

United States Election Assistance Commission 2024 Voluntary Voting System Guidelines Review





U.S. ELECTION ASSISTANCE COMMISSION

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- 1 Introduction 2
- 2 Summary of Published RFIs..... 2
 - 2.1 Standard Device Interfaces – RFI 2021-01..... 3
 - 2.2 Source and Integrity of Election Records – RFI 2021-02 3
 - 2.3 Logging of Ballot Selections – RFI 2023-01 3
 - 2.4 Minimum Ballot Positions – RFI 2023-02..... 4
 - 2.5 Block-Structured Exception Handling – RFI 2023-03 4
 - 2.6 Battery Backup for Central Count – RFI 2023-05..... 4
 - 2.7 Extensions to the VVSG 2.0 – RFI 2023-06..... 5
 - 2.8 Unique Identifier – RFI 2024-01..... 5
 - 2.9 Unauthorized Physical Access Alert – RFI 2024-02..... 5
 - 2.10 Logging of Physical Connections and Disconnections – RFI 2024-03 6
- 3 New Common Data Format Specifications..... 6
 - 3.1 Micro Common Data Format - NIST SP 1500-19 6
 - 3.2 Ballot Definition Common Data Format - NIST SP 1500-20..... 7
- 4 VVSG 2.0 Errata..... 7
- 5 Minor Update: VVSG Version 2.1..... 7
- 6 Conclusion..... 8
- 7 References 8



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1 Introduction

In late 2002, Congress passed the Help America Vote Act of 2002 (HAVA), which created the U.S. Election Assistance Commission (EAC) and vested it with the responsibility of adopting and maintaining the Voluntary Voting System Guidelines (VVSG). The most recent iteration of the VVSG, version 2.0 [\[1\]](#), sets forth voluntary guidelines for voting systems that are used by the EAC's Testing and Certification Program to ensure the systems are secure, accurate, and accessible.

On April 5, 2022, the EAC's Commissioners unanimously voted to adopt the VVSG Lifecycle Policy [\[2\]](#). The most recent iteration of this policy was adopted on April 8, 2024, again by unanimous vote by EAC Commissioners. This policy mandates a periodic review of the VVSG to ensure that the guidelines remain current with technological advancements and evolving threats. The review process includes collecting proposed changes from stakeholders, which are then analyzed by the Testing and Certification Program in consultation with the National Institute of Standards and Technology (NIST).

Additionally, feedback on VVSG requirements comes in the form of Requests for Interpretation (RFI) from registered voting system manufacturers and the Voting System Test Laboratories (VSTL). An RFI is a means by which manufacturers and VSTLs may request the EAC to provide a definitive interpretation of VVSG requirements when, while developing or testing a voting system, the meaning of a particular requirement is ambiguous. The responses to these RFIs often lead to the refinement of existing guidelines and are critical changes to consider in future iterations of the VVSG.

This report covers published VVSG 2.0 RFIs as well as a brief analysis of two new Common Data Format (CDF) specifications published by NIST, for consideration by the Technical Guidelines Development Committee (TGDC).

2 Summary of Published RFIs

The EAC's Testing and Certification Program undertakes a detailed analysis of each Request for Interpretation (RFI) submitted regarding the VVSG. The process begins when a voting system manufacturer or a VSTL identifies a requirement in the VVSG that is unclear or ambiguous during the development or testing phase of a voting system. They then submit an RFI to the EAC, requesting a clear and definitive interpretation of the requirement in question.

Each RFI is meticulously reviewed by the EAC's Testing and Certification Program, which collaborates with NIST to provide a well-considered response. This collaborative effort ensures that the interpretations are not only technically sound but also aligned with the latest advancements in voting technology and cybersecurity.

In addition to clarifying specific requirements, the RFIs play a crucial role in the iterative enhancement of the VVSG. The insights gained from these interpretations feed back into the



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Washington, DC 20001

guideline development process, facilitating continuous improvement, and ensuring that the VVSG evolves to meet the highest standards of election security and voter confidence.

The following sections provide a summary of each interpretation published by the EAC for VVSG 2.0 requirements [\[3-14\]](#)

2.1 Standard Device Interfaces – RFI 2021-01

RFI 2021-01 [\[3\]](#) concerns requirement 4.3-A, *Standard device interfaces*, which states that standard, common hardware interfaces and protocols must be used to connect devices. However, the boundary of the hardware interface is not specified.

This RFI discusses where proprietary cabling is employed; this requirement may be considered satisfied if the proprietary hardware or cabling terminates in a standardized electrical format and uses a published communication protocol. Components used in this capacity must be documented in the manufacturer technical data package (TDP), and part numbers must be documented appropriately by the VSTL in the Test Report. This termination may be considered the boundary of the hardware interface.

2.2 Source and Integrity of Election Records – RFI 2021-02

RFI 2021-02 [\[4\]](#), requirement 13.2-A, *Signing Stored Election Records*, states that cast vote records and ballot images must be digitally signed when stored and before being transmitted. This does not identify if these digital signatures apply to the common data format exchanges.

The context of the clarification is with respect to Principle 4 – Interoperability. Interoperability in the VVSG does not prescribe data protections within the requirements, nor do currently published CDF specifications. Principle 13 – Data Protections of the VVSG does not explicitly call out being applicable to CDF exchanges but it does apply to the data contained within the CDFs themselves. Therefore CVRs, including CDFs that contain CVRs, must be digitally signed when stored and before being transmitted.

2.3 Logging of Ballot Selections – RFI 2023-01

RFI 2023-01 [\[5\]](#) pertains to requirement 10.2.4-B, *Logging of Ballot Selections*. Logs and other portions of the audit trail must not contain individual or aggregate ballot selections. However, this does not encompass how logging of adjudication changes to a ballot by an election official must be captured.

When ballot selections have been changed by an election official, such as through adjudication for voter intent, these changes may be captured in the audit trail. At the time of adjudication, with proper procedural mechanisms in place, the cast ballot cannot be associated with the voter who cast it. Because this requirement is in the context of preserving voter secrecy, at the stage of adjudication it is appropriate to log any additional changes that have been made, but also important that these changes are logged as part of the adjudication process.



U.S. ELECTION ASSISTANCE COMMISSION

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2.4 Minimum Ballot Positions – RFI 2023-02

RFI 2023-02 [\[6\]](#) interprets requirement 1.2-C, *Minimum Ballot Positions*. A minimum of 10 million ballot positions must be read by the voting system and tabulated accurately. This requirement as stated does not indicate if the system must collectively reach a count of 10 million, or each device must read the minimum of 10 million ballot positions.

VVSG 2.0 requirement 1.2-C is more stringent than previous accuracy requirements where no errors are allowed in the minimum of 10 million ballot positions which must be successfully read and tabulated accurately by the entire voting system. The EAC will not identify a sample minimum for each tabulation device as this approach may be considered unnecessarily prescriptive. Instead, the distribution of the 10 million ballot positions across a system under test must be determined by the VSTL and approved by the EAC through the voting system test plan.

2.5 Block-Structured Exception Handling – RFI 2023-03

RFI 2023-03 [\[7\]](#) pertains to requirement 2.1-A, *Acceptable Programming Languages*, which states that application logic must be produced in a high-level programming language that has control constructs including block-structured exception handling. However, this does not cover high-level programming languages that perform quality exception handling which do not use the block-structure, explicitly in the case of the programming language Rust.

This RFI clarifies that the intent is to require exception handling in a structured manner. Without block-structured exception handling two major concerns exist in that 1) the programmer must check for every possible error condition in every possible location, and 2) unstructured exception handling obfuscates logic, making its verification more difficult. Though the Rust programming language does not use block-structure exception handling, it addresses both issues by handling errors in a structured and succinct way. Therefore, the Rust programming language is considered acceptable to satisfy requirement 2.1-A, *Acceptable programming languages*, and its sub requirements.

2.6 Battery Backup for Central Count – RFI 2023-05

Requirement 2.7-H, *Power outages, sags, and swell*, states that the voting system must withstand, without disruption of normal operation or loss of data, a complete loss of power lasting two hours. This requirement does not account for the amount of power required to operate larger components of the voting system, specifically central count scanners.

This same interpretation was published for the VVSG 1.0 in 2009 in RFI 2009-03 and is being pulled forward with the same interpretation for VVSG 2.0 standards, system, and testing in RFI 2023-05 [\[8\]](#). This requirement is to be updated to explicitly state its application to voter facing devices. All non-voter facing devices requiring more power than an average uninterruptible power supply can maintain for two hours are instead required to perform a graceful shutdown.



U.S. ELECTION ASSISTANCE COMMISSION

633 3rd St. NW, Suite 200

Washington, DC 20001

A graceful shutdown requires all non-voter facing devices process all ballots currently being tabulated. If power is lost during the tabulation process, the device must provide a report available upon power being restored and ensure that it can resume operations from the point of power loss.

2.7 Extensions to the VVSG 2.0 – RFI 2023-06

[\[9\]](#) Requirements 3.3-B, *Specification of common data format usage*, and 4.1-F, *Specification of common format usage*, state manufacturers must provide publicly available documentation on how they have implemented CDF specification for devices and functions. Descriptions must include CDF extension and constraint information. However, these requirements do not state which version of the published CDFs should be used and additionally if the use of extensions is prohibited.

Built-in extensions are incorporated into the CDF to address properties where a predefined literal does not exist. General extensions are disallowed for use due to complications and negative impacts on interoperability. Manufacturers are encouraged to work with NIST as they develop and incorporate extension points into updated versions of the CDFs as they are established. Manufacturers are required to implement the CDF specifications in the VVSG, but it is not required that all data exchange occur within the published CDFs. When necessary to exchange data not built into the CDFs, alternative methods may be used to achieve this.

2.8 Unique Identifier – RFI 2024-01

Requirement 9.1.5-F, *Unique Identifier*, states that paper-based voting systems must be capable of adding unique identifiers to the ballot after it has been cast by a voter. It is not clearly stated if this can be achieved procedurally or at both the central- and precinct-level scanners of a system.

Increased audit capability is a key feature in VVSG 2.0, covered in Principle 9 with the introduction of software independence. Requirement 1.1.5-G clarifies that a voting system must be capable of recording audit-related information in Cast Vote Records (CVR) as they are created, including identification of the corresponding voting ballot. Therefore, to achieve conformance to both requirements, RFI 2024-01 [\[10\]](#) describes that all voting system devices that create CVRs must have the capability of adding a unique identifier to a ballot after it has been cast by a voter. This capture information must also be included in the CVR as it is created.

2.9 Unauthorized Physical Access Alert – RFI 2024-02

Requirement 12.1-B, *Unauthorized Physical Access*, states voter facing devices must alert when access to a restricted component is detected during voting. However, it is not clear whether access to a secure container used for storing and transporting voting records applies to this requirement.



U.S. ELECTION ASSISTANCE COMMISSION

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When a voter facing device detects unauthorized access associated to the system’s settings, configuration, and local memory, it must produce an alert that sufficiently calls it to the attention of an election worker. This also applies to any unauthorized access to ports or areas containing removable media. The EAC interprets this requirement through RFI 2024-02 [\[11\]](#) that devices which use a secure container to store or transport voting records, are not required to produce an alert if unauthorized access to a secure container occurs. Requirements 12.1-A and 12.1-E regarding unauthorized physical access and secure containers must still be met.

2.10 Logging of Physical Connections and Disconnections – RFI 2024-03

[\[12\]](#) Requirement 12.1-D, *Logging of physical connections and disconnections*, states devices must log component connections and disconnections while a voter is voting. The requirement is not clear on whether logging of connections and disconnections pertains to secure containers used for storing and transporting voting records.

Unauthorized physical access to secure voting record containers is covered under requirement 12.1-E, but this does not address any electrical aspect of a secure container, if one exists. For a connection or disconnection to a secure container to be monitored and logged, an electrical connection must be established between the container and the voting system device. The EAC does not interpret 12.1-D as mandating such a connection. However, if access to a ballot box or other secure container requires the disconnection of a precinct voting system device during the active voting state, then the event must be logged. Access to a secure container through opening and closing of a door is not considered a connection or disconnection.

3 New Common Data Format Specifications

The following sections provide a summary for each of the new CDF specifications published by NIST. These new specifications cover use-cases identified as being important to consider for inclusion in the VVSG as they are not encompassed within the currently required CDF specifications.

3.1 Micro Common Data Format - NIST SP 1500-19

The NIST Micro CDF (mCDF) Specification [\[13\]](#) describes a data format for space-constrained environments, such as the placement of machine-readable data on paper. The specification is responsive to a need for interoperability in several key voting system scenarios in which the use of other storage mechanisms is impractical or disallowed.

Within the elections space, the following applications are considered:

- Exchange of activation information between ballot activation devices and ballot marking devices;
- exchange of contest option selections between ballot marking devices and ballot scanners;



U.S. ELECTION ASSISTANCE COMMISSION

633 3rd St. NW, Suite 200

Washington, DC 20001

- exchange of ballot style identifier information between full-face paper ballots and scanners; and
- other applications that require software-independent (e.g., paper) information exchange.

In the context of the exchange of contest option selections, mCDF is meant to reconcile the need for interoperable data exchange throughout the election process with the Voluntary Voting System Guidelines 2.0, Guideline 9.1:

An error or fault in the voting system software or hardware cannot cause an undetectable change in election results.

Thus, the mCDF is a format that supports the interoperability of software-independent (e.g., paper) vote records.

3.2 Ballot Definition Common Data Format - NIST SP 1500-20

The NIST Ballot Definition CDF Specification [\[14\]](#) describes a ballot definition CDF for the interchange of logical and physical ballot style information. It contains a UML (Unified Modeling Language) model of the election data and a JSON (JavaScript Object Notation), and XML (eXtensible Markup Language) format derived from the UML model. It contains background information regarding how geopolitical geography is structured and used in the model and schemas. It also provides usage examples for anticipated use-cases. The format is comprehensive and at the same time very flexible, able to accommodate election scenarios used throughout the United States.

4 VVSG 2.0 Errata

The EAC has published a document that contains errata specific to the VVSG 2.0 [\[15\]](#). The errata described in the publication are non-substantive errors that do not affect the core meaning of a statement or requirement.

5 Minor Update: VVSG Version 2.1

Given the number of published RFIs as well as the need for additional CDF specifications for interoperability purposes, it is the recommendation of the Testing and Certification Director that a minor update to the VVSG is both feasible and timely. The minor update, designated version 2.1, would be minimal, focusing on:

- Incorporating answers from the RFI process;
- Updating requirements to reflect current interoperability needs; and
- Address errata within the guidelines.



U.S. ELECTION ASSISTANCE COMMISSION

633 3rd St. NW, Suite 200

Washington, DC 20001

Given the last major update to the VVSG was adopted in February 2021 and the nature of this recommendation, initiating a minor revision aligns well with the lifecycle policy's intent to iterate the VVSG more frequently with a smaller set of updates.

6 Conclusion

The proposed changes to the VVSG within this report reflect analysis of requirements that necessitated published interpretations since version 2.0 has been adopted. Inclusion of these interpretations into a future revision is essential to ensure the guidelines are refined where intent is ambiguous or in conflict. Additionally, inclusion of the most recently published NIST CDFs into the VVSG will offer interoperable functionality that facilitates the possibility of component-level certification. Based on this analysis, the Testing and Certification Program recommends that the Technical Guidelines Development Committee (TGDC) consider drafting a minor update to the VVSG at this time. This update to VVSG 2.1 will enhance the clarity and applicability of the guidelines without imposing significant new requirements. New CDFs will require development by manufacturers, but it is not mandated as manufacturers may select to submit their systems to either VVSG 2.0 or 2.1.

This revision aligns with the requirements laid out in HAVA to have a quadrennial update to the document, ensuring that the VVSG remains current and agile. By incorporating answers from the Request for Interpretation (RFI) process, updating requirements to reflect current interoperability needs, and addressing errata within the guidelines, VVSG 2.1 will continue to support the integrity and reliability of voting systems.

The ongoing commitment to periodic reviews and stakeholder feedback is crucial for maintaining the VVSG's effectiveness in an evolving electoral landscape. As the Testing and Certification Program recommends, these updates will ensure that voting systems remain secure, accurate, and reliable for all citizens.

7 References

- [1] U.S. Election Assistance Commission, "Voluntary Voting System Guidelines Version 2.0," Feb. 10, 2021. [Online] Available: https://www.eac.gov/sites/default/files/TestingCertification/Voluntary_Voting_System_Guidelines_Version_2_0.pdf
- [2] U.S. Election Assistance Commission, "VVSG Lifecycle Policy," Apr. 8, 2024. [Online] Available: https://www.eac.gov/sites/default/files/2024-04/VVSG%20Lifecycle%20Policy%20version%2004.08.24_0.pdf.
- [3] U.S. Election Assistance Commission, "EAC Decision on Request for Interpretation 2021-01 Standard Device Interfaces," May 27, 2021. [Online]. Available: https://www.eac.gov/sites/default/files/testing_standard/files/EAC_Ddecision_on_Request_for_Interpretation_2021_01_Standard_Device%20Interfaces.pdf
- [4] U.S. Election Assistance Commission, "EAC Decision on Request for Interpretation 2021-02 Source and Integrity of Election Records," Jul. 12, 2021. [Online]. Available: - https://www.eac.gov/sites/default/files/testing_standard/files/EAC_Ddecision_on_Request_for_Interpretation_2021-02_13.2_Source_and_Integrity_of_Election_Records.pdf



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- [5] U.S. Election Assistance Commission, "EAC Decision on Request for Interpretation 2023-01 Logging of Ballot Selections," Feb. 10, 2023. [Online]. Available: - https://www.eac.gov/sites/default/files/testing_standard/files/EAC%20Decision%20on%20RFI%202023-01%20Logging%20of%20Ballot%20Selections_0.pdf
- [6] U.S. Election Assistance Commission, " EAC Decision on Request for Interpretation 2023-02 Minimum Ballot Positions," Aug. 4, 2023. [Online]. Available: <https://www.eac.gov/sites/default/files/2023-08/EAC%20Decision%20on%20RFI%202023-02%20Minimum%20Ballot%20Positions.pdf>
- [7] U.S. Election Assistance Commission, " EAC Decision on Request for Interpretation 2023-03 Block-Structured Exception Handling," Sep. 29, 2023. [Online]. Available: https://www.eac.gov/sites/default/files/2023-10/EAC_Ddecision_on_RFI_2023-03_Block_Structured_Exception_Handling.pdf
- [8] U.S. Election Assistance Commission, " EAC Decision on Request for Interpretation 2023-05 Battery Backup for Central Count," Sep. 29, 2023. [Online]. Available: https://www.eac.gov/sites/default/files/2023-10/EAC_Ddecision_on_RFI_2023-05_Battery_Backup_for_Central_Count.pdf
- [9] U.S. Election Assistance Commission, " EAC Decision on Request for Interpretation 2023-06 Extensions to the VVSG 2.0," Nov. 3, 2023. [Online]. Available: https://www.eac.gov/sites/default/files/2023-11/EAC_Ddecision_on_RFI_2023-06_CDF_Extensions.pdf
- [10] U.S. Election Assistance Commission, " EAC Decision on Request for Interpretation 2024-01 Unique Identifier," May 3, 2024. [Online]. Available: <https://www.eac.gov/sites/default/files/2024-05/EAC%20Decision%20on%20Request%20for%20Interpretation%202024-01%20Unique%20Identifier%202.pdf>
- [11] U.S. Election Assistance Commission, " EAC Decision on Request for Interpretation 2024-02 Unauthorized Physical Access Alert," Jun. 21, 2024. [Online]. Available: <https://www.eac.gov/sites/default/files/2024-06/EAC%20Decision%20on%20RFI%202024-02%20Unauthorized%20Physical%20Access%20Alert.pdf>
- [12] U.S. Election Assistance Commission, " EAC Decision on Request for Interpretation 2024-03 Logging of Physical Connections and Disconnections," Jun. 21, 2024. [Online]. Available: - <https://www.eac.gov/sites/default/files/2024-06/EAC%20Decision%20on%20RFI%202024-03%20Logging%20of%20Physical%20Connections.pdf>
- [13] National Institute of Standards and Technology, "NIST SP 1500-19: Micro Common Data Format Specification, Version 1.0," Jan. 2023. [Online]. Available: - <https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1500-19.pdf>
- [14] National Institute of Standards and Technology, " NIST SP 1500-20: Ballot Definition Common Data Format Specification, Version 1.0," Jan. 2023. [Online]. Available: - <https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1500-20.pdf>
- [15] U.S. Election Assistance Commission, "VVSG 2.0 Errata," Jul. 10, 2023. [Online]. Available: - <https://www.eac.gov/sites/default/files/2023-07/VVSG%202.0%20Errata%2007.10.23.pdf>