Human Factors and Privacy: Progress Report

Presentation for the
Technical Guidelines Development Committee (TGDC)

Dr. Sharon Laskowski

5 December 2006
National Institute of Standards and Technology

Overview

- Changes in the VVSG HFP section
  - I'll summarize the changes from VVSG 05 to VVSG 07. Most are clarifications and corrections. A few will need some discussion.
- Research Progress
  - I'll report 2 research projects to support further edits to VVSG 07
- Issues requiring further analysis
  - We are planning to examine a number of topics to support additions to VVSG 07.
- Discussion

VVSG 07 Chapter 3 draft

- I will use the VVSG HFP Section that is numbered as Chapter 3 for this discussion and is in your binder
- Note that comments in the draft are enclosed in double brackets "[[]]"
- A "*" at the beginning of the title indicates a change in policy or approach rather than just a technical fix.

We improved the usability of the document per resolution 10-05

- Requirements in our new word template are of the form:

→1.2.3-C Plain Language

with subrequirements such as:

—›1.2.3-C.1 Clarity of Warnings

Followed by Discussion

- Clearer formatting
- We have eschewed technical vocabulary where feasibly achievable: used plain language

* 3.1.3: We clarified HAVA legal requirements vs. VVSG requirements

Characteristic	**HAVA**	**VVSG**
Status	Federal Law	Federal Guidelines
Scope	Voting Systems and Procedures	Voting Equipment
Primary Audience	States	Equipment Vendors
Enforcement	Dept of Justice	EAC
Phase of Life-cycle	Procurement/Deployment	Certification Testing
Level	Broad/Functional	Detailed/Technical

3.2.1: We put in placeholders to show the proposed structure of benchmarks for performance requirements

- **3.2.1.1 - A. Overall Effectiveness** The system shall achieve an overall accuracy rating of at least XXX, as measured by the NIST Voting Performance Protocol (NIST VPP).
- **3.2.1.1 - B. Overall Efficiency** When the conventional visual/tactile interface is used, the system shall achieve an overall mean voting session time of at most XXX minutes as measured by the NIST VPP.
- **3.2.1.1 - C. Overall Satisfaction** The system shall achieve an overall satisfaction rating of at least XXX, as measured by the NIST VPP.
- **3.2.1.1 - D. Support for Independent Voting** No more than XXX% of subjects shall request external assistance in the process of executing and casting their ballots, as measured by the NIST VPP.

3.2.2: We clarified “voter’s choice”

- We made a distinction between editable and non-editable voter interfaces
- For voter editable ballot devices, the voter is prevented from overvoting and warned about undervoting, as before
- * For Precinct Count Optical Scan, main change is:

3.2.2.2 - A. Notification of Overvoting The voting system shall be capable of providing feedback to the voter that identifies specific contests or ballot issues for which he or she has made more than the allowable number of selections (i.e.overvotes).

We Dropped: "The system shall provide a means for an authorized election official to deactivate this capability entirely and by contest." as in VVSG'05 4.1.5.1.d.iii. Some questions from HFP subcommittee about this. Should we really allow disabling of overvote notification? Doesn't this contradict the spirit of HAVA 301(a)(1)(A)(iii)?

We added marginal marks requirement (with CRT)

3.2.2.2 - D. Handling of Marginal Marks

Paper-based precinct tabulators should be able to identify a ballot containing marginal marks. When such a ballot is detected, the tabulator shall:

- Return the ballot to the voter;
- Provide feedback to the voter that identifies the specific contests or ballot issues for which a marginal mark was detected;
- Allow the voter either to correct the ballot or to submit the ballot "as is" without correction.

3.2.3 Cognitive Issues: We added plain language requirements plus two others

C.1 Clarity of Warnings

C.2 Context before Action

C.3 Simple Vocabulary

C.4 Start Each Instruction on a New Line

C.5 Use of Positive

C.6 Use of Imperative Voice

C.7 Gender-based Pronouns

E.4 Placement of Instructions (ballot design)

G. Icons and Language (with CRT)

3.2.4 Perceptual Issues: We added adjustable font and contrast recommendations

3.2.4 - E. Available Font Sizes

A voting station that uses an electronic image display should be capable of showing all information in at least two font sizes, (a) 3.0-4.0 mm and (b) 6.3-9.0 mm, under control of the voter.

3.2.4 - J. High Contrast for Electronic Displays

The voting station should be capable of showing all information in high contrast either by default or under the control of the voter. High contrast is a figure-to-ground ambient contrast ratio for text and informational graphics of at least 6:1.

NOTE: Some vendors already implement these features for all their displays; and it is already required for accessible stations.

3.2.4 Perceptual Issues:
We added a VVPAT requirement (with VVPAT team)

3.2.4 - H. Visual Access to VVPAT

When the voting system asks a voter to compare two distinct records of his/her vote (as in VVPAT systems), both records shall be positioned so as to be easily viewable and legible from the same posture.

Does this need clarification?

* 3.2.5.1 Timing Issues: We added requirements on how long the system and voter wait for each other to interact

3.2.5.1 - A. Maximum Initial Response Time
The initial response time of the voting system shall be no greater than 0.5 seconds.

3.2.5.1 - B. Maximum Completed Response Time for Vote Confirmation When the voter performs an action to record a single vote, the completed response time of the voting system shall be no greater than one second in the case of a visual response, and no greater than five seconds in the case of an audio response.

3.2.5.1 - C. Maximum Completed Response Time for All Operations
The completed visual response time of the voting system shall be no greater than 10 seconds.

3.2.5.1 - D. System Activity Indicator If the system has not completed its visual response within one second, it shall present to the voter, within 0.5 seconds of the voter's action, some indication that it is preparing its response.

3.2.5.1 - E. Voter Inactivity Time The voting system shall detect and warn about lengthy voter inactivity during a voting session. Each system shall have a defined and documented inactivity time, and that time shall be between 2 and 5 minutes.

3.2.5.1 - F. Alert Time Upon expiration of the inactivity time, the voting system shall issue an alert and provide a means by which the voter may receive additional time. The alert time shall be between 20 and 45 seconds.

* 3.2.6 Alternative Languages: We clarified this requirement

VVSG 05: The voting equipment shall be capable of presenting the ballot, ballot selections, review screens and instructions in any language required by state or federal law.

This confuses deployment with requirement for certification.

Is the intention:

- Every certified model supports every language, or
- Every certified model supports only a list of declared languages?

VVSG 07: **3.2.6 – A.** The voting system shall be capable of presenting the ballot, ballot selections, review screens and instructions in any language declared by the vendor to be supported by the system.

3.2.7.1 Privacy at the Polls: we added a req from a discussion paragraph in VVSG05

3.2.7.1 - A.4 No Receipts

The voting system shall not issue a receipt to the voter that would provide proof of how he or she voted.

* 3.2.8 Usability for Poll Workers:
We created a new section, adapting some reqs from maintenance and safety;
these are still somewhat subjective

3.2.8.1 - A. Ease of Normal Operation

Procedures for system setup, polling, and shutdown shall be reasonably easy for the average poll worker to learn, understand, and perform.

3.2.8.1 - B. Usability Testing by Vendor

* Maintenance

3.2.8.2 - A. Physical Attributes for Maintenance

The following physical attributes shall be sufficiently available so as to support good maintainability:

- Presence of labels and the identification of test points
- Provision of built-in test and diagnostic circuitry or physical indicators of condition
- Presence of labels and alarms related to failures
- Presence of features that allow non-technicians to perform routine maintenance tasks (such as update of the system database)

3.2.8.2 - B. Additional Attributes for Maintenance

The following additional attributes shall be sufficiently available so as to support good maintainability:

- Clear and complete documentation for all maintenance conditions.
- Ease of detection by a non-technician that equipment has failed
- Ease of diagnosing problems by a trained technician
- Low false alarm rates (i.e. indications of problems that do not exist)
- Ease of access to components for replacement
- Ease with which adjustment and alignment can be performed
- Ease with which database updates can be performed by a non-technician
- Ease with which a poll worker can adjust, align, tune or service components

* Safety

3.2.8.3 - A. Compliance with Federal Regulations

Equipment design for personnel safety shall be equal to or better than the appropriate requirements of the Occupational Safety and Health Act, Code of Federal Regulations, Title 29, Part 1910

3.2.8.3 - B. Elimination of Hazards

All voting systems and their components shall be designed to eliminate hazards to personnel or to the equipment itself. Hazards include, but are not limited to:

- fire hazards
- electrical hazards
- potential for equipment tip-over (stability)
- potential for cuts and scrapes (e.g. sharp edges)
- potential for pinching (e.g. tight, spring-loaded closures)
- potential for hair or clothing entanglement

We removed one VVSG 05 req as not testable:

Defects in design and construction that can result in personal injury or equipment damage must be detected and corrected before voting systems and components are placed into service

3.3.2 Partial Vision: We updated and clarified older reqs on contrast and color

3.3.2 - C. High Contrast for Accessible Display

An accessible voting station shall be capable of showing all information in high contrast either by default or under the control of the voter. High contrast is a figure-to-ground ambient contrast ratio for text and informational graphics of at least 6:1.

3.3.2 - D. Adjustable Saturation for Color Displays

An accessible voting station with a color electronic image display shall allow the voter to adjust the color saturation. At least two options shall be available: a high and a low saturation presentation.

3.3.2 Partial Vision: We clarified distinctive on-screen controls and adjustability for A/V

3.3.2 - E. Distinctive Buttons and Controls

Buttons and controls on accessible voting stations shall be distinguishable by both shape and color. This applies to buttons and controls implemented either "on-screen" or in hardware. This requirement does not apply to sizeable groups of keys, such as a conventional 4x3 telephone keypad or a full alphabetic keyboard.

3.3.2 - F. Synchronized Audio and Video

The voting station shall provide synchronized audio output to convey the same information as that which is displayed on the screen. There shall be a means by which the voter can disable either the audio or video output, resulting in a video-only or audio-only presentation, respectively.

3.3.3 Blindness: We upgraded minimum rate of speech to a “shall”

3.3.3 - C.8 Control of Speed

The audio system shall allow voters to control the rate of speech. The range of speeds supported shall include 75% to 200% of the nominal rate.

3.3.5 Mobility: We added a space req based on a based on a suggestion to the EAC during the VVSG 05 comment period.

3.3.5 - B. Allowance for Assistant

When deployed according to the installation instructions provided by the vendor, the voting station shall allow adequate room for an assistant to the voter.

Research Progress

- Usability benchmarks
  - Our preliminary results appear to confirm our hypothesis that we can define benchmarks
  - Usability testing with our protocol and feasible sets of test voters can detect and measure error rates and discriminate among different implementations
  - The protocol successfully measured time to vote and satisfaction; on these two dimensions, there were no significant differences between the two systems tested.
  - Next steps:
    - additional experiments to determine benchmarks and test voter population
    - validate the test protocol
- Voting-specific plain language research has begun
  - Experiments have been defined

Issues requiring further analysis for VVSG 07: Color and Audio

- Color guidance: current reqs for color coding for color blindness (3.2.4-A) and color saturation (3.3.2-D) are very general
- Audio interface guidance: vote by phone and audio voter-editable ballot devices could benefit from research findings for Interactive Voice Response (IVR)

Issues requiring further analysis for VVSG07: Usability test reporting for voting

- ISO/IEC 25062:2006 "Common Industry Format (CIF) for Usability Test Reports“ will be used by both vendors and test labs
  - E.g., 3.2.1.2 - A. Usability Testing by Vendor
- But, it is a general format
- It should be customized for voting systems
  - Uniformity
  - Comparability
  - Guidance for states and usability and human factors professionals

Issues requiring further analysis for VVSG 07: Usability of documentation

- The documentation requirements include usability (with CRT)
  - Includes system documentation, setup, operations, user manuals, etc.
- Best practice for technical documentation should be applied
- Style guide is a good start

Issues requiring further analysis for VVSG 07: Usability testing for accessibility

- Accessibility design reqs are not sufficient to guarantee usability of accessible devices
- Benchmarks and test protocols are different for accessible devices
  - E.g, an audio interface is slower
- Work is needed to adapt:
  - the CIF test reporting
  - Usability test benchmarks and procedures

Issues requiring further analysis for VVSG07: Usability, Accessibility, and Security

- As security reqs are further developed, it is critical to consider impact on usability and accessibility
  - E.g. Issues for software independence, paper-based approaches
- Holistic approach: We plan close collaboration between STS and HFP
  - Helps to identify and articulate key issues
  - End-to-end accessibility for the voter process: can we develop a requirement to show that the entire system is accessible (the highest standard), or show how reasonable accommodation can fill gaps for full accessibility?

Discussion