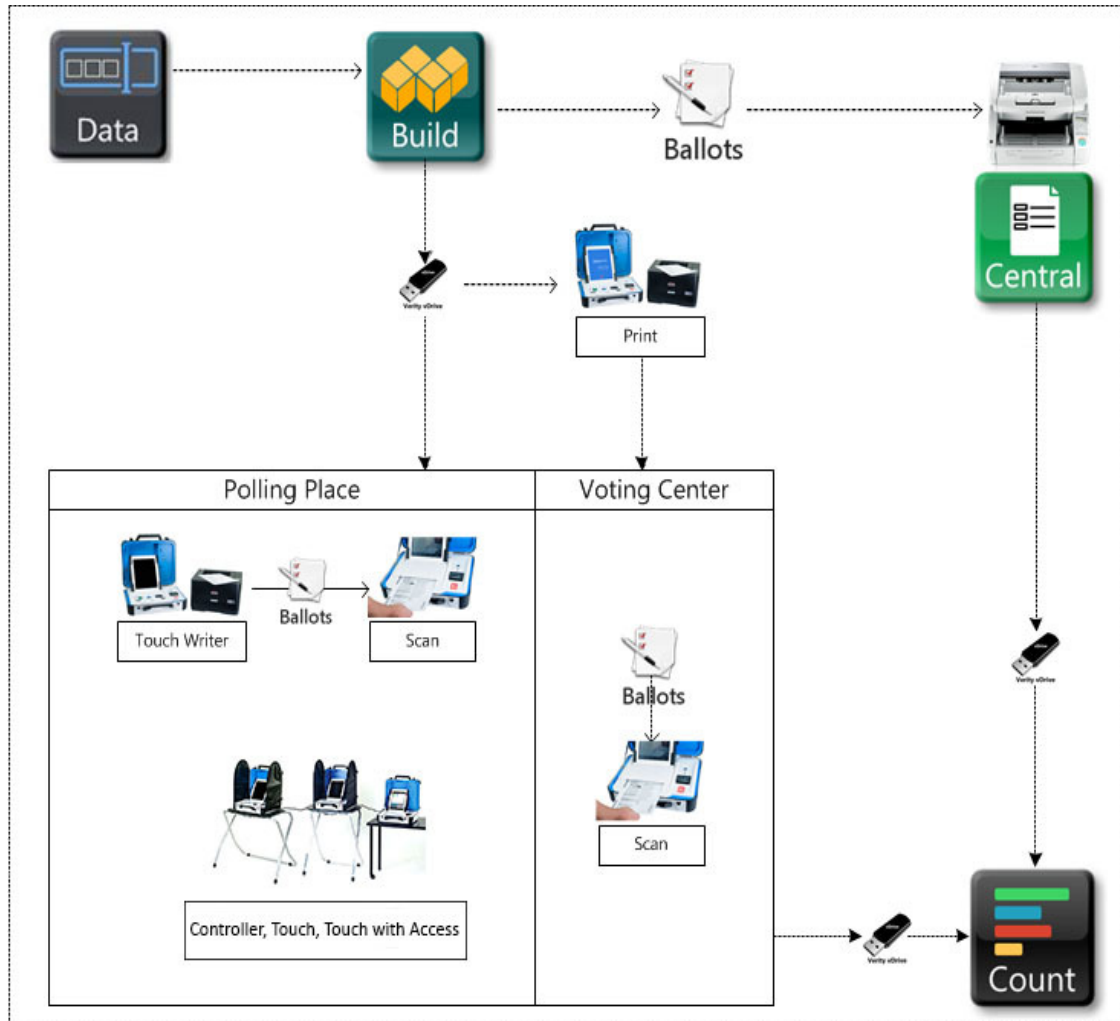
In addition, **Hart InterCivic** is required to provide training on the voting system and support throughout the duration of the project.

1.9 Target of Evaluation Description

1.9.1 System Overview

The **Hart Verity Voting 2.0** voting system is composed of 6 software applications, 4 polling place devices with accompanying firmware, a vote center device, as detailed in section 7 – Definition of the Hart Verity Voting 2.0 Voting System above. COTS printers, COTS thumb drives and COTS central scanners are supported by the voting system as well.

1.9.2 Block Diagram



Overview of the diagram:

- The components are displayed as touch points of data access, transfers, and verification.
- Dotted lines show the flow of data and air gaps using **Verity vDrives**.
- The **Verity Controller**, **Verity Touch/Verity Touch with Access**, **Verity Touch Writer** and **Verity Scan** components are part of the Polling Place setup.
- **Verity Print** is part of the voting center setup
- **Verity Key** (not shown) is required for user access into components to load elections, use features, and generate reports. Feature access depends on the roles applied to user accounts.



1.9.3 System Limits

This section details various limits within the **Verity Voting 2.0** voting system.

Element	Limit Requirement
Precincts	1,000
Splits per Precinct	20
Total Precincts + Splits in an election	6,000
Districts For voting devices and applications	100
Parties in a General Election	24
Parties in a Primary Election	10
Contests and Propositions combined	200
Contest Choices in a Contest	75
Total Contest Choices (voting positions) in an election	600
Maximum length of contestant name	100 characters
Maximum write-in length	25 characters
Ballot Styles	N/A
Voting Types	5
Maximum Polling Places per election	1200
Maximum devices per election	2400
Maximum number of central count devices	N/A
Media Device – Scan voting device	9999 sheets per vDrive
Media Device – Central application	60000 sheets per vDrive
Number of voters definable per election	1000000
Max. sheets per ballot	4 sheets
Scan - single sheet ballot	9999 Ballots
Scan - two sheet ballot	4999 Ballots
Scan - three sheet ballot	3333 Ballots
Scan – four sheet ballot	2499 Ballots
Central	1000000 Ballots
Count	4000000 CVRs, 1200 vDrives
Ballot Sizes	8.5" x 11", 8.5" x 14", 8.5" x 17", 8.5" x 19", 11" x 17"

1.9.4 Supported Languages

The **Hart Verity Voting 2.0** voting system has declared support for the English and Spanish languages for this certification project.



1.9.5 Supported Functionality

1.9.5.1 Voting Variations

Verity Voting 2.0 supports the following voting variations:

- Closed primaries
- Open primaries
- Partisan offices
- Non-partisan offices
- Write-in voting
- Primary presidential delegation nominations
- Ballot rotation
- Straight party voting
- Split precincts
- Vote for N of M

Note that **Verity Voting 2.0** does not include Ranked Choice Voting as a fully implemented voting variation. **Verity Build** will build a ballot to **allow** Ranked Choice voting. **The** voting devices **Verity Scan** and **Verity Touch Writer**, as well as **Verity Central** record RCV selections **voted**. **However**, **Verity Count** will not perform ranked choice processing, instead it will treat the 1st candidate selected as the candidate chosen. While the full functionality is not in place, SLI will test the implemented functional portions in their respective areas.

1.9.5.2 Verity Data – Pre-voting Functionality

Verity Data is a component of the Verity Voting system used by officials to enter election data for contests, candidates, proposition text, translations, and audio. Data also provides the user with controls for proofing of data, layout, and performs validation prior to locking the data to ensure its readiness for use in Verity Build.

Data - Election Data Entry

Verity Data is an application that provides pre-voting functionality; the Verity Data workstation should be located in a secure facility at the central administration location.

Data election data management software allows users to do the following tasks:

- Election data input, import, and export
- Election Data entry includes:
 - o Unique election identifier
 - o Election type
 - o Ballot Header information



- o Jurisdiction data
- o Polling place data
- o Voting variations
- o Party Information
- o Contests supported
- o Proposition data
- o Audio recording
- Multilanguage support
- Ballot proofing

Verity Data provides only previews of how ballots will look, once they are produced in **Verity Build**. Only **Verity Build**, the election definition software, has the capability to produce ballots; **Verity Data** does not.

1.9.5.3 Verity Build – Pre-voting Functionality

Verity Build allows users to prepare an election by defining ballot styles that **will be transferred to portable flash media to be used in the voting machines.** **Build** can import ballot data in a specified format.

Verity Build includes a ballot layout viewer capable of producing printed outputs for purposes of proof-reading all ballot styles, as well as the capability to proof recorded audio strings. After users view ballot styles electronically or in hard copy format, users may accept the election, which “locks” the election (in preparation for producing election media). Locking the election keeps the user from editing the source data and definition.

Importing and Managing Election Data

Verity Build supports importation of and management of election data as follows:

- Access to the Election Management component to import and export election based on data elements that have been properly formatted in accordance with standardized published specifications.

Proofing Election Data

Verity Build provides the following proofing capabilities:

- Users can:
 - View ballot style previews through an embedded viewer.
 - Print ballot style previews.
 - Save ballot styles to image files.
 - Proof recorded audio strings.
- **Verity Build** allows users to proof translations for supported languages.



- **Verity Build** supports the production of various reports that allow users to proof-read and validate ballot data entry.

Ballot Standards

Verity Build employs and supports the ballot standards as follows:

- Supports the following paper sizes:
 - 8.5" x 11"
 - 8.5" x 14"
 - 8.5" x 17"
 - 11" x 17"
- Supports ballot layouts in portrait orientation.
- Supports duplex ballot layouts.
- Supports the inclusion of ballot stubs on paper ballots.
- Supports layouts for a variety of ballot types, including Test mode, Official mode, and Sample ballots.
- Compatible with the production of ballots on standard, commercially available white paper stock.

Ballot Layout Features

Verity Build supports ballot layouts as follows:

- Supports the layout of ballots in paper-based and electronic formats.

Previewing Ballot Layouts

Verity Build supports previewing ballot layouts as follows:

- Allows users to view on-screen graphic previews of exact ballot layouts.
- Allows users to specify which ballot types are previewed, according to a variety of user-defined attributes, including precinct, style, type, language, and party.

Generating Election Media

Verity Build employs and supports generation of election media as follows:

- Allows users to generate portable flash media that includes election data and ballot style information that the user has accepted.

1.9.5.4 Verity Voting Devices - Common Functionality

The five **Verity 2.0** voting devices share a common physical platform which can be configured in a variety of ways. These devices include **Verity Controller**, **Verity Touch**, **Verity Touch with Access**, **Verity Print**, **Verity Touch Writer** and **Verity Scan**



General

- Used for different modes of voting (e.g., paper ballot scanning versus electronic ballot marking) use a common platform, or “base station”.
- The common platform accommodates different non-user configurable combinations of device modules. The common platform is the base from which the components for **Verity Controller, Verity Touch, Verity Touch with Access, Verity Print, Verity Scan** or **Verity Touch Writer** can then be added.

Voting Device Security

Verity Voting 2.0 Devices:

- Incorporate methods to prevent unauthorized persons from physically tampering with secure functions, or from performing acts that might interrupt a voting session.
- Incorporate physical access controls (locks, seals, tamper-evident labels, proprietary hardware interfaces) to ensure that there are no externally vulnerable open ports during normal storage and use.

Voting Device Authorization

Verity Voting 2.0 Devices:

- Requires pass codes as deemed necessary by specific functions within the voting device suite.

Voting Device Authentication

Verity Voting 2.0 Devices:

- Employ passwords to restrict access to key functions.
- Support the issuing and accepting of codes to associate ballots and entered votes per registered voter.

Voting Device Auditability

- All logs are saved with election data and CVRs.

Device Software Installation and Validation

Verity Voting 2.0 Devices:

- Support methods to verify that only authorized software is present on the devices.

Memory

Verity Voting Devices:

- Employ **Verity vDrive** devices and for the storage of Cast Vote Records, audit log information, backup data, and other election data.



- Removes date and time information from CVRs to protect voter privacy.
- Compare redundant data, to ensure data integrity.
- Support data backup.

Interactive touch display

Verity Voting Devices:

- Employ an interactive touch display for the user interface.
- Interactive touch display is capable of being removed for service, replacement, or to support required voting functions.

Device Error Handling

Verity Voting 2.0 Devices:

- Do not lose or corrupt any recorded data in the event of a sudden power failure.
- Do not accept ballots for submission if the device if it is not within normal operating parameters.
- If applicable, display the action to take in response to an error condition.

Election Logic

Verity Voting 2.0 devices use **Verity Build**-generated **Verity vDrives** as a means of installing and configuring any **Verity Voting 2.0**-defined election on the devices.

1.9.5.5 Verity Controller/Touch (Touch w/ Access) – Ballot Casting Voting Device Functionality

Verity Controller, Touch and **Touch with Access**, are Direct Recording Electronic (DRE) devices. The poll worker uses the **Verity Controller** to manage any combination of **Verity Touch** or **Verity Touch with Access** devices, up to a total of 12, that are connected via a daisy-chain network. When opening the polls, poll worker(s) use the **Verity Controller** to activate a code. This code is used by the voter, who selects any unused **Touch or Touch with Access** voting device and enters the activation code. This allows the voter to activate a ballot session and cast a vote in private. Voters use the touch display on the **Verity Touch or Touch with Access**, or the Verity Access ATI which is permanently attached to the **Verity Touch with Access**. After the voter privately and independently marks and reviews the ballot, he or she will electronically cast the ballot. The poll worker is able to utilize the **Verity Controller** to monitor the daisy chained **Verity Touch** devices and tell when one is available or in use.



1.9.5.6 Verity Print – Ballot Printing Voting Device Functionality

Verity Print is a pre-voting ballot production device that produces unmarked paper ballots. Print is paired with a commercial off-the-shelf printer to allow the user to select and print the desired ballot style based on the precinct and voter registration information.

The **Verity Print** device is activated so the election official can print a blank ballot from one selected precinct. Ballots can be printed on-demand for immediate use or can be printed in advance for emergency or absentee purposes.

1.9.5.7 Verity Scan – Ballot Scanning Voting Device Functionality

Verity Scan provides paper ballot scanning capabilities. When scanned, the system validates the ballot according to voter marks and the associated election contests. If issues are located, the system may provide a warning or flag the scanned ballot for review. The ballot is converted into a digital CVR, transferable on a **Verity vDrive** to another **Verity Voting 2.0** component for further review and tabulation.

General

Verity Scan Devices:

- Accommodate duplex scanning.
- Are capable of capturing and storing the ballot image on removable media.
- Are capable of capturing and storing the digital image of a write-in vote.
- Scan multi-sheet ballots up to 4 sheets per ballot.
- Scan paper ballots in all portrait orientations (face up, face down, header first, footer first).

Configurable Settings

Verity Scan Devices are configurable for:

- The types of mismarked ballots that are rejected and returned to the voter for review, or always accepted.
- Whether a poll worker or a voter is able to independently cast a rejected, mismarked ballot “as-is”.

Supported Ballot Types

Verity Scan Devices:

- Accept ballots with or without serial numbers.
- Accept ballots printed in Test mode.



- Accept ballots printed in Official mode.
- Maintain public ballot counters that reflect the number of ballots cast or marked for the current election configuration and the total number of sheets processed.

1.9.5.8 Verity Touch Writer – Ballot Marking Voting Device

The **Verity Touch Writer** is a voting device for voters to enter their vote options and generate a printed marked ballot. Poll workers open/suspend/close polls, generate access codes, and manage devices.

Voters review the contest options, enter vote options, and review their ballots prior to printing their marked ballot; voters can then scan their ballots with Verity Scan or place them in a ballot box.

General

Verity Touch Writer Devices:

- Support the following optional component:
 - **Verity Access** – An audio tactile interface (ATI) controller, which allows a voter to perform a voting session with tactile buttons and audio feedback.
- Support the following input methods:
 - Interactive touch screen display.
 - Access buttons.
 - Dual-switch input controller with tactile input (e.g., “jelly buttons”).
 - Dual-switch input controller with non-manual input (e.g., “sip-and-puff”).

Auditability

Verity Touch Writer Devices:

- Electronic device audit logs are capable of being filtered by device to indicate the number of ballots issued, voted, expired, and canceled.

Access Module

- All voter interfaces supported by **Verity Touch Writer** devices are capable of having **Verity Access** attached to it, to easily make it an accessible device.



COTS Printer

- The **Verity Touch Writer** includes a COTS printer for printing voted ballots.
- Page sizes include:
 - 8.5"x11"
 - 8.5"x14"
 - 8.5"x17"

1.9.5.9 Verity Central – Central Scanning and Ballot Resolution

Verity Central is a component that provides paper ballot scanning functionality (using high speed COTS document scanners), contest adjudication, and conversion of voter selection marks to electronic Cast Vote Records (CVRs). Once the CVRs are stored they can be transferred into **Verity Count** software for vote tabulation and reporting of election results.

Note: *Verity Central does not tabulate votes.*

General

Verity Central:

- Is capable of operating in server/client or stand-alone configurations.

Verity Central Workstations

Verity Central:

- Is designed with a minimum of one default workstation, and supporting multiple workstations as needed, up to a maximum of 4. The database for all content is kept on the Central *server* to ensure ballot review and distribution without multiple storage locations. Warning messages display for duplicate scans and access.
- Allows a workstation to be configured for paper ballot scanning, contest resolution, or both.
- Has an option provided to allow or reject duplicate ballots. Central has the ability to check all ballots for duplicate serial numbers in a database, should serial numbers be employed.
- Has an option to provide to allow or reject incomplete multi-sheet ballots.
- Enforces scanning preferences across all workstations in a network configuration (e.g., to ensure ballots are not scanned multiple times).
- Is a workstation configured for contest resolution provides an interface to manage write-in contests in one of two possible ways:
 - An option is provided to manage write-in names by resolving write-ins.
 - Has an option to hold write-ins as “unresolved” and defer their resolution to **Verity Count** (where other write-ins are typically managed).



Verity Central Database

Verity Central:

- Database stores all electronic ballot images, including Cast Vote Records, validly produced.
- Is capable of supporting multiple databases at the same time.
- Allows a user to close the database, which disables additional processing (scanning, resolution, batch management, saving CVRs, etc.) and keeps review and reporting functions enabled.

Verity Central Network

Verity Central:

- Functions supported for networks include:
 - Scanning to ensure ballots are not scanned multiple times across all **Central** workstations, when serial numbers are employed.
 - Provides resolution to ensure multiple poll workers and officials are not accessing the same ballot simultaneously.

Paper Ballot Scanning

Verity Central:

- Scanning functionality is enabled only for users with scanning privileges.
- Scanning functionality is enabled only for a workstation that is connected to a uniquely named scanning database available for scanning (i.e., with a status of Open or Ready).

Ballot Image Review and Contest Resolution

Verity Central:

- Provides functionality to review ballot images and resolve contests with irregular marks or marks that cannot be identified as valid.

Saving CVRs to Portable Media

Verity Central:

- Provides an interface to save ballots to portable media by batch.
- CVRs can be saved only for ballots in completely resolved scanned batches.



1.9.5.10 Verity Count – Tabulation and Audit Report Functionality

Verity Count reads, stores, and tabulates electronic Cast Vote Records (CVRs). **Verity Count** reads the CVRs from portable media devices that have been removed from scanning and electronic voting machines, or from central scanning workstations. Portable media devices from voting machines also contain audit log entries, as well as security features that allow **Verity Count** to authenticate media devices as they are read.

General

Verity Count:

- Is capable of tabulating and reporting results for any election that can be defined through **Verity Build**.
- Only accepts elections that have been accepted by a user in **Verity Build**.
- Is capable of being installed on a “standalone” PC that is not networked to other **Verity Voting** PC’s.
- Is capable of being installed on a networked workstation that is connected to other **Verity Count** workstations.
- In both standalone mode as well as networked mode, **Verity Count** collects and tabulates election data from **Verity vDrives**, from **Verity Scan** devices as well as **Verity Central** installations.
- Is capable of supporting multiple elections at the same time.

Reading and Tabulating Data from Portable Media

Verity Count:

- Allows users to read portable media devices associated with the election definition on which tabulation is based.
- Validates portable media inserted into the tabulation PC before accepting data.

Election Progress Dashboard

Verity Count:

- Provides a “dashboard” to monitor polling places and precincts reporting, and progress in reading portable election media.

Processing Write-In Votes

Verity Count:

- Allows users to add certified write-in names to the tabulation database, for purposes of resolution.
- Provides a user interface for reviewing and resolving all write-in ballots. **Verity Count** displays write-in ballots configured not to be resolved in **Verity Central** or cast on **Verity Scan**.



Reporting

Verity Count:

- Provides users with a set of standard reports in default configuration.
- Allows users to generate customized reports based on filtered data contained in the standard reports.

Auditing & Recount Features

Verity Count:

- Provides a dedicated “dashboard” to facilitate a user’s ability to create customized data records for purposes of auditing results.
- Provides an auditing dashboard which is capable of accessing records for all portable media devices that have been tabulated.

1.9.6 Excluded Requirements

*In this section we identify VVSG requirements that do not pertain to the declared system being certified. For this certification project Hart has elected to not support their **Verity Relay** transmission capabilities. As such, the table below enumerates the requirements that will not be subject to verification for this project.*

Requirements Not Under Test	Description	Reason for Exception
3.1.2.c	Biometric identification and authentication	No biometrics implemented
7.6.2	Casting of ballots via telecommunications	Telecomm casting of ballots not implemented
7.7	Wireless Communications	Wireless communications not implemented
7.9	Voter Verifiable Paper Audit Trail	VVPAT not implemented

1.9.7 Additional Functionality/Requirements

A review of the Hart Technical Requirements Documentation (TRDs) resulted in SLI’s determination that Hart has some functionality/requirements that are considered beyond the scope of the VVSG, but since they are in the declared



system, will require (per 2005 VVSG, volume 2 section 3.2.2) review and verification. Additional functionality/requirements to be audited within the scope of this certification are detailed below.

Verity Security Requirements 4005464 A03

- Verity Desktop Systems that store critical election data shall be connectable to an Uninterruptable Power Supply that will provide sufficient power to allow the use to shutdown the system gracefully.
- Verity shall not allow simultaneous access by the same user.
- The secure BIOS shall verify the chain of trust before allowing the system to boot.
- BIOS Verification
- The BIOS shall store a hash computed over the entire BIOS executable stored in persistent memory.
- Electronic keys shall work for one and only one election
- The user must not be able to open multiple Verity Voting applications at the same time on a single computer.
- The following requirements shall apply to Verity Count. These requirements may be applied to other desktop applications.
 - The user must not be able to start, open, or access any other applications on the computer while the Verity application is open.
 - The user must not be able to access Operating System functionality while the Verity application is open.

Verity Central TRD 4005453 A01

- The application shall NOT allow two users to access an individual ballot simultaneously [VCS PRD 4.4.5.9.1].
- The application shall support up to 4 simultaneous client workstations per server.
- Each workstation connected to the server shall be required to have a unique Workstation Name [VCS PRD 4.4.2.2.4].
- Before initiating scanning, the system shall verify that there is sufficient free space available to save and process all ballot images from the scan batch.
- The application shall allow the user to protect a contest, which when protected does not allow manual or automatic resolution actions to be performed on the contest during the adjudication process [VCS PRD 4.4.5.6.8.2].
- Protected contests shall not allow manual resolution actions.
- Protected contests shall not be affected by the automatic resolution feature.
- The application shall allow the user to remove protection from a contest.
- The application shall include an interface for creating Recovery Media.

Verity Count TRD 4005454 A02

- Minimum vote threshold.
- *Note: Minimum Vote Threshold is used to notify Election officials of potential privacy issues when there are only a small number of voters in a category.*

Verity Polling Place Device Suite TRD 4005457 A03

- The title of the report shall be "Configuration Readiness Report".



- The report shall include a barcode.
- The barcode shall contain the following data:
 - The assigned polling place.
 - The device serial number.
 - The Election Media Device identifier.

1.10 Changes from Verity 1.0 to Verity 2.0

Features new to Verity 2.0 include:

Verity Data, which provides the user with controls for proofing of data, layout, and audio created. **Verity Data** also performs validation on the exported information to ensure that it will successfully import into **Verity Build**.

Verity Controller, which is a polling place device that is used to activate and accumulate results from a range of 1 to 12 **Verity Touch/ Verity Touch with Access** DREs daisy chained to **Verity Controller**.

Verity Touch, which is a Direct Recording Electronic (DRE) device that allows a voter to cast their vote electronically via touch screen

Verity Touch with Access which is a Direct Recording Electronic (DRE) device that allows a voter to cast their vote electronically via the **Verity Access** audio-tactile interface.

Verity Print, which is a voting center ballot printing solution for paper ballots.

Updates to features from **Verity Voting 1.0** to **Verity Voting 2.0** include:

Build Changes

1. Verity Controller settings added to Election Settings screen
2. Verity Print settings added to Election Settings screen
3. Cumulative support in:
 - a. Contest creation
 - b. Ballot layout
 - c. Data validation
 - d. CSV export
 - e. Reports
4. Add export functionality to electronic ballot preview
5. Change number of ranks in Ranked Choice Voting from 5 to 6

Central Changes

1. Cumulative voting mark analysis and adjudication
2. Resolve defect associated with Product Advisory dated 9/30/15 with Central write-in adjudication in a Straight Party contest.
3. Change number of ranks in Ranked Choice Voting from 5 to 6



Count Changes

1. Change number of ranks in RCV from 5 to 6
2. Provisional Ballot Support:
 - a. Election Dashboard progress bar
 - b. Support Provisional Ballot Retrieval Code in CVR
 - c. New Provisional Ballots screen
 - d. Help Tab content
 - e. Provisional Ballot Status import/export
 - f. Provisional Ballot Status report
 - g. Provisional Ballot parsing logic
3. Support Touch/Controller on:
 - a. Device Log report
 - b. Voting Device report
 - c. vDrive Status report
 - d. Custom report filters
 - e. Auditing dashboard filters
 - f. Text write-in resolution changes
 - i. Display in resolution screen
 - ii. Auto-assign if exact match to existing write-in candidate

Verity Scan Changes

1. Cumulative voting mark analysis and second chance voting
2. Change number of ranks in Ranked Choice Voting from 5 to 6

Verity Touch Writer Changes

1. Cumulative Voting:
 - a. Contest Display
 - b. Vote Capture
 - c. Help Screen Content
2. Aesthetic changes to Contest List screen
3. Add number of available choices to the contest audio
4. Add "Your ballot has N sheets" to the ballot printing audio
5. Change number of ranks in Ranked Choice Voting from 5 to 6

1.11 Change Control and Configuration Management

The SLI project team follows a standard Change Control and Configuration Management (CM) process. This specifies the methods used by SLI to ensure changes are managed and controlled effectively and efficiently and defines the process for receipt, check-in, storage and disposition of hardware, source code, TDP and non-TDP Documents.



It specifies the processes and procedures used by SLI to identify, monitor, and control versions of all of the stated EAC project deliverables, ensuring that the items are constantly and reliably managed throughout the entire duration of the engagement to ensure changes are managed and will not result in invalidated or wasted testing efforts.

A summary of these tasks includes:

- Receive source code:
 - Delivery department will perform a code check-in on the server. Code is placed in the specific project's TDP folder with the delivery date and documentation of what was delivered.
 - Delivery department notifies Test Manager (TM) of delivery via email.
 - TM will notify the **Source Code Review** (SCR) team, via email, the code is ready for review.
 - TM will review the documentation of what was delivered to determine possible testing impacts.
 - Source Code Reviewer (SCR) updates status of delivered code as received, what code to compare it to (if this is not new code), where code has been placed, and who will do the review of the code.
 - The code is checked out by the SCR who is responsible for the code review.
 - When the code review is complete, the TM is notified.
 - A peer review is done on the review and all written discrepancies are verified and an official Discrepancy Report is sent.
 - If the Source Code Review (SCR) Team determines the code does not meet the requirements of the 2005 VVSG, the SCR team will review code impacts with the TM
 - TM determines when code is ready for a Trusted Build. When it is, the TM sends approval for a Trusted Build to the Trusted Build team.

- Receive TDP documents:
 - Delivery department will perform a check-in of the documents on the server.



- Documents are placed in the specific project's TDP folder with the delivery date.
- Delivery department notifies TM of delivery via email.
- TM assigns VTS personnel to perform the documentation review.
- VTS personnel perform a PCA on the pertinent documentation
- A peer review is done on the review all written discrepancies are verified and an official Discrepancy Report is sent.
- Receive Hardware
 - The HW Specialist or designee checks in equipment that is delivered by **Hart InterCivic**
 - Operational Status Checks are performed on all delivered hardware.
 - When the equipment comes back from the hardware lab testing, the HW Specialist checks in the equipment and verifies it's the same hardware that was sent to the lab.
 - The equipment is stored in a secure room with controlled access.
- Trusted Build:
 - The TM assigns a Trusted Build team member to review the Trusted Build procedures and perform the build.
 - Trusted Build team member follows build procedures exactly as written.
 - Trusted Build team member pulls the finalized source code from the specific folder where it was checked in.
 - Once build is complete the Trusted Build team member provides the completed build to the SLI Delivery Team to be checked in.
 - Trusted Build team member notifies the TM that the Trusted Build is completed.
 - TM assigns appropriate VTS(s) to load the resulting applications/installs and begin testing.
 - The VTS team performs appropriated installations, and begins testing.

2 PRE-CERTIFICATION TESTING AND FINDINGS



This section addresses any pre-certification testing that has been performed on the system under review. For this certification project, no previous testing has been performed on the **Verity Voting 2.0** voting system

2.1 Evaluation of prior VSTL testing

No prior VSTL testing has been performed on the **Hart Verity Voting 2.0** voting system, other than that done by SLI during the Verity Voting 1.0 EAC certification project.

2.2 Evaluation of prior non-VSTL testing

No prior state or non-VSTL lab testing has been performed on the **Hart Verity Voting 2.0** voting system. Review of Hart internal testing is performed during the FCA review.

2.3 Known Vulnerabilities

Hart Verity Voting 2.0 is a modification of **Verity Voting 1.0**, which has had only limited exposure in the field.

Within the declared system, the only public facing components are the **Verity Scan** precinct optical scanner, which processes ballots marked by voters in a public polling place, **Verity Touch Writer**, a precinct place ballot marking device, these devices are included as part of the **Verity Voting 1.0** voting system. New to **Verity Voting 2.0** are polling place devices **Verity Controller** and **Verity Touch/Verity Touch with Access**, as well as voting center device **Verity Printer** which are used in tandem as part of the **Verity Voting 2.0** DRE solution to enable voters to cast ballots electronically.

Verity Central is a central count location device, which is implemented in a secure environment.

There are no known vulnerabilities to this particular system at this time.

Review of the “Known Vulnerabilities” database, maintained by SLI, has provided 14 known vulnerabilities to previous Hart systems already accounted for in SLI’s Test Methods.

3 Physical Configuration Audit

3.1 TDP Documentation Analysis & Review

SLI will complete an assessment of the deliveries of the Technical Data Package, including Functional Requirements, Specifications, End-user documentation, Procedures, System Overview, Configuration Management Plan, Quality Assurance Program, and manuals for each of the required hardware, software and



firmware components of the **Hart Verity Voting 2.0** voting system, in order to ensure that the documentation corresponds to the configuration and operation of the system. Any subsequent re-deliveries of the TDP items will be solely the result of fixes to discrepancies identified in the remaining FCA or PCA activities.

3.1.1 Document Review

SLI conducts a PCA review of all vendor traced documents submitted for review in the delivery of the **Hart Verity Voting 2.0** TDP. These include the following areas:

- System configuration overview
- System functionality description
- System hardware specifications
- Software design and specifications
- System test and verification specifications
- System security specifications
- User/system operations procedures
- System maintenance procedures
- Personnel deployment and training requirements
- Configuration management plan
- Quality assurance program

Each document included in the delivery of the voting system TDP is reviewed for compliance to the pertinent 2005 VVSG, Volume 2, Sections 2.2 through 2.13 and Volume 2, Section 6.6 requirements that are applicable to that document. Results and associated discrepancies of the documentation TDP review will be detailed in the final test report.

3.2 TDP Source Code Analysis & Review

3.2.1 Source Code Review

The certification test project for the **Hart Verity Voting 2.0** voting system includes software and firmware that have been created as proprietary to **Hart InterCivic**, as well as review of any commercial off the shelf products. SLI will ascertain what source code has been modified from the Verity Voting 1.0 source code base, and conduct a source code review of all modified proprietary source code, and modified COTS products, submitted in the delivery of the voting system TDP for compliance to the VVSG, version 2005, Volume 2, Section 6.6. The coding languages involved in the vendor's applications include:



- C#
- C
- C++

For Source Code Review Tools utilized by SLI, please see table 4.

Any subsequent re-reviews of source code will be the result of fixes to discrepancies identified in the Functional Configuration Audit activities.

COTS Operating systems and software used in the voting system will be verified as authentic and unmodified, otherwise reviewed as is applicable.

Schemas for each database will be reviewed for consistency between related fields, such as those between **Verity Central** and **Verity Count**.

3.3 QA & CM Process Review

The review processes employed are designed to verify that the manufacturer not only has written processes and procedures in both the Quality Assurance and Configuration Management arenas, but that those processes and procedures are actually implemented within the software development life cycle that is used to produce the **Hart Verity Voting 2.0** version that is submitted for certification.

The QA portion of the review focuses on the testing performed by **Hart InterCivic**. The scope of the testing performed is reviewed in order to verify that **Hart InterCivic** has verified that all VVSG requirements are met. SLI reviews the test case design documents and data as provided by **Hart InterCivic**. In evaluating each module, with respect to flow control parameters and data on both entry and exit, SLI assesses discrepancies between the Software Specifications and the test case design. Surveys addressing Quality Assurance aspects as implemented by Hart will be sent to Hart QA personnel. Additionally interviews of key Quality Assurance staff may be conducted to verify that the QA processes and procedures are known, understood and implemented by the appropriate personnel within the organization. The interviews will be conducted if issues are seen with either project artifacts or survey responses.

The CM portion of the review focuses on the organizations understanding and implementation of the declared configuration management processes, procedures and policies. Initial deliverables will be reviewed against all pertinent CM processes employed by **Hart InterCivic**. Any and all subsequent deliveries will also be reviewed to determine that appropriate processes are employed. Surveys addressing Configuration Management aspects as implemented by Hart will be sent to Hart CM personnel. Additionally, interviews of pertinent staff, with regard to configuration management, may be conducted to verify that processes, procedures and policies are known, understood and implemented within the organization. The



interviews will be conducted if issues are seen with either project artifacts or survey responses.

3.4 Trusted Build

The Trusted Build will be conducted prior to SLI's formal test execution and will be completed on site at SLI's facility or a secure lab at the vendor's facility approved by SLI. SLI will use its approved standard lab procedure that details the processes for controlling, managing, and conducting the Trusted Build. This process includes the following:

- Preparation for the Trusted Build - Obtaining and reviewing **Hart InterCivic's** procedure for constructing the build platform, verifying the target build platform, and acquiring and verifying the necessary materials.
- Execution of the Trusted Build – SLI will perform the Trusted Build by using the step-by-step build procedure, as provided by **Hart InterCivic** to create a pristine build environment. SLI records and ascertains the following items throughout the build process:
 - Build environment images at various key points
 - Build environment and file hashes at various key points
 - Build environment hardware characteristics
 - Build results from code compilation and file hashes
 - Final software install files and file hashes
- Deliverables to Testing – Upon completion of the Trusted Build, certain items are sent to the SLI test group. The final result will be media containing the following:
 - Final software install files
 - Hash values to validate install files
- Final Record Keeping and Archiving Procedures – At the conclusion of the Trusted Build process, SLI completes all final record keeping and archiving procedures at SLI's facility. This record keeping includes any unique identifiers, results of the build with version numbers and dates and descriptions of all hashes and images in the repository.

4 MATERIALS REQUIRED FOR TESTING



Any materials that are used in an election cycle must be provided to SLI to facilitate testing of the voting system. This section outlines these materials that are required.

4.1 Software/Firmware

Any and all software/firmware that is to be used by the declared voting system whether directly or indirectly, in a production environment, must be validated during the certification process.

The following software/firmware is required for the execution of hardware, software, and security tests. This includes all supporting software such as operating systems, compilers, assemblers, application software, firmware, any applications used for burning of media or creation/management of databases.

4.1.1 Hart Verity Voting 2.0 Software/Firmware

Hart Verity Voting 2.0 voting system consists of the following software and firmware components:

- **Verity Data** EMS software
- **Verity Build** EMS software
- **Verity Central** high speed optical scanner software
- **Verity Count** central count location accumulation and tallying software
- **Verity Controller** device firmware
- **Verity Touch** DRE firmware
- **Verity Touch with Access** DRE firmware
- **Verity Scan** optical scanner firmware
- **Verity Touch Writer** BMD firmware
- **Verity Print** printer firmware
- **Verity** Device Microcontroller firmware for **Verity Touch Writer**

Note: Versions for each will be available after execution of the Trusted Build, and will be listed in the Test Report

4.1.2 COTS Software/Firmware

This section details the Commercial Off The Shelf software and firmware utilized within the **Verity Voting 2.0** system.



Table 3 – COTS Software/Firmware

Manufacturer	Application	Version	Verity Voting 2.0 Component
Microsoft	Microsoft Windows Embedded Standard 7 with Service Pack 1 – 64bit	6.1.7601	Data/Build, Data/Build + Count, Central, Count, Print, Scan, Touch Writer, Controller, Touch, Touch with Access
Microsoft	Microsoft SQL Server 2012 for Embedded Systems	11.00.2100	Data/Build, Data/Build + Count, Central, Count
Microsoft	Microsoft SQL Server 2012 Express	11.00.2100	Print, Scan, Touch Writer, Controller, Touch, Touch with Access
McAfee	McAfee Application Control for Devices	6.1.1.369	Data/Build, Data/Build + Count, Central, Count, Print, Scan, Touch Writer, Controller, Touch, Touch with Access

4.1.3 Additional Supporting Test Software

This section outlines any and all test specific software that will be used in the certification campaign.

Table 4 – Additional Supporting Test Software

Manufacturer	Application	Version
Riverbed	WireShark	1.10.6
LocMetrics	<u>LocMetrics Line Counter</u> , a commercial application used to determine the counts of executable and comment lines	
SLI	<u>Module Jogger</u> , a SLI proprietary application used to parse module names from C/C++, Java and VB code and populate the identified module names into the review documents	
PrestoSoft	<u>ExamDiff Pro</u> : a commercial application used to compare revised code to previously reviewed code	

4.2 Equipment

The following equipment is required for the execution of the hardware, software and security tests. This includes system hardware, general purpose data processing and communications equipment, and any test instrumentation required.



4.2.1 Hart Verity Voting 2.0 Equipment

The following **Hart Verity Voting 2.0** equipment will be used in testing:

Table 5 – Hart Verity Voting 2.0 Equipment

Hardware	Model
Verity Scan (digital scanner)	Revision C
Verity Touch Writer (BMD)	Revision C
Verity Controller	Revision B
Verity Touch	Revision B
Verity Touch with Access	Revision B
Verity Print	Revision B

4.2.2 COTS Equipment

The following Commercial Off-the-Shelf equipment will be used in testing:

- Desktops/Laptops
- Printers

Table 6 – COTS Equipment

Manufacturer	Hardware	Model
OKIDATA (for Verity Build, Verity Print, Verity Central, Verity Touch Writer and Verity Count)	Ballot and Report Printer	B431d
OKIDATA (for Verity Build, Verity Print, Verity Central, Verity Touch Writer and Verity Count)	Ballot and Report Printer	B432dn
OKIDATA (for Verity Print, Verity Build)	Ballot Printer	C831dn
OKIDATA (for Verity Print, Verity Build)	Ballot Printer	C911dn
OKIDATA (for Verity Count)	Ballot Printer	ML-1121
Eaton	UPS for Verity Touch Writer printer	5P1500
Various (for Verity Build, Verity Central and Verity Count)	Intel-Windows Workstation (Minimum Requirements) Processor – Intel Celeron D 420 3.06GHz Dual Core Memory – 2GB upgradable to 4GB Hard Drive – 120 GB	



Manufacturer	Hardware	Model
	Removable Storage – 8xDVD+/-RW Slim line USB Ports – 4 ports Video Card - Integrated Graphics Keyboard - USB Keyboard Mouse - USB Mouse	
Various (for Verity Build , Verity Central and Verity Count)	Monitor (Minimum Requirements) Panel Size - 50.8 cm Aspect Ratio - Widescreen (16:9) Optimal Resolution - 1600 x 900 at 60Hz Contrast Ratio - 1000: 1 Brightness - 250 cd/m2 (typical)	
Kodak (for Verity Central)	Document Scanner	i5600
Canon (for Verity Central)	Ballot Scanner	DR-G1100
Canon (for Verity Central)	Ballot Scanner	DR-G1130

4.3 Test Materials

The following test materials are required for the performance of testing including, as applicable, test ballot layout and generation materials, test ballot sheets, test ballot cards and control cards, standard and optional output data report formats, and any other materials used in testing.

- Ballots & Blank Ballot grade paper
- Thumb Drives
- Ballot marking pens
- Printer paper rolls

4.4 Deliverable Materials

The following are documents and materials to be delivered as a part of the **Hart Verity Voting 2.0** system.

- Specifications and Manuals
- Verity System Description
- Verity Voting System Limits
- Verity XML Election Definition Reference
- Verity Airgap Interface Technical Reference Manual
- Verity Software Architecture Design
- System Description Technical Document
- Verity Central Technical Requirements Document



- Verity Count Technical Requirements Document
- Election Management Technical Requirements Document
- Electronic Voting Devices Technical Requirements Document
- Verity Key Design Technical Document
- Verity Logging Technical Requirements Document
- Verity Precinct Scanner Technical Requirements Document
- Verity Security Requirements Requirements Document
- Verity Datastore Schema
- System Description Technical Document
- Verity Security Requirements
- Verity Risk and Threat Assessment
- Verity Key Design
- Verity Service and Maintenance Guide
- Verity Software Architecture Design
- Verity Voting Maintenance Information Operations Guide
- Verity Build Quick Reference Guide
- Election Definition and Device Settings Technical Reference Manual
- Verity Central Quick Reference Guide
- Central Ballot Scanning and Review Software Technical Reference Manual
- Verity Count Quick Reference Guide
- Count Vote Tabulation Software Technical Reference Manual
- Verity Voting Maintenance Information
- Operations Guide
- Quality Manual
- Voting System Implementation and Maintenance
- Supplier Qualification and Management
- Verity Operational Guide
- Verity Performance Characteristics
- Verity Bill of Materials and Approved Vendor List for each Verity Component
- Verity Scan Assembly
- Verity Touch Writer Assembly
- Verity Access Assembly
- Verity Ballot Box Assembly
- Verity Standard Booth Assembly
- Verity Accessible Booth Assembly
- Verity Electronics Specification
- Verity Base Station Microcontroller Specification
- SQA Requirements Management Process
- Management and Best Practices Training Agenda
- Verity Data Training Agenda
- Verity Build Training Agenda
- Verity Central Training Agenda



- Verity Count Training Agenda
- Verity Service and Maintenance Training Agenda
- Verity Polling Place Operations Training Agenda
- Assisting Persons With Disabilities Training Agenda
- Train the Trainer Training Agenda
- Verity Operations PRD – Ops/Services/Supply Chain Planning Document
- Configuration Management Process
- Verity Operational Guide
- Software Versioning Procedure
- Voting System Implementation and Maintenance
- Sample Import XML template

5 TEST SPECIFICATIONS

The following are the specifications for testing to be conducted on the **Hart Verity Voting 2.0** system. The specifications contain details on the focus of testing, configuration(s), and the functions to be tested. Additional information to the specifications will be provided in the associated appendices.

5.1 Requirements

The **Hart Verity Voting 2.0** will be tested to the approved 2005 VVSG requirements.

All requirements within the VVSG are verified against **Hart Verity Voting 2.0** voting system unless noted otherwise in section *1.9.6-Excluded Requirements*.

Hart InterCivic has not declared support for any telecommunications capabilities. As such, VVSG 1.0 telecommunications specific requirements are not scheduled to be evaluated, as listed in the “Excluded Requirements” section.

To evaluate the system test requirements, each section of the EAC 2005 VVSG shall be analyzed to determine the applicable tests. EAC 2005 VVSG Volume I sections, as well as the accompanying strategy for evaluation, are described below:

- **Section 2: Functional Requirements** – The requirements in this section shall be tested during the FCA, utilizing the SLI Test Methods in combination with test suites specially designed for the **Hart Verity Voting 2.0** voting system. The data input during these tests shall be the predefined election definitions submitted as part of the Test Plan Package.



- **Section 3: Usability and Accessibility** – The requirements in this section shall be tested during the Usability Test, utilizing SLI Test Methods in combination with test suites developed to cover the applicable requirements of this section.
- **Section 4: Hardware Requirements** – The requirements in this section shall be tested and/or overseen by SLI personnel, per Sections 4.4.2 and 6.3.1.
- **Section 5: Software Requirements** – The requirements in this section shall be tested during source code review, TDP review, and FCA. A combination of review and functional testing shall be performed to verify these requirements are met. The functional testing will occur if the source code review reveals potential areas of issue within the code that are not explicitly covered by the VVSG source code requirements. The functional test team will work with the source code review team to determine what testing will need to be done in order to verify no issue is resident within the inspected code.
- **Section 6: Telecommunication** – The requirements in this section shall not be tested, due to no transmission capabilities being supported by **Verity Voting 2.0**.
- **Section 7: Security Requirements** – The requirements in this section shall be tested during source code review, FCA, and Security Tests, utilizing SLI Test Methods, SLP's and test suites custom designed for the **Verity Voting 2.0** voting system.
- **Section 8: Quality Assurance (QA) Requirements** – The requirements in this section shall be tested throughout the test campaign via various methods. The TDP review shall be performed on **Hart** QA documentation to determine compliance to EAC 2005 VVSG requirements and the requirements stated in the **Hart** QA Program document. All source code shall be checked to ensure that proper QA documentation has been completed. All equipment received for initial testing and follow-up testing shall be checked against **Hart** documentation to ensure their QA process is being followed. SLI personnel will complete the requirements of EAC 2005 VVSG Vol. 2, Section 7, Quality Assurance Testing and Section 1.3.1.5, Focus of Vendor Documentation that requires SLI personnel to examine documents or conduct an external evaluation utilizing equipment, documents and support information provided by **Hart** during the test campaign. SLI may also choose to interview **Hart's** QA staff.
- **Section 9: Configuration Management (CM) Requirements** – The requirements in this section shall be tested throughout the test campaign. The TDP review shall be performed on the **Hart** configuration management documentation to determine EAC 2005 VVSG compliance and to further



determine whether **Hart** is following its documented CM requirements. Any discrepancies shall be formally reported to **Hart** and the EAC. SLI personnel may conduct an onsite audit of the **Hart** CM Program, if deemed necessary.

5.2 Hardware Configuration and Design

The **Hart Verity Voting 2.0** system, as declared in the application for certification submitted to the EAC, consists of:

- A **Verity Data** workstation to create all election information
- A **Verity Build** workstation to create all election media.
- **Verity Print** is a pre-voting ballot production device that is paired with COTS printer, to produce unmarked paper ballots.
- At the precinct level, **Verity Scan** optical scanners, **Verity Touch Writer** BMD and **Verity Controller/Verity Touch/Verity Touch with Access** DRE configurations are employed.
- The central count location employs a high speed COTS scanner, in combination with a workstation that utilizes the **Verity Central** software, for tabulation of absentee ballots.
- The consolidation, tally and reporting location employs a workstation with **Verity Count** software as well as a printer.

Note that these are the basic components of the system. The software components (**Verity Data**, **Verity Build**, **Verity Central** and **Verity Count**) can be run in either a stand alone configuration where there is one lone workstation, or in a networked configuration of like type workstations, such as a **Verity Build** workstation with a database that acts as the network's server and one more additional **Verity Build** workstations that do not have databases, using the server database.

5.3 System Review

This section describes the workings of the **Hart Verity Voting 2.0** voting system and will assist the reader with understanding the flow of the voting system.

5.3.1 Verity Data

Verity Data is a data management application that allows users to manage election and jurisdiction data in a manner that is compatible for use with the **Verity Voting** system.

Verity Data collects and exports data only. More specifically, it accepts user input of jurisdiction-specific data (e.g., precincts, districts) and election-specific data (e.g., contest titles, choices) and exports the data in an XML format compatible for import into **Verity Voting's** election definition software, **Verity Build**.



Verity Data cannot perform any of the following functions typical of voting system components; again, it is a data management application only.

5.3.2 Verity Build

Verity Voting 2.0 is initially entered through the **Verity Build** application. New election data is imported into the system via an XML file that is populated outside of the certified system. Existing election data (previously imported) can be re-used within the Build application.

Once the **Verity Build** application is entered, and an election is imported, the normal path will take the user through the chevron workflow, which includes the Proof, Configure and Create chevrons.

5.3.3 Verity Touch Writer

Verity Touch Writer is a polling place ballot marking device solution for paper ballots. Touch Writer is paired with a commercial off the shelf printer to allow the voter to mark then print their vote selections. **Verity Touch Writer** is used in conjunction with **Verity Scan** to provide the voter with a reviewable paper ballot.

5.3.4 Verity Scan

Verity Scan records Cast Vote Records (CVRs) and audit log data in redundant, secure storage locations. The storage locations include the **vDrive**, CFAST and the ballot box for scanned paper ballots. Paper ballots can be scanned and transferred into digital CVRs. **vDrive** storage allows for the CVRs and device logs to be transferred into the **Verity Central** ballot resolution system or the **Verity Count** tabulation system.

5.3.5 Verity Central

Verity Central is a high volume scanning and ballot review system within the **Verity Voting 2.0** system. This application acts as a centralized compilation and processing site for final ballot handling, reading and processing before tabulation.

Verity Central allows for ballots to be scanned in bulk for users to review during scanning and through resolution for voter intent. Each ballot has the front and back pages scanned simultaneously to capture all voter marks, supporting duplex ballots. Users with proper training can review the ballots for write-ins and ballots flagged as having voter intent issues (such as overvotes, undervotes, and write-in candidates). Once all votes have been reviewed as indicated by flagging, the ballots are then written as Cast Vote Records (CVRs) to vDrives. The final CVR records on **vDrives** are then sent to a **Verity Count** workstation for official tabulation.

Within the **Verity Central** application, the workflow follows the path of chevrons Election, Scan, Review, Write Ballots, and Reports.



5.3.6 Verity Count

Verity Count allows users to tabulate all voted ballots with updates of the election. Users can generate standard and custom reports for the entire election or specific precincts and polling places. Users insert and read ballots from **vDrives**. As ballots are read, **Verity Count** can tabulate automatically or as manually clicked, updating all reporting polling places and precincts, to give an at-a-glance view into the election.

Verity Count has the following chevrons: Elections, Read, Resolve, Results, and Import/Export.

5.4 Testing Strategies

This section looks at the voting system and the individual components in order to determine testing strategies at the component level as well as the system level.

5.4.1 How each Device will be tested

- How the each device will be tested (**Verity Touch Writer, Verity Scan, Verity Controller/Verity Touch/Verity Touch with Access, Verity Print**)
 - Each device will be tested first as an individual component in order to verify that all declared functionality is present and working as documented, then with **Verity Build** produced media and data, then as an integrated piece of the voting system where it will accept user input instructions and interact with any other components of the system as is appropriate.

5.4.2 How each election central Application will be tested

5.4.2.1 Complementary Applications:

These applications that exist as complementary applications within the voting system to enable the primary applications to perform their intended function. These applications include the **Verity User Manager** and **Verity Election Management** applications.

- How **Verity User Manager** and **Verity Election Management** will be tested
 - Each application will be tested within each of its parent applications, which include **Verity Data, Verity Build, Verity Central** and **Verity Count**. Each application will be tested in both stand alone configurations and networked configurations.

- **Verity User Manager** will be verified to assign correct access rights for each defined role type in
- **Verity Election Management** will be verified to import, export and save election data in both stand alone configurations and networked configurations.

5.4.2.2 Primary Applications

These applications exist as primary applications within the voting system perform their intended function, relative to the conduction of an election.

- How **Verity Data, Verity Build, Verity Central** and **Verity Count** will be tested
 - **Verity Data, Verity Build, Verity Central** and **Verity Count** will each be tested first as an individual component in order to verify that all declared functionality is present and working as documented, then as an integrated piece of the voting system where it will interact with adjoining applications voting systems workflow.
- How **Verity Build** will be tested
 - **Verity Build** will import **Verity Data** information, then output **Verity Build** produced media and data, which will feed into **Verity Touch Writer, Verity Scan, Verity Central** and **Verity Count**.
- How **Verity Central** will be tested
 - **Verity Central** will input **Verity Build** produced media and data, then accept user filled out ballots as well as **Verity Touch Writer** produced ballots, prior to producing all defined output medias.
- How **Verity Count** will be tested
 - **Verity Count** will input **Verity Build** produced media and data, then accept **vDrive** data from **Verity Scan, Verity Controller** and **Verity Central**, prior to producing all defined output medias.

5.4.3 How different System Level Configurations will be tested

As noted earlier, **Verity Data, Verity Build, Verity Central** and **Verity Count** are each capable of being run as standalone instantiations or networked with a central database. When run as a standalone implementation, **Verity Data, Verity Build** and **Verity Count** are able to be run on the same physical device, but are not able to do so when any is in a networked configuration. Given these possible configurations, the following configurations will be exercised:

- **Verity Data** will be tested in standalone mode with accompanying database
- **Verity Build** will be tested in standalone mode with accompanying database
- **Verity Data, Verity Build** and **Verity Count** will be tested in standalone mode with accompanying database



- **Verity Count** will be tested in standalone mode with accompanying database
- **Verity Central** will be tested in standalone mode with accompanying database
- **Verity Data** will be tested in a networked mode with accompanying database and 3 client workstations.
- **Verity Build** will be tested in a networked mode with accompanying database and 3 client workstations.
- **Verity Central** will be tested in a networked mode with accompanying database and 3 client workstations.
- **Verity Count** will be tested in a networked mode with accompanying database and 3 client workstations.

5.5 Software System Functions

The **Hart Verity Voting 2.0** system operations documentation has been reviewed in conjunction with the Supported Functionality Declaration provided by the manufacturer. Based on this review, the applicable system functions have been identified for testing. The following key areas of voting system functionality will be evaluated during test suite design.

5.5.1 Election Definition Creation

The Election Definition focus will target creation of contests, candidates, propositions, ballot formatting and instruction. All aspects of creating regional districts, jurisdictional parameters, grouping and displaying of associated election data will be analyzed and tested. In addition, the ability to support baseline election types, various other election types, voting variations and languages (if supported) will be verified. This functionality involves **Verity Data** and **Verity Build**.

5.5.2 Election Media Creation

This area focuses on the creation and handling of media for the purposes of installing election data onto voting devices, as well as the creation of physical ballot layouts and creation of any/all media used to hold/transfer election data. This functionality involves **Verity Build**.



5.5.3 Pre-voting Aspects

Pre-voting aspects include pre-election preparatory, diagnostic, and election verification functions of a voting system. The focus will include device preparation, all required pre-voting tasks, and verification of manufacturer recommended pre-voting tasks. This functionality involves **Verity Data, Verity Build** and **Verity Print**.

5.5.4 Voting Aspects – Polling Place

Polling place aspects include all required and additional supported voting functions, including HAVA compliant requirements. This area will focus on all aspects of election functions and capabilities at the polling place from opening of the polls through closing the polls. This functionality involves **Verity Scan, Verity Touch Writer** and **Verity Controller/Touch/Touch with Access**.

5.5.5 Voting Aspects – Central Count

The focus of the central count functions is primarily the usage of a COTS high speed scanner to scan large quantities of absentee ballots and passing each image to **Verity Central** for interpretation of the voter's markings on the ballot. This functionality involves **Verity Central**

5.5.6 Post Voting Aspects

This area will focus on all required election post-voting functions. This includes any additional supported election functions performed after closing the polls, device auditing, transmission, and reporting aspects of the voting system. This functionality involves **Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central** and **Verity Count**.

5.5.7 Error Messaging and Recovery

This area will focus on the system's ability to generate appropriate error messaging within each system component and the system's ability to recover from error conditions in order to proceed with all election functions. This functionality involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central** and **Verity Count**.

5.5.8 Auditing

This area will focus on device and system level auditing capabilities and will verify at a minimum the required audit functionality. This includes audit trail capability throughout the life cycle of the voting system and audit log content requirements. This functionality involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central** and **Verity Count**.



5.5.9 Security

Overall system and device level logical and physical security aspects will be tested. Physical security will focus on the areas of integrity (ballot box doors, locks and seals) and detection (compromised ballot box doors, locks or seals). Logical security will focus on the areas of access controls, accountability, confidentiality, and integrity. These logical security areas will be applied to the OS, Database, Network and Application entities used by the EMS, BMDs and Scanners used by the voting system under test. This functionality involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central** and **Verity Count**.

5.6 Test Suite Design

5.6.1 Hardware Qualitative Examination Design

SLI will review all reports submitted by the manufacturer of previous testing conducted by acceptable hardware test labs, on the equipment contained in the **Hart Verity Voting 2.0 voting system**. The results will be compared against the guidelines of the VVSG 2005, Section 2 to identify any additional testing required. In addition, SLI will create the following test suites to focus on Maintainability, Accessibility, and Usability of the voting system:

- **Accessibility** - Testing accessibility requirements for a voting system generally consist of both objective and observable requirements. In combination the two types of requirements verify that the voting system components are accessible to all eligible voters, including those that may have a type of challenge that creates a need for assistance of some type. The voting systems should be self contained such that the individual voter is able to cast their vote without assistance from another party. Accessibility calls for the voting system to take into account vision, varying degrees of vision, dexterity, mobility, aural issues, and speech and language proficiency. This test involves **Verity Scan, Verity Touch Writer** and **Verity Controller/Touch/Touch with Access**.
- **Maintainability** - Maintainability encompasses a range of maintenance actions that examine all scheduled and unscheduled events in place for preventing failures on all hardware devices. Testing verifies the ease with which maintenance actions can be performed based on the design characteristics of the equipment and software. Non-technical election workers are to be able to be made aware of the problem through the



equipment and software's ability to correctly self-diagnose problems. This test involves **Verity Scan**, **Verity Touch Writer** and **Verity Controller/Touch**.

- **Usability** – Usability is defined as a measure of the effectiveness, efficiency, and satisfaction achieved by a specified set of users with a given product in the performance of specified tasks. In the context of voting, the primary user is the voter, the product is the voting system, and the task is the correct recording of the voter ballot selections. Testing is conducted to ensure voters are able to negotiate the process effectively, efficiently and comfortably according to the requirements dictated. This test involves **Verity Scan**, **Verity Touch Writer** and **Verity Controller/Touch**.

5.6.2 Hardware Environmental Test Design

Hardware environmental testing is performed to verify conformance to Vol. 1, Section 4 of the FEC VVSG 2005. Testing will be accomplished through a combination of testing performed by SLI and testing performed by subcontractor labs. Specific hardware test plans from the subcontractor labs are included in Attachments B & C – Hardware Test Plans.

5.6.3 Software Module Test Design and Data

Incorporating the manufacturer's software specifications, SLI will validate that all software/firmware components of the system adhere to expected flow control parameters and specifications for data input and output.

5.6.4 Functional Test Design

SLI has prepared functional test modules using the operator/user procedures contained within **Hart InterCivic's** TDP. Functionality provided by **Verity Voting 2.0** voting system is exercised in order to verify that each functional component performs as expected. Accept/reject criteria are based on requirements of the VVSG and the system specification documents provided within the TDP. As many of the individual functional components rely on preceding functionality within the system, SLI incorporates system level suites that employ modules that exercise the individual functional components of the system, as well as the interaction (data transfer) between components.

5.6.5 Testing of the System

Testing of the System involves exercising the specific functions of each component of a voting system as well as the entire voting system. Testing will focus on the functionality of an election management system, the polling place devices, and



devices required for communications and data loading and will then focus on functionality of the integrated voting system.

There are various types of testing. Table 7 *Types of Testing* provides the descriptions of these kinds of tests and their associated benefit.

Table 7 – Types of Testing

Type of Testing	Description	Benefit
Nominal Conditions	Testing all nominal functional capabilities of all components of the voting system as it relates to the Requirements Matrix.	Nominal conditions testing ensure that the voting system is tested against all elements specified in the Requirements Matrix.
Data Driven	This is testing that is based on the data that is used throughout the voting system. For example, if 'x' is input in a field, it would branch to a different part of the application than if 'y' was entered. The goal is to ensure that all branches get tested.	The tests verify that each unique data element can be accessed and used according to the voting system's user documentation. These test cases are based on the election data or vote data used and not the functional flow or work flow of the voting system.
Usability	The purpose of UI Testing is to test all of the screen and data elements that exist on each and every screen. SLI will verify responses to input, text syntax, error message content, and audit message input.	These tests verify every action will work that a user can perform on a screen. These tests will also verify that any screen or data element will not take the user by surprise.
Error Messaging and Recovery	Exercise system's ability to recover from hardware, software, and data errors.	Ensures that the system is able to successfully recover should there be a system or data error.
End-to-End	This is system testing in a true end-user environment following all pre-election day, election day, and post election day voting rules and processes.	This is used to demonstrate that a system can be used to perform its job following the exact set of processes and steps that would be used by the target customer or end-user.
Regression	Testing that validates that existing functionality is unchanged with the introduction of new functionality and correction of defects.	Manual test script execution and parallel tests will test end-to-end functionality.



Type of Testing	Description	Benefit
Formal Execution	Final verification of the voting system in a true end-user environment, following all pre-election day, election day, and post election day voting rules and processes.	Results are the best the system can perform. Verify that fixes have not introduced impacts on other functional aspects of the system and demonstrate that a system can be used to perform its job following the exact set of processes and steps that would be used by the target customer or end-user.
Volume Test	Testing the voting system's response to conditions that range from processing more than the expected number of ballots/voters per precinct to processing more than the expected number of precincts to any other similar volume conditions.	Determine if there are limits to the voting system's ability to operate under conditions that tend to overload the system's capacity to process, store, and report data.
Stress Tests	Testing the voting system's responses to transient overload conditions by subjecting polling place devices to ballot processing at high volume rates.	Evaluates the voting system and software's response to hardware-generated interrupts and wait states.
Accessibility Test	Exercises system capabilities of voters with disabilities.	Validates that the voting system is tested against all applicable ADA and HAVA requirements for voters with disabilities, as specified in the Requirements Matrix.
Performance Tests	Tests accuracy, processing rate, ballot format, handling capability and other performance attributes specified by Hart Verity Voting 2.0 voting system.	Performance testing ensures that the voting system meets all performance elements specified in the Requirements Matrix.

5.6.6 Software Functional Test Case Design

As described in the "Testing Strategy" section above, each individual component of the voting system will be reviewed independently, such that all functionality present in the component is verified to work as documented, and that all functionality is appropriately documented. For the components that are able to be networked, this will be reviewed as well. This approach corresponds to the following functional testing to be done.



5.6.6.1 Single workstation configurations

All functionality present in **Verity Data**, **Verity Build**, **Verity Central** and **Verity Count**, including those covered in the “System Review” and “Supported Functionality” sections above, is verified to work as documented, and that all functionality is appropriately documented.

5.6.6.2 Client/Server configurations

Testing of the client/server configuration, for **Verity Data**, **Verity Build**, **Verity Central** and **Verity Count**, will be the focus of this testing, such that reliability of data consistency between workstations in the server/client configuration is verified.

5.6.6.3 Verity Devices

All functionality present in **Verity Print**, **Verity Scan**, **Verity Touch Writer**, **Verity Controller**, **Verity Touch** and **Verity Touch with Access**, that covered in the “System Review” and “Supported Functionality sections above, is verified to work as documented, and that all functionality is appropriately documented.
This test covers **Verity Print**.

5.6.7 System Level Test Suite Design

System level test suites will focus on exercising the components as an integrated system. Testing will include the following:

- **Readiness Testing** - Ensuring readiness of a voting system is crucial for testing and assisting each jurisdiction in preparing for use of a voting system. Readiness Testing is different from testing very specific pieces of functionality within a system; it is broader than acceptance and functionality testing. It focuses on creating a validated baseline for testing and verifying system readiness.

The Readiness suite consists of a full system setup. The setup includes an election creation module (**Verity Build**), precinct location count devices (**Verity Touch Writer**, **Verity Controller/Touch/Touch with Access** and **Verity Scan**), Central Count devices (**Verity Central** with associated COTS scanner as well as an accumulation and reporting system (**Verity Count**). A basic election will be created and executed, including offices with candidates, parties, referenda, ballot styles, various jurisdiction types, as well as basic implementations of other supported features that are relevant to the jurisdiction.

The Readiness test is considered the gateway test which is performed prior to any other formal testing.



This test involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central** and **Verity Count**.

Vote counts will be accumulated from **Verity Central, Verity Controller** and **Verity Scan**.

- **Election Validations** - Election suites are created to replicate each type of election that can be implemented by the jurisdiction. Within the election types, pertinent voting variations, that are applicable to that type of election, will be validated and verified to a greater depth than what is done in the Readiness test. Each suite has a particular focus to it, such that when executed successfully, a given requirement, or set of requirements, are determined to have been successfully implemented by the voting system.

- **GenVariation1**

The focus of this suite is validating N of M voting, Partisan offices, Non-Partisan Offices, Ranked Order Voting, Straight Party Voting, Ballot Rotations, Ballot Formatting, precincts and split precincts, as well as Tally and Reporting functionality.

This test involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central** and **Verity Count**.

Vote counts will be accumulated from **Verity Central, Verity Controller** and **Verity Scan**.

- **GenVariation2**

This suite builds off the GenVariation1 Test. Additional definition is added, with a focus on validating N of M voting, Partisan offices, Non-Partisan Offices, Write-Ins, ADA/HAVA, as well as Tally and Reporting functionality.

This test involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central** and **Verity Count**.

Vote counts will be accumulated from **Verity Central, Verity Controller** and **Verity Scan**.

- **PriOpen**



The focus of this suite is to conform to an Open Primary election with focus on validating primary presidential delegation nominations, N of M voting, Partisan offices, Non-Partisan Offices, Straight Party Voting, Ballot Rotations, Ballot Formatting, ADA/HAVA, precincts and split precincts, as well as Tally and Reporting functionality.

This test involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central** and **Verity Count**.

Vote counts will be accumulated from **Verity Central, Verity Controller** and **Verity Scan**.

- **PriClosed**

This suite builds off the PriOpen Test, taking the election definition and modifying it to conform to a Closed Primary election with N of M voting, Partisan offices, Non-Partisan Offices, Ballot Formatting, ADA/HAVA, precincts and split precincts, as well as Tally and Reporting functionality.

This test involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central** and **Verity Count**.

Vote counts will be accumulated from **Verity Central, Verity Controller** and **Verity Scan**.

- **PriBlanketOpen**

This suite builds off the PriOpen Test, taking the election definition and modifying it to conform to a Blanket Open Primary election with N of M voting, Partisan offices, Non-Partisan Offices Ballot, Ballot Formatting, ADA/HAVA, precincts and split precincts, as well as Tally and Reporting functionality.

This test involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central** and **Verity Count**.

Vote counts will be accumulated from **Verity Central, Verity Controller** and **Verity Scan**.

- **Error Messaging and Recovery** - SLI will focus on Error Messaging and Recovery in key areas of the system identified from researching previous testing and voting system documentation to help identify potential failure



points. Voting systems can be subject to various conditions and when the system exceeds limitations errors are typically found. Testing of Error messaging will focus on the appropriate error messages being generated in response to a specific error and content of the message. The testing of the voting system Error Recovery capability is incorporated into Stress testing in order to leverage the necessary range of performance impacts needed to generate system errors and force recovery.

This test involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central and Verity Count.**

- **System Audit Content Validations** - Audit records are used to track what system functions have been executed, what data has been modified, as well as by who and when. Additionally, audit record data content can be a key factor in identifying system anomalies and provide assistance in troubleshooting system errors. In tandem with the System Audit Validation, analysis of a voting system is performed to determine strategic points of the system that require auditing, along with the content needed to accurately depict the machinations of the system for the given situation. Tests are incorporated either into Election Validation suites or specific Audit Validation suites, as needed, such that all related requirements are explicitly validated. This testing focuses on validating system's ability to provide audit capability throughout the entire voting system, including availability, generation, integrity, and accuracy of the system's audit capability to ensure it meets the necessary requirements. Negative testing will be utilized to force the system into conditions that will trigger errors and verify the voting system captures those conditions.

This test involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central and Verity Count.**

- **Security Validations** –

Security Testing

The Security Test Suites are SLI's tests for verifying that a voting system will correspond to requirements in VVSG Volume 1, Section 7. It incorporates systems security provisions, unauthorized access, deletion or modification of data, audit trail data, and modification or elimination of security mechanisms. The vendor documentation will be reviewed to ensure sufficient detail is present to operate the voting system in a secured manner.



In its security testing SLI identifies the specific threats that are tested for and the associated risk if a flaw or exception is identified in a voting system. SLI maintains a “Threat Matrix Database” that is updated minimally once a year as well as whenever an issue is uncovered. The tests used by SLI are designed to ensure that the voting system meets or exceeds the requirements in the VVSG. Any instance where an anomaly or possible security flaw is identified, the potential risk is reported and evaluated.

Security testing includes testing each individual component of the system and the system as a whole. As such, **Verity Data, Verity Build, Verity Touch Writer, Verity Scan, Verity Controller/Touch/Touch with Access, Verity Print, Verity Central** as well as **Verity Count** will be subjected to review, as will the system as a whole and its interactions between components.

Test suites are created to validate and verify various aspects of system security at both the component level and the system level, as applicable. Each suite will have a particular focus to it, such that when executed successfully, a given requirement, or set of requirements, will be determined to have been successfully implemented by the voting system. **The tests will also verify that appropriate log messages are written when appropriate (e.g. an invalid attempts to login or access to a database).** Topics of Security review will include:

- Access Control

Access control testing verifies procedures and system capabilities that detect or limit access to system components in order to guard against loss of system integrity, availability, confidentiality, and accountability. This testing verifies that system resources such as data files, application programs and computer-related facilities and equipment are protected against unauthorized operation, modification, disclosure, loss or impairment. Unauthorized operations include modification of compiled or interpreted code, run-time alteration of flow control logic or of data, and abstraction of raw or processed voting data in any form other than a standard output report by an authorized operator.

This test involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central** and **Verity Count**.

- Software Security

Software security testing will be conducted to verify the installation procedures and ongoing foreign software detection



mitigation abilities of the voting system in order to protect against the modification of the software and/or the insertion of malicious software during the installation and during ongoing operations.

This test involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central and Verity Count.**

- **Physical Security Measures.**

Physical security testing verifies monitoring and control of the environment of the work place and computing facilities. It also verifies monitor and control access to and from such facilities. For example: doors, locks, cameras, barricades, fencing, cable locks, etc., can be utilized for implementation of physical security. Separating the network and work place into functional areas are also physical controls. Some portions of physical security are functional while other portions are procedural. Functional portions will be tested as appropriate while procedural portions will be verified to be documented as called out by the VVSG.

This test involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central and Verity Count.**

- **Language** – Testing is conducted to ensure the voting system is capable of presenting the ballot, ballot selections, review screens and instructions in the required languages.

This suite builds off the Readiness Test, taking the election definition and modifying it. Additional definition is added, with a focus on validating the system's ability to handle the prescribed foreign languages that have been declared to be supported, English and Spanish.

This test involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central and Verity Count.**

Vote counts will be accumulated from **Verity Central, Verity Controller and Verity Scan.**

- **Data Retention/HW Integrity** – Testing integrity requirements ensure the physical stability and function of the vote recording and counting processes,



such that the system is not prone to a single point of failure that would prevent voting at a polling place. Testing will also verify prevention of failure of data input or storage, in terms of data retention, as well as confirming that appropriate audit records are maintained without modification.

This test involves **Verity Data, Verity Build, Verity Print, Verity Scan, Verity Touch Writer, Verity Controller/Touch/Touch with Access, Verity Central** and **Verity Count**.

Vote counts will be accumulated from **Verity Central, Verity Controller** and **Verity Scan**.

- **Import Election Data** – Testing the import capabilities of the voting system as the primary means of populating the system with election data. This test will verify the appropriate documentation exists for a 3rd party to create the necessary XML data file to create an election within the **Verity Voting 2.0** voting system. Testing will also verify that **Verity Build** successfully checks for appropriate data and gracefully handles **invalid** data. This test configuration covers **Verity Build**.
- **Accuracy** – Testing the ability of the system to capture, record, store, consolidate and report the specific selections and absence of selections, made by the voter for each ballot position without error. Required accuracy is defined in terms of an error rate that for testing purposes represents the maximum number of errors allowed while processing a specified volume of data.

Accuracy testing is conducted at both the device level and the system level.

Each device is subjected to scrutiny that will verify that the requirements for accuracy are met. Additionally, the system will be reviewed and exercised to validate that the accumulation, tallying and reporting mechanisms at the system level are able to accurately perform their functions.

There are three potential stages to the accuracy test:

- Go/no go, where after approximately 26,000 ballot positions, if any errors are found the test fails,
- If no errors are found the test continues to the 1.55 million ballot position mark, where if 1 error is found the test may progress to approximately the 3.1 million ballot position mark. **If** no more errors are encountered, the test passes.
- If more than 1 error is found at the 1.55 million ballot position mark the test fails.



This test covers **Verity Touch Writer, Verity Scan, Verity Controller/Touch/Touch with Access, Verity Central** as well as **Verity Count**.

Vote counts will be accumulated from **Verity Central, Verity Controller** and **Verity Scan**.

- **Mark Sensitivity** - The purpose of Ballot Mark Sensitivity testing is to determine that the system under test is able to accurately determine when a mark has been made within a ballot marking position. For this test, various marks are made within the ballot marking positions, using Verity supported colors of ink.

Marks include fully filled boxes, left and right oriented slashes, “X” markings, check marks, horizontal single line marks, and circles of various sizes.

Marks also include vertical lines within the marking position that fill approximately ten percent of the designated space. Small dots down to approximately five percent of the ballot marking position are also included. Inks implemented include blue and black.

This test covers **Verity Scan, Verity Central** as well as **Verity Count**.

Vote counts will be accumulated from **Verity Central, Verity Controller** and **Verity Scan**.

- **Volume** – Testing a system’s response when subjected to large volumes of data, “more than the expected”, as called out in the standards. Volume testing is typically considered a type of non-functional testing. However, as a voting system’s primary function is to accumulate, tally, and pass a volume of data (votes) the VSTL approaches volume testing as a functional test. Experience has shown that large amounts of data can slow a system, or even cause failures and loss of data due to architectural limitations. The testing will focus on not only passing large amounts of data but how the system operates and handles the data in key areas of functionality within the voting system. **Displayed and logged error messages, or the lack of, will be noted.**

This test covers **Verity Scan, Verity Controller/Touch/Touch with Access, Verity Central** as well as **Verity Count**.



Vote counts will be accumulated from **Verity Central, Verity Controller** and **Verity Scan**.

- **Stress** - Testing a “system’s response to transient overload conditions.” Experience has shown that when passing a dataset through a system that eclipses the system architectural limitations, failures can occur and result in the loss of critical data. The testing will focus on the system’s ability to operate after the limitations have been exceeded and if failures occur, how the data is maintained or recovered in key areas of functionality within the voting system. **Displayed and logged error messages, or the lack of, will be noted.**

This test covers **Verity Scan, Verity Controller/Touch/Touch with Access, Verity Central** as well as **Verity Count**.

5.7 Standard VSTL Test Methods and Uncertainty of Test Data Measurement

This test campaign utilizes Standard VSTL test methods and nominal type test data only.

5.8 EAC Interpretations

The test engagement described in this Certification Test Plan utilizes only standard VSTL test methods that conform to the EAC Testing and Certification Program Manual and the appropriate voting system standard. EAC interpretations affecting the certification project, test plan and test methodology and are implemented as noted below.

- EAC Decision on RFI 2007-01
- EAC Decision on RFI 2007-02
- EAC Decision on RFI 2007-03
- EAC Decision on RFI 2007-04
- EAC Decision on RFI 2007-05
- EAC Decision on RFI 2007-06
- EAC Decision on RFI 2008-01
- EAC Decision on RFI 2008-02
- EAC Decision on RFI 2008-03
- EAC Decision on RFI 2008-12
- EAC Decision on RFI 2008-11



- EAC Decision on RFI 2009-02
- EAC Decision on RFI 2009-03
- EAC Decision on RFI 2009-04
- EAC Decision on RFI 2009-05
- EAC Decision on RFI 2009-06
- EAC Decision on RFI 2010-004
- EAC Decision on RFI 2010-01
- EAC Decision on RFI 2010-02
- EAC Decision on RFI 2010-03
- EAC Decision on RFI 2010-05
- EAC Decision on RFI 2010-06
- EAC Decision on RFI 2010-07
- EAC Decision on RFI 2010-08
- EAC Decision on RFI 2012-01
- EAC Decision on RFI 2012-03
- EAC Decision on RFI 2012-04
- EAC Decision on RFI 2013-01
- EAC Decision on RFI 2013-02
- EAC Decision on RFI 2013-03
- EAC Decision on RFI 2013-04
- EAC Decision on RFI 2015-05

RFI's not implemented in this test campaign, are:

- EAC Decision on RFI 2009-001, VVPAT Accessibility
- EAC Decision on RFI 2012-02, Transmission of Results (Official vs. Unofficial)
- EAC Decision on RFI 2012-05, Public Telecomm and Cryptography
- EAC Decision on RFI 2012-06, Use of Public Telecomm Networks and Data Transmission

EAC notices of clarification affecting the certification project are implemented as noted below.

- NOC 07-001 Timely Submission of Application for Certification
- NOC 07-005 VSTL responsibilities and Third Party Lab Oversight
- NOC 08-001 Use of Previous Non-core HW Testing
- NOC 08-003 EAC Conformance Testing Requirements
- NOC 09-001 Test Plan NOC
- NOC 09-002. Testing Independence
- NOC 09-003 de minimis change TDP
- NOC 09-004 Test Report
- NOC 09-005 Modification Test Plan
- NOC 11-01 de minimis data change final



- NOC 12-01 COTS Computer Equivalency for de minimis Change
- NOC 12-02-Clarification of System ID Tool Functionality FINAL 4.19.12
- NOC 13-01_Discrepancy_Listing_in_Test_Report-FINAL-10 17 13
- NOC 13-02_Detailed_Description_of_Changes_for_Modifications
- NOC 15-01, Test Readiness Review

EAC notices of clarification, noted below, not affecting the certification project are not implemented:

- NOC 07-002 VSTL work outside of voting system testing
- NOC 07-003 State and Federal Testing
- NOC 07-004 Manufacturing facilities
- NOC 08-002 EAC Mark of Certification
- NOC 14-01_Technology_Testing_Agreement

6 TEST DATA

Test data for **Hart Verity Voting 2.0** voting system is compiled such that all functionality declared will be tested to determine conformance to the standards.

6.1 Data Recording

SLI has evaluated the system functionality, as described by manufacturer technical documentation, as well as requirements as listed in the EAC 2005 VVSG, and made determinations as to expected results of all data inputs into the **Hart Verity Voting 2.0** voting system. This includes:

- Election type
- Precincts of all types
- Districts
- Offices
- Contests
- Candidates
- Parties
- Devices used
- Voting variations employed
- Issues/Referendums
- Votes cast for each candidate/issue/referendum
- Vote consolidation data from one device/level to the next

The data is contained in one master data record, including each input and each expected output. This data is incorporated into the appropriate test suite, populating test modules with exact expected data for the function being tested.



Testing information is recorded in the test suites, as well as in test notebooks, which are utilized according to SLI's standard lab procedure *SLP-VC-30 - Test Notebooks*.

6.2 Test Data Criteria

SLI has evaluated the system functionality as described by manufacturer technical documentation, as well as requirements as listed in the EAC 2005 VVSG, and made determinations as to expected output of all data inputs into the **Hart Verity Voting 2.0** voting system. A data matrix has been recorded into one master data record that couples data inputs to their expected output, as determined above. The system's execution shall be measured against the expected results.

6.3 Test Data Reduction

SLI processes the test data by manually recording input data into each pertinent module within the Test Suites as well as the exact output that is generated, e.g., the vote counts when the data is consolidated.

7 TEST PROCEDURE AND CONDITIONS

This section describes the test conditions and procedures for execution of test suites. If a particular sequence is mandatory for the execution of suites, a rationale will be given. Additionally, this section is used to describe procedures for setting up equipment that will be utilized in the execution of the test suites.

7.1 Facility Requirements

Testing will be performed on site at SLI in Denver, Colorado.

Three secure labs are available with appropriate power supply and space to accommodate the various configurations defined within this test plan. Temperature/humidity gauges will be employed in order to determine the appropriate conditions exist during testing.

Unless otherwise specified herein, all remaining tests, including system level functional testing, shall be performed at standard ambient conditions:

- Temperature: 25°C ± 10°C (77°F ± 18°F)
- Relative Humidity: 20 to 90%
- Atmospheric Pressure: Local Site Pressure



All TDP and test documentation is stored on site at SLI's facility in a secure project directory on SLI's secure Voting server.

Environmental hardware testing for hardware components of the **Hart Verity Voting 2.0** voting system was performed at the NVLAP or A2LA accredited testing laboratories list in section "1.8.1.5, 3rd Party Hardware Testing".

7.2 Test Setup

Configurations of **Verity Voting 2.0** will be deployed that conform to each specific test suite's needs. Some configurations will consist of standalone implementations, while other configurations will utilize networked implementations of various applications, such as **Verity Build**, **Verity Central** and **Verity Count**. In all instances **Verity Voting 2.0** documentation will be followed in the setup of the configurations.

Successful completion of operational status checks will indicate that the system is ready for test execution.

7.3 Test Sequence

While there is no required sequence for performing voting system certification testing and audits, there are prerequisite tasks for some testing. Any needed prerequisites are contained within the suite for that test.

8 TEST OPERATIONS PROCEDURES

An inventory has been performed to verify the voting equipment received contains hardware and software elements as defined in the TDP prior to commencement of testing.

Throughout the testing effort, test suites and modules will be marked as follows:

- **Accept** – Test is accepted as successful.
- **Reject** – Test is rejected as unsuccessful.
- **NT** – Not Testable is used for test modules that cannot be followed. For example, if failure of one test modules failure precludes attempting subsequent test modules, the latter will be marked as NT.

Test results **Reject**, **NT** will include comments by the VTS explaining the reason for the result.



Issues encountered during review and testing will be documented in the Discrepancy Report as well as the EAC VRT system. Issues that do not conform to the requirements of the VVSG, version 2005 will be marked as **Documentation Discrepancies** or **Functional Discrepancies** (a discrepancy occurs when the software does not meet defined software requirements or specifications). SLI employs a system of checks such that any issue uncovered during testing is first designated as an “anomaly”. The anomaly is then reviewed and the cause is determined as to be either caused by a flaw in the test or in the voting system itself. If the issue is determined to be a flaw in the test, the test will be re-written, re-validated and then formally re-run. If the issue is determined to be a flaw in the voting system, then a discrepancy is opened against the system. While test suites and test modules undergo a validation phase prior to formal execution, last minute code changes can possibly change the behavior from what the test module defines as expected, which if this is the case, the review process employed during the anomaly phase will reveal, thus reducing the chance of a false positive in terms of an unfounded discrepancy being written against the voting system.

Issues that are encountered during testing or documentation review, but are not addressed by the applicable standard will be added to the Discrepancy report and noted as **Informational**. The vendor has the option whether to address Informational issues. All responses provided by the vendor are noted in the Discrepancy Report attachment to the Certification Test Report.

9 Approval Signatures

SLI:

Traci Mapps
VSTL Director
December 21st, 2015

10 Appendix A – Detailed System Review



10.1 Detailed System Review

This section describes the workings of the **Hart Verity Voting 2.0** voting system in a detailed manner, and will assist the reader with understanding the flow of the voting system.

10.1.1 Verity Data

Verity Data is a data management application that allows users to manage election and jurisdiction data in a manner that is compatible for use with the **Verity Voting** system.

Verity Data collects and exports data only. More specifically, it accepts user input of jurisdiction-specific data (e.g., precincts, districts) and election-specific data (e.g., contest titles, choices) and exports the data in an XML format compatible for import into **Verity Voting's** election definition software, **Verity Build**.

Verity Data cannot perform any of the following functions typical of voting system components; again, it is a data management application only.

Verity Data cannot:

- define Verity Voting elections
- generate paper ballots
- generate electronic ballots
- generate election-specific programs for vote recording or vote counting equipment
- install ballots or election specific programs
- program device settings for Verity Scan, or for Verity Touch Writer
- produce flash memory vDrives for use in Verity Voting devices
- capture votes
- accumulate vote totals
- generate post-voting reports
- store any voting data (including ballot images, tally data or cast vote records)

Once the **Verity Data** application is entered, and election data is imported, the normal path will take the user through the chevron workflow, which includes the Selection Election, Edit Data, Preview Ballots and Export for Voting chevrons.

10.1.1.1 Select Election Chevron

The **Select Elections** chevron has one option: **Elections**.

The **Elections** tab is used to load election data. All election data sets in **Verity Data** are listed here.



10.1.1.2 Edit Data Chevron

The **Edit Data** chevron has eight main tabs with multiple second-level tabs. At the first level are Election, Jurisdiction, Contests, Ballot Data, Translations, Audio, Import, and Export.

Of these top-level tabs, four have multiple second-level tabs.

- Election second-level tabs are Basic Info, Voting Types, Parties, Preferred Wording, and Rules.
- Jurisdiction second-level tabs are Precincts, Districts, and Polling Places.
- Contests second-level tabs are Titles and Choices.
- Ballot Data second-level tabs are Ballot Instruction, Additional Text, Ballot Order, Ballot Header, and Ballot Stub.

Under the Elections tab:

- The Basic Info sub-tab allows users to Add title, date, jurisdiction, languages.
- The Voting Types sub-tab allows users to create and edit voting types.
- The Parties sub-tab enables users to specify political parties for the election data set.
- The Preferred Wording sub-tab enables users to customize ballot labels.
- The Rules sub-tab allows users to specify whether the election data should be configured for straight-party voting.

Under the Jurisdiction tab:

- The Precincts sub-tab enables users to add precincts and precinct splits to an election data set and assign display order.
- The Districts sub-tab enables users to add, delete, or change district information.
- The Polling Places sub-tab enables users to add, modify, and delete Polling Places for the current election data set.

Under the Contests tab:

- The Titles sub-tab provides a place to type the names of elections.
- The Choices sub-tab enables users to add choices to contests.

Under the Ballot Data tab:

- The Ballot Instructions sub-tab adds ballot instruction text and images in English (Spanish is added through the Translations screen).
- The Additional Text sub-tab adds additional text and associate with precincts and districts; specify layout rules and add an image.
- The Ballot Order sub-tab changes ballot data order.
- The Ballot Header sub-tab specifies the data to appear in the header, including header images, if applicable.



- The Ballot Stub sub-tab specifies stub location and the data to appear on the stub, including stub images, if applicable.

The Translations tab displays the list of translations for the current election data set. Users can view and enter translations in all of the languages selected for the election data set.

The Audio tab displays each audio item name and its status, as well as the text for it. Users are able to import, export, record, edit audio clips and delete an existing recording.

The Import tab allows users to select from among the many data sets listed for import. When importing data, users should match the Election Type of the Election into which the data is being imported. Partial or Full data sets can be imported for an election.

The Export tab functions in exactly the same way as the Import tab, with one exception. Instead of importing data into the Data application, users export data from the application.

10.1.1.3 Preview Ballots Chevron

The Preview Ballots chevron has four first-level options: Select Template, Data Validation, Preview, and Reports.

The Select Template tab displays the list from which users select a template for each language. Users click to select a template to attach in their data file when exporting to removable media.

The Data Validation tab displays the Data Validation screen, which shows the status of the data to be exported. All items with a red “x” status must be resolved before exporting the election data file and loading it into **Verity Build**.

The Preview tab shows a preview of what ballots will look like in **Verity Build**.

The Reports tab offers two reports, System Log, and Audit Log reports.

10.1.1.4 Export For Voting Chevron

The Export for Voting chevron has one option: Validate & Export for Voting.

The Validate & Export for Voting tab displays the Exporting Your Election screen. If the election has validation errors that must be resolved before the election can be exported, the Election Export dialog window displays an error message.



Clicking the Export button in the lower-right corner exports the election data file to external media. From there the file can be imported into **Verity Build**, where the election data file will become an election definition.

10.1.2 Verity Build

Verity Voting 2.0 is initially entered through the **Verity Build** application. New election data is imported into the system via an XML file that is populated outside of the certified system. Existing election data (previously imported) can be re-used within the Build application.

Once the **Verity Build** application is entered, and an election is imported, the normal path will take the user through the chevron workflow, which includes the Proof, Configure and Create chevrons.

10.1.2.1 Proof Chevron

The Proof chevron has four tab functions within it, Data Validation, Ballot Preview, Reports, and Proof Audio.

The Data Validation tab is where the imported data is validated. This allows the user to review all aspects of an election data set.

Once the data is validated, the ballots are previewed, in the Ballot Preview tab, where users can preview the details for any selected ballot. Details that can be previewed include: ballot by language, ballot by type, sorted precinct and style lists, as well as filtered precinct and style lists.

The Reports tab enables users to generate and print reports. The Reports screen contains a list of all of the reports available in **Verity Build**. From the Reports screen, users can generate, view, customize, and print selected reports.

The Proof Audio tab provides users with a way to proof audio items for their ballots. Audio items are those recordings used to create accessible audio ballots. Users proof audio items for each language in the election.

10.1.2.2 Configure Chevron

The Configure chevron and its tabs of functionality follow the Proof chevron in the **Verity Voting 2.0** system of election definition creation. The Configure workflow chevron contains two tabs: Election Settings, and Accept Election.

The Election Settings tab has six sub-tabs, Printed Ballots, Voting Type Setup, Device Reports, Device Passcodes, Scan and Touch Writer.

The Printed Ballots sub-tab allows the user to set printed ballot settings.

The Voting Type Setup sub-tab allows users to set rules for specific voting, such as early voting, absentee voting as well as Election Day voting types, and associated parameters for each.



The Device Reports sub-tab allows users to control the sort order for choices on device reports, such as: Report results at the [select level] which allows users to control the level of detail on device reports; Zero report, which allows users to control whether the Zero Report shows only totals for the device or totals by precinct and precinct split; and Ballot count report, which allows users to control whether the Ballot Count Report shows only totals for the device or totals by precinct and precinct split.

The Device Passcodes sub-tab is where passcodes are defined and maintained. Passcodes are defined for **Verity** user types and for opening, suspending, and closing the polls by voting type.

The Scan sub-tab is where users can configure the ballot processing rules for scanning ballots. The four scanning exceptions are Undervote, Overvote, Invalid Vote, and Blank Ballot. In Build, each jurisdiction defines how these exceptions are to be treated.

The Touch Writer sub-tab is where the BMD can be configured to specify the number of minutes the voter access code is active.

The Accept Election tab represents the final step in the proofing process. On the Accept Election screen, users can do one of two things: accept the election, or navigate away from this screen.

Elections must be secured for security and consistency purposes. In Build, the Accept function locks election data against further edits. This step effectively defines all of the ballot styles for the election. After that, the entire formatted election definition is transferred to vDrives. The election definition is then carried forward on vDrives throughout the election process.

10.1.2.3 Create Chevron

The Create chevron is dimmed, indicating that it is unavailable, until the election has been accepted in the **Configure** workflow. The Create chevron has three tabs: Ballots, vDrives, and Keys. The Ballots tab is used to configure ballots for printing.

Printing options available for each ballot include: Quantity, where users can type or use the dial to select a quantity of ballots; Type, where users can click to select either the Official, Test, or Sample ballot; Ballot serial numbers, which can be enabled; and Include ballot stub, where users can click to select the check box to include ballot stubs on printed ballots.

A vDrive is a removable media device that carries election data throughout the election process.

The vDrives tab, which is used to create and read vDrives, allows users to choose a Device Type, specify the quantity of vDrives to write, write the vDrives, print a report of vDrives written, and then read vDrive statistics.



The Keys tab allows the Election Official Key to be written. Keys are made for the entire system, including **Scan**, **Touch Writer**, **Central** and **Count**.

10.1.3 Verity Touch Writer

Verity Touch Writer is a polling place ballot marking device solution for paper ballots. Touch Writer is paired with a commercial off the shelf printer to allow the voter to mark then print their vote selections. **Verity Touch Writer** is used in conjunction with **Verity Scan** to provide the voter with a reviewable paper ballot.

10.1.4 Verity Scan

Verity Scan records Cast Vote Records (CVRs) and audit log data in redundant, secure storage locations. The storage locations include the **vDrive**, CFAST and the ballot box for scanned paper ballots. Paper ballots can be scanned and transferred into digital CVRs. **vDrive** storage allows for the CVRs and device logs to be transferred into the **Verity Central** ballot resolution system or the **Verity Count** tabulation system.

10.1.5 Verity Central

Verity Central is a high volume scanning and ballot review system within the **Verity Voting 2.0** system. This application acts as a centralized compilation and processing site for final ballot handling, reading and processing before tabulation.

Verity Central allows for ballots to be scanned in bulk for users to review during scanning and through resolution for voter intent. Each ballot has the front and back pages scanned simultaneously to capture all voter marks, supporting duplex ballots. Users with proper training can review the ballots for write-ins and ballots flagged as having voter intent issues (such as overvotes, undervotes, and write-in candidates). Once all votes have been reviewed as indicated by flagging, the ballots are then written as Cast Vote Records (CVRs) to vDrives. The final CVR records on **vDrives** are then sent to a **Verity Count** workstation for official tabulation.

Within the **Verity Central** application, the workflow follows the path of chevrons Election, Scan, Review, Write Ballots, and Reports.

10.1.5.1 Elections Chevron

The Elections chevron has three tab options: Elections, Tasks and Preferences.

The Elections tab allows a user to open a loaded election. Elections are imported through the Election Management application.

The Tasks tab manages tasks and the closing of polls for scanning ballots, resolving voter intent issues, and writing vDrives.

The Preferences tab provides configuration settings for maintaining and



interacting with election results within Central.

No other chevrons will become active and accessible until an election is opened from the Elections tab and at least one task is created and opened from the Tasks screen.

10.1.5.2 Scan Chevron

The Scan chevron includes the tabs, Scan, Manage Batches, Search Ballots and Settings.

The Settings tab should be accessed prior to scanning. Scanner Setup opens a scanner driver setup window and sets the scanner to be used.

Test Scan is used to run a ballot through the selected scanner in order to verify proper operation.

Defer write-in resolution to **Verity Count** which when selected, any resolutions of voted write-ins will be handled through a **Verity Count** workstation, not through **Verity Central**.

Allow duplicate serial numbers where when scanning ballots, each ballot may have a unique serial number (per the election definition). This option allows for the same serial number to be reused and not rejected during ballot scanning.

Allow incomplete multi-sheet ballots where when scanning ballots, any incomplete ballots are allowed to scan and not be rejected. Incomplete ballots do not include all pages.

The Scan tab enables users to scan large amounts of ballots, front and back at the same time, when sent through. As the ballots are scanned, the ballot images are analyzed and accepted or rejected. If rejected, the system alerts the user to review the ballot for issues.

The Manage Batches tab displays all scanned and saved batches of ballots. Users can generate and view a report on a batch, delete the batch entirely, change the type, and edit the notes.

The Search Ballots tab provides a screen for searching out specific ballots within scanned batches of ballots. These ballots can be viewed or deleted from the batch. Search criteria can be a serial number, batch ID number or scan order.

10.1.5.3 Review Chevron

The Review chevron has two tabs, Review Images, and Write-in Candidates.

The Review Images tab allows the user to filter and review ballots to resolve voter intent issues.

The Write-in Candidates tab allows the user to manage write-in candidate choices for contests. All possible candidate options are listed on the screen, separated by election contest.



10.1.5.4 Write Ballots Chevron

The Write Ballots chevron provides an interface for writing ballots to vDrives. All ballots must be written to vDrives prior to closing polls for a task. If the vDrive is damaged or is lost, the previously written batches can be rewritten to a new vDrive as recovery media.

The Write ballots chevron contains 2 tabs, Write Ballots and Recovery vDrive tabs.

The Write Ballots tab allows the user to write ballots to vDrives. The screen displays a list of batches available for writing to vDrives. Every written vDrive has a backup restoration copy saved. Once ballot batches are written to a vDrive, the batches cannot be selected and written to other vDrives.

The Recovery vDrive tab allows the user to create new vDrives to replace damaged or lost vDrives. If the vDrive with written batches is determined to be damaged or is lost, the user can create another vDrive of previously written data.

10.1.5.5 Reports Chevron

Reports chevron is the final chevron used in **Central**. The Reports chevron has 2 tabs, Reports and Exports.

The Reports tab provides detailed information on the database at the time of generation. User are allowed to generate, view, and print reports. A set of standard reports is provided to the user in order to generate and review against the loaded task and election.

The Exports tab provides export options against the database. This data is exported to CSV files.

10.1.6 Verity Count

Verity Count allows users to tabulate all voted ballots with updates of the election. Users can generate standard and custom reports for the entire election or specific precincts and polling places. Users insert and read ballots from **vDrives**. As ballots are read, **Verity Count** can tabulate automatically or as manually clicked, updating all reporting polling places and precincts, to give an at-a-glance view into the election.

Verity Count has the following chevrons: Elections, Read, Resolve, Results, and Import/Export.

10.1.6.1 Elections Chevron

The Elections chevron has 3 tabs, Elections, Tasks and Preferences.

The Elections tab allows a user to open an election.



The Tasks tab manages tabulation tasks, used to tabulate election results. A task is required to begin working with election data and generating results and reports.

The Preferences tab provides configuration settings for maintaining and interacting with election results within **Verity Count**.

10.1.6.2 Read Chevron

The Read chevron has 2 tabs: Dashboard and Media Reading.

The Dashboard tab provides an overview of the entire election, options for viewing further details, reading additional vDrives, and an option for tabulating results.

The Media Reading tab provides extensive details for vDrives read into the system, including the amount of successful and failure reads and the current status of the vDrive reading. If ready to insert, a new vDrive can be inserted for CVR loading.

10.1.6.3 Resolve Chevron

The Resolve chevron has 1 tab: Write-in Votes.

The Write-In Votes tab allows review and resolution of ballots with write-in votes of candidates.

10.1.6.4 Results Chevron

The Results chevron has the following tabs: Options, Reports, Precincts, Polling Places, Registered Voters, Vote Recording and Auditing Dashboard.

The Options tab provides preferences and configuration settings for all generated reports.

The Reports tab provides option for generating standard and custom reports.

The Precincts tab provides details reports and information for all precincts and precinct-splits.

The Polling Places tab details reports and information for polling places as they receive and report voting data.

The Registered Voters tab provides details information regarding all registered voters for a precinct/precinct split with options to configure and update totals.

The Vote Recording tab provides options for recording manual votes, changing voting totals through adding or subtracting ballots based on reviews.

The Auditing Dashboard tab provides an interface for generating filtered reports and exports of raw CVR data.

10.1.6.5 Import/Export Chevron

The Import/Export chevron has 2 tabs, Import and Export.



The Import tab provides options for importing data from CSV files.

The Export tab provides options for exporting data into CSV files.

Each of the software based portions of the **Verity Voting 2.0** voting system (**Verity Data, Verity Build, Verity Central** and **Verity Count**) provide the ability to be utilized in either a single application implementation or a networked configuration, utilizing a centralized database implementation. **Both configuration types will be exercised.**

End of Certification Test Plan
