U. S. ELECTION ASSISTANCE COMMISSION

VOTING SYSTEM TESTING AND CERTIFICATION PROGRAM

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Notice of Clarification

NOC 09-001: Clarification of the Requirements for Voting System Test Laboratories (VSTLs) Development and Submission of Test Plans

Issued by Program Director, May 1, 2009:

VSTL Test Plan

Objective of this NOC:

The objective of this document is to clarify the intent, content and use of Test Plans as currently outlined in the 2005 Voluntary Voting System Guidelines (VVSG), in the EAC Testing and Certification Program Manual, and in the EAC Laboratory Accreditation Program Manual. The clarification has been carefully drafted to align with the published 2005 VVSG Volume 1 and Volume 2 requirements and to be consistent with both EAC manuals. Information pertaining to the test plans contained in the documents noted above has been included by reference at the end of this document.

> Since 2007, it has been the experience of the EAC that test plan documents that have been developed and submitted for EAC review and approval, in many instances, do not meet the intent and objective of the test plan defined in the 2005 VVSG or the EAC Manuals. All test plans need to incorporate a strategic and tactical assessment as to how the project will be accomplished.

This is not a new requirement but rather defines with more clarity items already contained in the EAC program documentation. The overall objective of the test plan is to make the evaluation process more efficient and to help ensure that the testing being planned is appropriate and comprehensive. Additionally, the test plan should be structured to reduce the risk that differences of opinion and content related to the test campaign, and do not negatively impact the test report review and acceptance process.

Clarification Statement:

The Test Plan is addressed in all four primary documents (2005 VVSG Volumes I &II, EAC Testing and Certification Program Manual and EAC Voting System Test Laboratory Program Manual) defining and describing the requirements of the program, which is a testament to the importance placed on the test plan document. The content of all of these documents remains valid, but clarification appears necessary to further describe the expected depth and completeness

of the test plan that is necessary to help ensure that a comprehensive test campaign is carried out and to help ensure that test campaigns are consistent among different VSTLs .

The test plan shall document the strategy and plan for testing each section of the applicable voluntary voting system guidelines and is to be used as a key tool to manage the test campaign and to verify that a voting system or component meets all VVSG and program defined requirements. The test plan shall be written with completeness and clarity that will allow all constituents to understand what testing will be conducted, to assess each group of VVSG requirements, and to assure that the test plan will remain a living document throughout the life of the test campaign. The objective is to address each section (in both Volume I and Volume II of the 2005 Voluntary Voting System Guidelines) in detail, and to clearly and succinctly describe the strategy and/or approach for testing each section.

Discussion and Details of the Test Plan:

Existing statements guiding EAC certification test plans

The following two statements provide a global direction as stated in current program documents:

> "This plan **shall** provide for testing of the system sufficient to ensure it is functional and meets all applicable voting system standards "

> "Test plans **shall** be developed to ensure that a voting system is functional and meets all requirements of the applicable, approved voting system standards. The highest level of care and vigilance **is required** to ensure that comprehensive test plans are created. A test plan should ensure that the voting system meets all applicable standards and that test results and other factual evidence of the testing are clearly documented. System testing must meet the requirements of the VVSG."

Test Plan Purpose:

The purpose of a test plan is to communicate the intent of testing activities to be undertaken by an EAC accredited VSTL. Care should be taken to clearly communicate the scope and requirements of testing, the test strategies, and the resource needs. This information identifies the purpose and boundaries of the test campaign:

- What will be tested,
- How it will be tested,
- What resources are needed for the testing.

Stating this information clearly will expedite the review, feedback and approval of the test plan, and therefore increase the efficiency of the entire test campaign.

Planning is generally considered to be an important component of any successful complex project. The size and complexity of voting system conformance testing, necessitates that the test plan be a critical deliverable of the test campaign. Therefore timely submittal, review, and refinement of the test plan are the only vehicle that coordinates and communicates a strategy and a plan as to how a specific test campaign will be successfully completed to achieve the testing objectives. A "Timely Submittal" is defined as submittal of the Test Plan to the EAC before the beginning of actual testing, but after pre-testing activities such as TDP review, PCA assessment and FCA assessment allow sufficient review and examination of the voting system. The expected review time is established to fully understand the system architecture and to develop a cohesive plan that is realistic to the planned milestones of the test campaign with out missing critical scope items.

Because future events in any test campaign cannot be 100% predicted and controlled, the initial submission of the test plan is viewed as a baseline that enables periodic updates as events cause the plan to change. The VSTL is expected to update specific sections of the plan and resubmit as necessary to enable all stakeholders (Manufacturer, EAC, the public and states or jurisdictions) to understand and use the test plan. As the Target of Evaluation changes via Engineering Change Orders, component changes, or COTS product changes, the test plan shall be updated since these changes may significantly impact the testing. These test plan changes might also alter the original schedule and may require that an updated schedule be submitted with the revised test plan. The following are examples of issues that would likely require updating the test plan:

- Changes to the manufacturers' application for testing.

- Engineering Changes that alter the scope or function of the voting system.

- Information discovered during testing that change the strategy on how best to test the voting system.

For the test plan to be an effective, living document it needs to be clear and complete so that any of the stakeholders (VSTL project manager, VSTL testers, third party lab personnel, manufacturer, EAC, States and Jurisdictions) can review the plan and understand what needs to be done to complete the project. In order to accomplish these goals the following general topics shall be included in the test plan. They are further defined in the test plan outline later in the document.

- A detailed, comprehensive knowledge of the scope of evaluation
  - That each requirement or group of requirements is going to be evaluated for compliance
  - That all features, interfaces and characteristics of the individual devices and the system are evaluated to applicable requirements
- Titles of test lab personnel who will be responsible for each aspect of the test campaign
- Detailed project schedule including what the critical path is for timely project completion
- What test methods will be used to evaluate each section of the requirements (more than one test method may be used for a section)
  - What is tested in document review
  - What is tested in source code review
  - What is operationally tested
  - What is tested at a component/subsystem level
  - What is tested at a system only level

Test Plan Relationship:

Below is a diagram intending to help distinguish the scope and type of information expected in the test plan vs. either a test case or a test report.
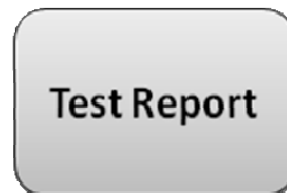
Test Plan
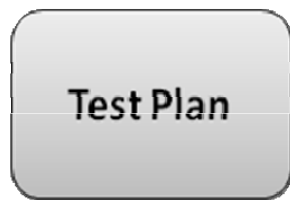
A plan of action that describes the strategy for testing the requirements specified in each section of the standard (what will be tested or the target of evaluation, TOE). Criteria and methods used for determining the strategy as well as the process used shall be documented."

How the TOE will be tested, Which includes all the step by step information of

Test Cases

how to perform the test to yield repeatable and consistent results

Merging the actual testing and test results with the test plan and the test cases. Including all relevant findings regardless of compliance with pass criteria

Test Report

The following criteria have been used to determine the quality of test plans for a number of industries and are equally applicable to the testing of voting systems:

- *Usefulness:* Will the test plan effectively serve its intended functions?
- *Accuracy:* Is it accurate with respect to any statements of fact?
- *Efficiency:* Does it make efficient use of available resources?
- *Adaptability:* Will it tolerate reasonable change and unpredictability in the project?
- *Clarity:* Is the test plan self-consistent and sufficiently unambiguous?
- *Usability:* Is the test plan document concise, maintainable, and helpfully organized?
- *Compliance:* Does it meet externally imposed requirements?
- *Foundation:* Is it the product of an effective test planning process?[1]

In order to meet these criteria, and to provide the most value to any voting system test campaign, the test strategy should focus most effort on areas of potential technical risk and areas of potential weakness reported to the EAC by States or local jurisdictions using the voting system. The test strategy should be flexible enough to incorporate reasonable variation and make use of the testers' experience and ability to use situational reasoning to focus on important but, perhaps unanticipated, problems. A more rigid test strategy may make it more likely that a particular subset of voting system problems will be uncovered, but because voting systems are complex, an excessively rigid test strategy will reduce the likelihood that a majority of important problems will be uncovered.

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[1] " Test Plan Evaluation Model": James Bach, Satisfice, Inc. 1999, see 17 U.S.C. 107.

The test schedule included in the test plan shall highlight any dependencies on the level of system development, the testability of the voting system, and the VSTLs assessment of risks associated with the test campaign The test schedule can stand alone *only* to the extent that the voting system is highly testable, that system development and documentation are complete, and that the test campaign is not interrupted by the frequent need for the manufacturer to fix reported problems with the voting system.

Finally, EAC approval of the Test Plan does not mean that the EAC accepts responsibility that efforts described in the Test Plan will produce full and adequate testing to certify the system.   The following bullets discuss the meaning of EAC approval of the Test Plan:

• Approval simply signifies that the tests proposed, if performed properly, appear to be sufficient to fully test the system. A final determination of the sufficiency of the testing is a global evaluation based on the test plan, test cases, and test report reviews, as well as the EAC's Quality Monitoring Process outlined in ch. 8 of the Program Manual.

• Approval allows the test laboratory to begin test case development, testing, and test report submittal.

• A test plan is approved based on information submitted. It is not known if relevant information was omitted that would affect the testing campaign.

• The test plan is a living document and is expected to change and be updated during various phases of the testing life cycle. A final version that reflects all of the testing completed (TDP, S/W, Hardware, Software etc) should be submitted to the EAC at the completion of testing. If this final "as run" test plan does not reflect all the testing required, the EAC reserves the right to request further updates to the test plan and possibly additional testing.

Test Plan Outline (enhanced):

As noted this outline is provided as an aid to test plan development. The outline has been enhanced with sub bullets to incorporate the items in the discussion above (These items are noted in red text). Note that these may change significantly, depending on the specific project planned.

1 Introduction
    1.1 References
    1.2 Terms and Abbreviations
    1.3 Testing Responsibilities
        1.3.1 Project schedule with
            1.3.1.1 Owner assignments
            1.3.1.2 Test case development
            1.3.1.3 Test procedure development and validation
            1.3.1.4 3rd party tests
            1.3.1.5 EAC and Manufacturer dependencies
    1.4 Target of Evaluation Description
        1.4.1 System Overview
        1.4.2 Block diagram
        1.4.3 System Limits
        1.4.4 Supported Languages
        1.4.5 Supported Functionality
        1.4.6 VVSG (might be easier to list excluded reqs from VVSG)

References:

IEEE 829-1998 Test Plan Structure

- *Test plan identifier*
- *Introduction*
- *Test items*
- *Features to be tested*
- *Features not to be tested*
- *Approach*
- *Item pass/fail criteria*
- *Suspension criteria and resumption requirements*
- *Test deliverables*
- *Testing tasks*
- *Environmental needs*
- *Responsibilities*
- *Staffing and training needs*
- *Schedule*
- *Risks and contingencies*
- *Approvals*

EAC Testing and Certification Program Manual:

4.2. Policy.

4.4. Test Plan.

   4.4.1. Development.

   4.4.2. Required Testing.

      4.4.2.1. *New System*.

      4.4.2.2. *System Not Previously EAC Certified*.

      4.4.2.3. *Modification*.

      4.4.2.4. *EAC Identified Systems*.

      4.4.2.5. *Certification Upgrade*.

   4.4.3. Format.

   4.4.4. EAC Approval.

      4.4.4.1. *Review*.

      4.4.4.2. *Unaccepted Plans*.

      4.4.4.3. *Effect of Approval*.

   4.5.1. Changes.

EAC Laboratory Accreditation Program Manual

   2.10.1. <u>Test Plan Package</u>.

2.10.1.1. Requirements Matrix.

2.10.1.2. Test Plan.

    2.10.1.2.1. Format.
    2.10.1.2.2. Content.

Appendix A Certification Test Plan Format and Content

VVSG Volume 1:

The accredited testing laboratories who use this information to develop test plans and procedures for the analysis and testing of systems in support of the national certification testing process

Test campaign: Sum of the work by a voting system test lab 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

Testing standard: Standard that is concerned with test methods, sometimes supplemented with other provisions related to testing, such as sampling, use of statistical methods or sequence of tests

Test method: Specified technical procedure for performing a test

Test plan: Document created prior to testing that outlines the scope and nature of testing, items to be tested, test approach, resources needed to perform testing, test tasks, risks and schedule

VVSG Volume 2:

Appendix A provides the requirements for the National Certification Test Plan that is prepared by the voting system test lab and provided to the EAC for review.