NIST HANDBOOK 150-22
2017 Edition

National
Voluntary
Laboratory
Accreditation
Program

VOTING SYSTEM TESTING

Dana Leaman
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National Institute of
Standards and Technology
U.S. Department of Commerce

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U.S. Department of Commerce
Wilbur L. Ross, Jr., Secretary

National Institute of Standards and Technology
Kent Rochford, Acting NIST Director and Under Secretary of Commerce for Standards and Technology

NVLAP AND THE NVLAP LOGO

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Foreword

The NIST Handbook 150 publication series sets forth the procedures, requirements, and guidance for the accreditation of testing and calibration laboratories by the National Voluntary Laboratory Accreditation Program (NVLAP). The series is comprised of the following publications:

- NIST Handbook 150, *NVLAP Procedures and General Requirements*, which contains the general procedures and requirements under which NVLAP operates as an unbiased third-party accreditation body;

- NIST Handbook 150-xx program-specific handbooks, which supplement NIST Handbook 150 by providing additional requirements, guidance, and interpretive information applicable to specific NVLAP laboratory accreditation programs (LAPs).

The program-specific handbooks are not standalone documents, but rather are companion documents to NIST Handbook 150. They tailor the general criteria found in NIST Handbook 150 to the specific tests, calibrations, or types of tests or calibrations covered by a LAP.

NIST Handbook 150-22, *NVLAP Voting System Testing*, presents the technical requirements and guidance for the accreditation of laboratories under the NVLAP Voting System Testing LAP. The 2016 edition is based upon revisions to the *Voluntary Voting System Guidelines (VVSG) Version 1.1*, the U.S. Election Assistance Commission's (EAC's) *Testing and Certification Program Manual Version 2.0*, and the EAC *Voting System Test Laboratory Program Manual Version 2.0*, and supersedes and replaces the 2008 edition.

This handbook was written with the participation of technical experts in applicable fields of testing concerning voting systems and is approved by NVLAP.

The body of the handbook has been structured to conform with internationally accepted rules for the structure and drafting of standards, where appropriate, to promote ease of use and understanding.

This handbook is available on the NVLAP web site (http://www.nist.gov/nvlap).

Questions or comments concerning this handbook should be submitted to NVLAP, National Institute of Standards and Technology, 100 Bureau Drive, Stop 2140, Gaithersburg, MD, 20899-2140; phone: 301-975-4016; fax: 301-926-2884; e-mail: nvlap@nist.gov.

Introduction

The Help America Vote Act (HAVA) of 2002 (Public Law 107-252) was signed into law by President George W. Bush on October 29, 2002. Section 231 of HAVA requires the Director of NIST to provide for the accreditation of laboratories that conduct testing on hardware and software of voting systems. In response to HAVA, the National Voluntary Laboratory Accreditation Program (NVLAP) has established a program for laboratories that test voting systems.

On December 13, 2005, the EAC unanimously adopted the Voluntary Voting System Guidelines of 2005 (VVSG 1.0). The VVSG 1.0 increased security requirements for voting systems and expanded access, including the opportunity for disabled individuals to vote privately and independently. The VVSG 1.0 took effect in December 2007, at which time voting systems could no longer be tested against VSS-2002 and all previous national standards became obsolete.

Additionally, on March 31, 2015, the EAC approved updates to the VVSG 1.0 to allow for improved efficiencies in testing. The VVSG 1.1 was unanimously approved to clarify and add to requirements in the VVSG 1.0. In addition to the approved VVSG 1.1, the EAC also approved revisions to its Testing and Certification Program Manual and Voting System Test Laboratory Program Manual.

Voting system test laboratories (VSTLs) are required to meet the requirements in NIST Handbook 150, HAVA requirements, VVSG 1.0, VVSG 1.1 and any other criteria deemed necessary by the EAC. VSTLs should be familiar with general election administration practices and the election and voting communities including the state and local organizations of election officials.

1 General information

1.1 Scope

1.1.1 The purpose of this handbook is to set out procedures, technical requirements, and guidance for accreditation of voting system testing laboratories (VSTLs).

1.1.2 This handbook supplements the procedures and general requirements found in NIST Handbook 150. The scope of the Voting System Testing Laboratory Accreditation Program (VST LAP) is the set of requirements contained in the VVSGs as specified in the Help America Vote Act (HAVA) of 2002 (Public Law 107-252), VVSG 1.0, VVSG 1.1, and any other requirements or tests or test assertions deemed necessary by the U.S. Election Assistance Commission (EAC).

1.1.3 The additional requirements and interpretive comments contained in this handbook make the general NVLAP criteria specifically applicable to the VST LAP.

1.1.4 The requirements of NIST Handbook 150 and this handbook are normative (i.e., mandatory) and must be combined to produce the criteria for accreditation in the VST LAP.

1.2 Organization of handbook

The numbering and titles for first and most second level headings of this handbook match those of NIST Handbook 150. Lower-level headings are generally specific to the VST LAP. In some cases, upper-level headings have been included in the document with no additional text. In these cases, refer to NIST Handbook 150.

1.3 Program description

1.3.1 HAVA states that it is "an act to establish a program to provide funds to States to replace punch card voting systems, to establish the Election Assistance Commission to assist in the administration of Federal elections and to otherwise provide assistance with the administration of certain Federal election laws and programs, to establish minimum election administration standards for States and units of local government with responsibility for the administration of Federal elections, and for other purposes."

1.3.2 HAVA Section 231 requires EAC and NIST to develop a national program for accrediting voting system testing laboratories. On June 23, 2004, NIST published a notice in the *Federal Register* announcing the establishment of this program.

1.3.3 The purpose of the VST LAP is to accredit VSTLs to conduct testing of voting systems and components, providing a measure of confidence that such laboratories are capable of performing testing to meet the requirements of HAVA. VSTLs provide testing services for core voting requirements and may subcontract requirements that are not voting-specific. VSTLs use tests and test methods and test assertions derived from or contained in VVSG 1.0, VVSG 1.1, plus other EAC-approved test methods, including test methods incorporated by reference (e.g., electromagnetic compatibility).

1.3.4 Laboratories that achieve NVLAP accreditation are recommended by NIST to the EAC for designation as EAC-accredited voting system test laboratories (VSTLs). The EAC maintains a list of accredited VSTLs to help vendors and elections officials identify resources to fulfill system testing requirements.

1.3.5 EAC-accredited VSTLs test voting systems for conformance with the voluntary voting system standards. Laboratory test reports are reviewed by the EAC for compliance with certification requirements.

1.4 References

The following documents are referenced in this handbook. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) shall apply within one year of publication or within another time limit specified by regulations or other requirement documents.

— NIST Handbook 150, *NVLAP Procedures and General Requirements*, available at <https://www.nist.gov/nvlap>

— Help America Vote Act (HAVA) of 2002 (Public Law 107-252), available at <https://www.eac.gov>

— Voluntary Voting System Guidelines 1.0, available at < https://www.eac.gov/voting-equipment/voluntary-voting-system-guidelines/#VVSG_1.0__2005_>

— Voluntary Voting System Guidelines 1.1, available at < https://www.eac.gov/voting-equipment/voluntary-voting-system-guidelines/#VVSG_1.1_Approved>

— U. S. EAC Voting System Test Laboratory Program Manual, Version 2.0, effective May 31, 2015, available at <https://www.eac.gov/testing_and_certification/manuals_forms_and_notice_of_clarifications.aspx >

— U. S. EAC Testing & Certification Program Manual, Version 2.0, effective May 31, 2015, available at < https://www.eac.gov/testing_and_certification/manuals_forms_and_notice_of_clarifications.aspx >

1.5 Terms and definitions

The VST LAP brings together requirements from a number of different communities. Each of these communities may have its own special vocabulary and its own definitions. Where the same word is used by more than one community, the laboratory must ensure that all involved parties understand which definition the laboratory is using in its contracts, test plans, reports, etc.

For the purposes of this handbook, the terms and definitions given in NIST Handbook 150; VVSG 1.0, Volume I, Appendix A; the VVSG 1.1, Appendix A, and the following apply.

1.5.1 Authority to do business in the United States

As a condition of accreditation, all laboratories shall be lawfully entitled or otherwise not prohibited from doing business with the United States or its citizens or operating in the United States.

1.5.2 Certification test report
Report of results of independent testing of a voting system by an accredited test laboratory with a recommendation to approve the system under test for certification.

1.5.3 Core voting system tests
The core voting system tests in the VST LAP include: technical data package review, physical configuration audit, source code review, functional configuration audit, system integration test, volume tests, telecommunications tests, and security tests with the exception of vulnerability and penetration testing that require specialized skillsets. While VVSG 1.1 and VVSG 1.0 include testing for the following: electromagnetic compatibility, telecommunications, environmental, electrical, acoustical, and cryptographic modules, these test methods are covered through a separate accreditation and are not part of the VST accreditation process.

1.5.4 Election Assistance Commission (EAC)
The U.S. Election Assistance Commission (EAC) was established by the Help America Vote Act of 2002 (HAVA). Central to its role, the Commission serves as a national clearinghouse and resource for information and review of procedures with respect to the administration of federal elections.

1.5.5 EAC-accredited laboratory
A voting system testing laboratory (VSTL) which has the authority to do business in the United States and which has been accredited by the EAC per HAVA Section 231. The determination of the authority to do business will be determined by the EAC as part of its accreditation program.

1.5.6 Key personnel
Laboratory management and technical staff fundamental to the NVLAP accredited testing process. These are staff personnel who impact the process in such a way that their loss would negatively affect the quality of the testing.

1.5.7 Letter of intent
A written agreement between the laboratory and the EAC committing the laboratory to meet the EAC requirements. The letter of intent must be sent to the EAC prior to EAC accreditation.

1.5.8 National Institute of Standards and Technology (NIST)
An agency within the U. S. Government's Department of Commerce tasked with developing, maintaining, and disseminating standards within the United States. NIST also conducts research in fundamental measurement processes and provides technology services to public and private sector organizations. NVLAP is the laboratory accreditation group within NIST.

1.5.9 Test campaign
The sum of the work by a VSTL on a single product or system from contract through test plan, conduct of testing for each requirement (including hardware, software, and systems), reporting, archiving, and responding to issues afterwards.

NOTE Testing of modified products and systems for re-qualification is a new test campaign.

1.5.10 Voluntary Voting System Guidelines
Voluntary voting system standards developed, adopted, and published by the EAC. The guidelines are identified by version number and date.

1.5.11 Voting system

The total combination of mechanical, electromechanical, or electronic equipment (including software, firmware, and documentation required to program, control, and support the equipment) that is used to define ballots; to mark, cast, and count votes; to report or display election results; and to maintain and produce any audit trail information; and the practices and associated documentation used to identify system components and versions of such components; to test the system during its development and maintenance; to maintain records of system errors and defects; to determine specific system changes to be made to a system after the initial qualification of the system; and to make available any materials to the voter (such as notices, instructions, forms, or paper ballots). [VVSG 1.0, Volume I, Annex A]

1.5.12 Voting system testing laboratory (VSTL)

A testing laboratory accredited by NVLAP under the VST LAP for core voting system tests in the VVSG 1.1 and VVSG 1.0 standards. A VSTL provides attestation to the EAC that a voting system conforms to these standards for consideration as a qualified voting system.

1.6 Program documentation

1.6.1 General

Assessors use NVLAP checklists to ensure that each laboratory receives an assessment comparable to that received by others. Checklists assist assessors in documenting the assessment to NVLAP requirements found in NIST Handbook 150 and this handbook. Checklists contain definitive statements or questions about all aspects of the NVLAP criteria for accreditation, and form part of the on-site assessment report (see NIST Handbook 150). The current version of each checklist is available on the NVLAP web site <https://www.nist.gov/nvlap>.

1.6.2 NIST Handbook 150 Checklist

All NVLAP programs use the NIST Handbook 150 Checklist (formerly called the General Operations Checklist), which contains the requirements published in NIST Handbook 150. The checklist items are numbered to correspond to clauses 4 and 5 and annexes A, B, and E of NIST Handbook 150.

1.6.3 NIST Handbook 150-22 Checklist

The NIST Handbook 150-22 Checklist (also referred to as the VST Program-Specific Checklist) addresses the requirements specific to voting system testing given in NIST Handbook 150-22.

1.6.4 NVLAP lab bulletins

NVLAP lab bulletins are issued to laboratories and assessors, when needed, to clarify program-specific requirements and to provide information about program additions and changes.

2 LAP establishment, development and implementation

This clause contains no information additional to that provided in NIST Handbook 150, clause 2.

3 Accreditation process

3.1 General

3.1.1 This clause discusses the assessment and accreditation process for voting system testing laboratories.

3.1.2 An overview of the laboratory accreditation process is provided in NIST Handbook 150, clause 3, and includes information pertaining to application for accreditation; on-site assessment; proficiency testing; accreditation decision; granting accreditation; renewal of accreditation; changes to scope of accreditation; monitoring visits; and suspension, denial, revocation, and voluntary termination of accreditation.

3.1.3 NVLAP may consider a pre-assessment on-site visit to better define the laboratory's requested scope of accreditation.

3.1.4 Proficiency testing may be required before initial accreditation and periodically thereafter. Laboratories will be informed when proficiency testing is required.

3.2 Management system review

3.2.1 Prior to applying to NVLAP, the laboratory shall have a fully implemented quality management system. A copy of the quality manual and relevant associated documents will be sent to NVLAP with the application forms.

3.2.2 Prior to an on-site assessment, one or more NVLAP assessors review the documents to ensure they cover all aspects of the management system and, if followed, satisfy the requirements in NIST Handbook 150 and this handbook. During the review, the assessors may identify nonconformities and require changes to the management system so that it meets the requirements.

3.2.3 It is recommended that the laboratory create a cross-reference document to allow the laboratory and the assessors to verify that all NVLAP requirements are addressed in the quality management system documentation.

3.3 On-site assessment

3.3.1 When the quality management system review has been completed and nonconformities resolved, NVLAP will schedule the on-site assessment.

3.3.2 A typical NVLAP on-site assessment is conducted by a team of two NVLAP assessors over a two- to three-day time period. The assessment will normally take place at the main laboratory site.

3.3.3 The laboratory shall have its facilities and equipment in good working order and be ready for examination according to the NVLAP requirements and the laboratory management system manual. Efforts will be made to minimize disruption of the normal working routines during the assessment. The assessors will need time and workspace to complete assessment documentation during their visit to the laboratory site.

3.3.4 The assessors will use the checklists described in 1.6 to ensure that the assessment is complete and that all assessors cover the same items at each laboratory. The assessors may request additional information in an effort to clarify checklist responses or delve more deeply into a specific issue.

3.3.5 The activities covered during a typical on-site assessment are described below. The assessor, prior to the visit, will provide a specific agenda.

a) *Opening meeting:* The assessors meet with laboratory management and supervisory personnel to explain the purpose of the on-site assessment and to discuss the schedule for assessment activities. Information provided by the laboratory on its application form may be discussed during this meeting. At the discretion of the laboratory manager, other staff may attend this meeting.

b) *Staff interviews:* The assessors ask the laboratory manager to assist in arranging times for individual interviews with laboratory staff. The assessors interview staff filling key positions (e.g., laboratory manager, authorized representative, and any authorized signatories) and staff who have an effect on the outcome of testing. It is not necessary for the assessors to talk to all staff; however, they will select staff representing all aspects of the laboratory.

   These interviews are conducted to determine if staff are properly trained, assigned, supervised, and technically competent for the tasks assigned to them. The staff are expected to know HAVA, the VVSG 1.0, the VVSG 1.1, and the specific technical aspects of systems that the laboratory tests.

c) *Records review:* The assessors review laboratory documentation, including the management system, quality manual, equipment records, record-keeping procedures, testing procedures, laboratory test records and reports, personnel competency records, personnel training plans and records, procedures for updating pertinent information (e.g., the VVSG 1.1, VVSG 1.0, and state regulations), and safeguards for the protection of vendor-sensitive and proprietary information.

   Assessors do not need access to employee information that may be considered sensitive or private such as salary, medical information, or performance reviews for work done outside the scope of the laboratory's accreditation. However, this information is often stored together with personnel information the assessors need to check (e.g., job descriptions, resumes, and technical performance reviews). In these cases, the assessors work with the laboratory to ensure that they are able to perform their review without violating individual privacy. At the discretion of the laboratory, a member of its human resources department may be present during review of personnel information.

d) *Internal audit and management review:* The assessors review and discuss with staff the laboratory's internal audit and management review activities. The discussion will include all aspects of those activities including the management system procedures, the audit findings, the results of the management review, and the actions taken to resolve problems identified.

e) *Demonstrations:* Test personnel are requested to demonstrate their competence to perform the test methods for which the laboratory is seeking accreditation. The demonstrations include system configuration. For tests that cannot be completed during the on-site visit, portions of tests are

observed. The laboratory should have a voting system available during the on-site visit for the purpose of these demonstrations.

f) *Proficiency testing:* When applicable, the assessors discuss all aspects of proficiency testing with staff. Test methodology and the records documenting the laboratory's execution of the testing are reviewed and discussed.

g) *On-site assessment report:* The assessors prepare an on-site assessment report, which summarizes their findings (nonconformities and comments). This report normally consists of the Signature Sheet, On-site Assessment Narrative Summary, the NIST Handbook 150 Checklist, and the VST Program-Specific Checklist.

h) *Closing meeting:* At the end of the on-site assessment, the assessors hold a closing meeting with the laboratory manager and staff to discuss the on-site assessment report and the laboratory's plans for resolution of nonconformities. The process for resolving nonconformities is documented in NIST Handbook 150.

At the conclusion of the discussion, the report is finalized and the assessors and the laboratory's authorized representative sign the report. A copy of the complete report is given to the laboratory representative. Any disagreements between the laboratory and the assessors are referred to NVLAP.

3.4 Proficiency testing

3.4.1 Proficiency testing requirements for this LAP are under development. Proficiency testing may include the testing of artifacts and quizzes and written examinations.

3.4.2 Applicant and accredited laboratories will be informed when proficiency testing is required.

3.5 NVLAP recommendation to EAC

3.5.1 NVLAP will accept an application for accreditation from any laboratory. However, HAVA permits the EAC to list only "independent, non-Federal" laboratories.

3.5.2 Once a VSTL has been granted NVLAP accreditation, NVLAP will recommend it to the Director of NIST for submission for consideration by the EAC (see HAVA 231 (b)(1)).

3.5.3 The EAC will determine if the laboratory meets EAC requirements and that a letter of intent has been filed before it grants accreditation (see HAVA 231 (b)(2)).

4 Management requirements for accreditation

4.1 Organization

4.1.1 The laboratory shall establish and maintain policies and procedures for maintaining laboratory impartiality and integrity in the conduct of voting system testing. When conducting testing under HAVA, the laboratory policies and procedures shall ensure that:

a) the laboratory cannot perform both developmental testing and accredited testing of a particular voting system or system component;

b) the laboratory cannot provide consultation or other services to a voting system developer such that the independence, or appearance of independence, in the testing of a voting system or system component would be compromised;

c) the laboratory has defined its prohibited conflicts and prohibited practices; and

d) the laboratory has documented the process for enforcement of its policies and procedures with regard to prohibited conflicts and practices. The enforcement program shall include an annual collection and review of employee information related to testing or development of voting systems including, but not limited to: any financial interests, prior employment or activities in outside organizations, gifts, and/or work related to voting system development. Any conflicts shall be resolved and documented.

4.1.2 The laboratory shall have physical and electronic controls augmented with an explicit policy and set of procedures for maintaining separation, both physical and electronic, between the laboratory test personnel and laboratory consultants, product developers, system integrators, and others who may have an interest in and/or may unduly influence the outcome of the test.

4.2 Management system

4.2.1 The controlled version of the laboratory management system documentation may be paper-based or computer-based. Version control shall be maintained in either case. If both methods are used, one or the other will be identified as a primary source with the other having the status of a copy (e.g., historical, archive, working, distribution).

4.2.2 The following general management system procedures (required, but not limited to) shall be available for assessor examination prior to the on-site visit (if requested), but in any event shall be part of the on-site assessment process:

a) internal audits and management review;

b) writing and implementing system procedures;

c) writing and implementing system instructions;

d) staff training and individual development plans;

e) contract review;

f) staff members, including contractors, who work at home and at alternate work sites outside the laboratory (e.g., telecommuting);

g) hiring and utilizing contractors (subject matter experts);

h) referencing NVLAP accreditation and use of the NVLAP symbol.

4.2.3 The following program-specific procedures (required, but not limited to) shall be available for assessor examination prior to the on-site visit (if requested), but in any event shall be part of the on-site assessment process:

a) review of the vendor technical data package (VVSG 1.1, Volume II, Section 3 and VVSG 1.0, Volume II, Section 2);

b) writing a test plan for first-time testing and testing of modified systems (VVSG 1.1, Volume II, Appendix A and VVSG 1.0, Volume II, Appendix A);

c) writing test operation procedures (VVSG 1.1, Volume II, Appendix A and VVSG 1.0, Volume II, Appendix A.6.4);

d) writing a national certification test report (VVSG 1.1, Volume II, Appendix B and VVSG 1.0, Volume II, Appendix B);

e) reviewing the configuration management plan (VVSG 1.1, Volume II, Section 2 and VVSG 1.0, Volume II, Section 2.11);

f) performing security testing and penetration testing (VVSG 1.1, Volume II, Section 7.4 and VVSG 1.0, Volume II, Section 6.4);

g) performing usability and accessibility testing, including review of the summative usability reports delivered in the TDP in the format of ISO/IEC 25062:2006 *Common Industry Format (CIF) for Usability Test Reports* (VVSG 1.1, Volume I, 3.2.7-a.iv, 3.2.8.1-b, 3.3.3-a, 3.3.10 and VVSG 1.0, Volume I, 3.1.1, 3.2.2.1-a, 3.2.2.2-a, 3.2.3-a), and any testing with voters with a range of demographics;

h) conducting the test campaign, including procedures for working with the EAC during the test campaign and for utilizing the EAC virtual review tool (VRT);

i) test readiness review;

j) deficiency criteria tracking;

k) witnessing of system build and installation.

4.3 Document control

There are no requirements additional to those set forth in NIST Handbook 150.

4.4 Review of requests, tenders, and contracts

4.4.1 The procedures for review of contracts shall include procedures to ensure that the customer understands that its products and systems must meet the requirements of HAVA, VVSG 1.0, VVSG 1.1, and the EAC.

4.4.2 The review shall include (but is not limited to): laboratory competencies and resources to provide the service, vendor-supplied documentation, tests to be conducted, testing in additional certification testing, and subcontracting.

4.4.3 Procedures for the review of requests, tenders, and contracts shall include provisions to ensure that any state certification testing does not replace or dilute national certification requirements.

4.4.4 When conducting a contract review, the VSTL shall determine if there are any special or changed requirements from the EAC or from state or local election authorities.

4.5 Subcontracting of tests and calibrations

4.5.1 Subcontracting of tests is the use of laboratory services outside of the VSTL to perform tests, e.g., electromagnetic compatibility testing, environmental testing, shock and vibration testing, and Federal Information Processing System (FIPS) 140 validation. The word *subcontracting* is not used to describe a mechanism by which the laboratory employs staff members (see 5.2.7).

4.5.2 All core voting system testing shall be conducted by a VSTL (which may include individuals hired on a contract, see 5.2.7). If the VSTL subcontracts testing for any core voting system testing within its scope of accreditation, the subcontracted laboratory shall also be an EAC-accredited VSTL authorized to do business in the United States.

4.5.3 If laboratories accredited in another LAP are available for non-core testing, VSTLs shall use accredited laboratories. When an accredited laboratory is not available for non-core testing, the VSTL shall conduct an audit of the subcontracted laboratory and shall document that the laboratory is competent and qualified for use.

4.5.4 When a VSTL subcontracts to another laboratory, the VSTL is responsible for ensuring that setup, configuration, testing, and reporting is competent, appropriate, and conducted by qualified people. The VSTL shall ensure that there are no gaps in the knowledge required to conduct the testing. For example, a VSTL subcontracting with another laboratory to conduct temperature cycling tests shall conduct the functional testing itself rather than allowing the subcontractor to do so. The VSTL is responsible for ensuring that the entire voting system is properly tested.

4.6 Purchasing services and supplies

There are no requirements additional to those set forth in NIST Handbook 150.

4.7 Service to the customer

There are no requirements additional to those set forth in NIST Handbook 150.

4.8 Complaints

There are no requirements additional to those set forth in NIST Handbook 150.

4.9 Control of nonconforming testing and/or calibration work

There are no requirements additional to those set forth in NIST Handbook 150.

4.10 Improvement

There are no requirements additional to those set forth in NIST Handbook 150.

4.11 Corrective action

There are no requirements additional to those set forth in NIST Handbook 150.

4.12 Preventive action

There are no requirements additional to those set forth in NIST Handbook 150.

4.13 Control of records

4.13.1 The laboratory shall set policies and procedures on the retention of records that meet the requirements of HAVA and the EAC and meet the needs of its customers as agreed in a contract. The policy shall require that all test documentation be maintained for a minimum of 5 years after the last test performed on any version of the voting system (or component of any version of the voting system).

4.13.2 Laboratory records shall be maintained, released, or destroyed in accordance with the laboratory's policy on proprietary information and contractual agreements with customers.

4.13.3 The test report plus the laboratory's records of the test shall contain sufficient information to allow repeating, reproducing, and/or auditing the entire test.

4.14 Internal audits

4.14.1 The internal audit shall cover the laboratory management system and the application of the management system to all laboratory activities, including compliance with NVLAP, HAVA, VVSG 1.0, VVSG 1.1, contractual, laboratory management system, and any additional EAC requirements.

4.14.2 In the case where only one member of the laboratory staff is competent to conduct a specific aspect of a test method, and performing an audit of work in this area would result in that person auditing his or her own work, the audit may be conducted by another staff member. External experts may also be used in these situations.

5 Technical requirements for accreditation

5.1 General

The quality manual shall contain, or refer to, documentation that describes and details the laboratory's implementation of procedures covering all of the technical requirements in NIST Handbook 150 and this handbook.

5.2 Personnel

5.2.1 The laboratory shall maintain a competent staff appropriate for testing voting systems to be recognized by the EAC under HAVA.

5.2.2 Laboratory personnel shall be knowledgeable of all relevant references in this handbook.

5.2.3 The laboratory shall maintain a list of personnel designated to fulfill NVLAP requirements including: technical manager, authorized representative, approved signatories, QA manager, and team leaders.

5.2.4 The laboratory shall notify both NVLAP and the EAC within 15 days of any change in key personnel. When key personnel are added to the staff, the notification of changes shall include a current resume for each new staff member.

5.2.5 Laboratories shall document the required qualifications for each technical staff position.

5.2.6 The laboratory, or laboratories that are subcontracted, shall have staff members with knowledge and skills commensurate with the scope of work, i.e., a technical or scientific degree (e.g., a bachelor's or advanced degree in Computer Science, Computer Engineering, Computer Security, Electrical Engineering, Human Factors and Ergonomics, Usability Engineering, Human Factors and Applied Psychology, Human Computer Interaction, or similar discipline), or equivalent experience (e.g., professional certification; experience conducting testing in areas related to voting systems, experience conducting security and penetration testing, experience conducting usability and accessibility reviews in several domains (not just web sites), testing with users, and conformance to usability and accessibility standards).

5.2.7 The laboratory shall ensure adequate training of staff for the testing activities derived from the laboratory scope of accreditation. Personnel shall possess knowledge of, or be trained prior to accreditation on/in, the areas listed below:

a) general requirements of the test methods, including generation of test reports;

b) familiarity with testing techniques including penetration testing on Internet networks;

c) system security concepts;

d) physical security;

e) identification and authentication technologies and techniques;

f) cryptographic and security terminology;

g) assessing system performance against both usability and accessibility requirements;

h) universal design principles;

i) expert heuristic review for usability and accessibility;

j) executing summative, quantitative, performance-based human-computer interaction usability tests and reporting on these tests;

k) protocols for interacting with people who have disabilities;

l) standards compliance.

5.2.8 The laboratory shall have documented a detailed description of its training program for new and current staff members. Each new staff member shall be trained for assigned duties. The training program shall be updated and current staff members shall be retrained when the VVSG 1.1 or VVSG 1.0 or other versions of the VVSG change, or when the individuals are assigned new responsibilities.

5.2.9 The laboratory shall review annually the competence of each staff member for each test method the staff member is authorized to conduct. A record of the annual review of each staff member shall be dated and signed by the supervisor and the employee.

5.2.10 Individuals hired to perform testing activities are sometimes misidentified as *subcontractors*. NVLAP does not make a distinction between full-time laboratory employees and individuals hired on a contract. NVLAP requires that the VSTL maintain responsibility for and control of any work performed within its scope of accreditation. To that end, the VSTL shall ensure all individuals performing testing activities satisfy all NVLAP requirements, irrespective of the means by which individuals are compensated (e.g., the VSTL shall ensure all test personnel receive proper training and are subject to annual performance reviews, etc.). When a change in the key personnel occurs a report shall be submitted to NVLAP and to the affected validation program.

5.2.11 The records for each person having an effect on the outcome of the testing shall include:

a) position description;

b) resume/biography to match the person to the position;

c) duties assigned;

d) annual competence review;

e) training records and training plans.

5.2.12 In order to maintain confidentiality and impartiality, the laboratory shall maintain proper separation between personnel conducting testing and other personnel inside the laboratory or outside the laboratory, but inside the parent organization.

5.3 Accommodation and environmental conditions

5.3.1 The laboratory shall have adequate facilities to conduct the voting system testing on its scope of accreditation. If testing activities are conducted at more than one location, all locations shall meet the NVLAP requirements. If performing usability tests with users, the location shall also be accessible for people with disabilities.

5.3.2 A protection system shall be in place to safeguard customer proprietary hardware, software, test data, electronic and paper records, and other materials. This system shall protect the proprietary materials and information from personnel outside the laboratory, visitors to the laboratory, laboratory personnel without a need to know, and other unauthorized persons.

5.3.3 Laboratories shall have systems (e.g., firewall, intrusion detection) in place to protect internal systems from distrusted external entities. The laboratory shall have regularly updated protection for all systems against viruses and other malware.

5.3.4 If the laboratory is conducting multiple, simultaneous tests, it shall maintain a system of separation between the products of different customers. This includes the product itself, the test platform, peripherals, documentation, electronic media, manuals, testing area, office space, and records.

5.3.5 If testing activities will be conducted outside the laboratory, the management system shall include procedures for conducting activities at customer sites or other off-site locations. For example, procedures may explain how to secure the site, where to store records and documentation, and how to control access to the test facility.

5.3.6 If the laboratory is conducting its tests at a customer site or other location outside the laboratory facility, the environment shall conform, as appropriate, to the requirements for a laboratory environment. If a customer's system on which a test is conducted is potentially open to access by unauthorized entities during test, the VSTL shall control the test environment. This is to ensure that the systems are in a defined state compliant with the requirements for the test before starting testing work and that the systems ensure that unauthorized entities do not gain access during testing.

5.4 Test and calibration methods and method validation

5.4.1 The test methods for this program are given in the VVSG 1.1 and VVSG 1.0. In the VVSG 1.1 and VVSG 1.0, there are specified test methods, test methods that require adaptation, and requirements for which the laboratory shall have to develop test methods. When the EAC publishes amendments or augmentations to the standards or guidelines, the laboratory shall develop procedures for implementation of the new requirements. The laboratory shall provide a matrix cross-referencing the laboratory's test methods to the voting system standard.

5.4.2 Where the laboratory has developed or modified test methods to meet the requirements of the VVSG 1.1 and VVSG 1.0, validation of the test methods shall be referenced in the test report.

5.4.3 For the purposes of achieving product certification under HAVA, laboratories shall comply with interpretations of the test methods and test assertions as provided by the EAC. When exceptions to the testing methodology may be necessary for technical reasons, the laboratory shall request an interpretation from the EAC, inform the customer, and document the details of an interpretation in the test report.

5.4.4 As a part of the testing procedure, the laboratory shall describe by whom and how the voting system will be configured. If the customer configures any part of the voting system, the laboratory shall verify the configuration, including all software.

5.4.5 Testing may be conducted at the customer site, the laboratory or another location that is mutually agreed to by the laboratory and the customer. When testing activities are conducted outside the laboratory, the laboratory shall have additional procedures to ensure the integrity of all tests and recorded results. These procedures shall also ensure that the same requirements that apply in the laboratory are maintained at the non-laboratory site.

5.5 Equipment

5.5.1 For the purposes of this section "equipment" is defined as test equipment used in the testing process. Test equipment includes software and hardware products or other assessment mechanisms used by the laboratory to support testing of products and systems.

5.5.2 The laboratory shall document and maintain records on all test equipment used during testing. The laboratory shall have procedures to configure and operate all equipment within its control.

5.5.3 Equipment used during the conduct of testing shall be under configuration control. The laboratory shall have procedures to ensure that any equipment used for testing is in a known state prior to use for testing.

5.5.4 Any software test tools shall be validated to be sure that they are accurately testing to the standard. They shall also be examined to ensure they do not interfere with the conduct of the test and do not modify or impact the integrity of the product under test in any way. VVSG 1.1 and VVSG 1.0 require the documentation of the test software and supporting hardware in the certification.

5.6 Measurement traceability

All developed test methods and tests performed within the test campaign shall be traceable to VVSG 1.1 and VVSG 1.0. This validation shall be documented (e.g., cross-reference matrix).

5.7 Sampling

This section does not apply to the VST LAP since testing to the entire standard is required.

5.8 Handling of test and calibration items

5.8.1 The laboratory shall maintain separation between and control over the items from different tests, to include the product being tested, its platform, peripherals, and all documentation.

5.8.2 When the product being tested includes software components, the laboratory shall ensure that configuration management mechanisms are in place to prevent inadvertent modifications to the software

components during the testing process. This includes the customer's software, test tools, and commercial off-the-shelf (COTS) software.

5.9 Assuring the quality of test and calibration results

The laboratory procedures for test method validation shall include tests for abnormal conditions as well as normal operations where the program functionality includes requirements to detect and respond to invalid data, operator actions, or hardware malfunctions.

5.10 Reporting the results

5.10.1 Reports shall be submitted in a form consistent with the requirements of the latest version of the VVSG and EAC Voting System Testing and Certification Laboratory Manual. For example, the report shall contain sufficient information for state certification officials to identify what testing was completed for the purpose of ascertaining what additional testing may be necessary at the state level.

5.10.2 Reports shall meet customer-laboratory contract obligations and be complete.

5.10.3 The section of a test report that meets the VVSG 1.0, and VVSG 1.1 requirements for a summary or the recommendation section of a test report for a customer shall also meet the requirements of NIST Handbook 150 on opinions and interpretations under *Reporting the results*.

6 Additional requirements

There are no additional requirements beyond NIST Handbook 150 and its associated normative annexes, and any other normative references previously cited in this handbook.