

Meeting Minutes (Official)
Technical Guidelines Development Committee (TGDC) Meeting
March 22-23, 2007
National Institute of Standards and Technology (NIST)
Gaithersburg, MD 20899

Members in Attendance:

Dr. William Jeffrey – Chair
Patrick Gannon
Hon. John Gale
Tricia Mason
Alice Miller
Paul Miller
Philip G. Pearce
Helen Purcell
Whitney Quesenbery
Ronald Rivest
Daniel Schutzer
Sharon Turner-Buie (via Conference Call)
David Wagner

Committee Support Staff:

Melissa Lieberman, General Counsel Office, NIST
Mark Skall, Chief, Software Diagnostics and Conformance Testing, Information Technology Laboratory (ITL), NIST
Barbara Guttman, Software Diagnostics and Conformance Testing, ITL, NIST
John Wack, Software Diagnostics and Conformance Testing, ITL, NIST
Alan Goldfine, Software Diagnostics and Conformance Testing, ITL, NIST
David Flater, Software Diagnostics and Conformance Testing, ITL, NIST
Wendy Havens, Software Diagnostics and Conformance Testing, ITL, NIST
Lucy Salah, Software Diagnostics and Conformance Testing, ITL, NIST
Allan Eustis, Software Diagnostics and Conformance Testing, ITL, NIST
Lynne Rosenthal, Software Diagnostics and Conformance Testing, ITL, NIST
Thelma Allen, Software Diagnostics and Conformance Testing, ITL, NIST
Sharon Laskowski, Information Access, ITL, NIST
John Cugini, Information Access, ITL, NIST
Nelson Hastings, Computer Security, ITL, NIST
Rene Peralta, Computer Security, ITL, NIST
Bill Burr, Computer Security, ITL, NIST
Mary Saunders, National Voluntary Laboratory Accreditation Program (NVLAP), NIST

March 22, 2007: Morning Session # 1

Dr. William Jeffrey, TGDC Chair, called the eighth plenary session of the Technical Guidelines Development Committee to order at 9:00 a.m. He introduced himself as the Director of the National Institute of Standards and Technology (NIST) and Chair of the Technical Guidelines Development Committee.

After the Pledge of Allegiance, the Chair recognized Ms. Thelma Allen as the TGDC Parliamentarian and requested that she determine if a quorum of the Committee was present. Ms. Allen then called the roll (see Table 1). Eleven TGDC members answered "present." Ms. Allen notified the Chair that a quorum (simple majority) of the Committee was present either in person or via conference call connection. (Note: Secretary Gale arrived after the initial roll call. Mr. Miller participated by conference call during portions of the first day's proceedings and in person during the second day's proceedings.)

Dr. Jeffrey thanked the Parliamentarian and welcomed the Committee members back to NIST's Gaithersburg campus. He noted that two Committee members would be delayed because of flight cancellations due to inclement weather in the Midwest. The Chair also recognized the substantial contributions of the Committee members working with NIST staff since the December 2006 plenary. "I look forward to a productive meeting as we review the progress of the three working Subcommittees over the next two days."

The Chair welcomed U.S. Election Assistance Commissioner Donetta Davidson, Executive Director Tom Wilkey and accompanying EAC staff. Dr. Jeffrey then entertained a motion to adopt the December 4th and 5th, 2006 Technical Guidelines Development Committee Meeting minutes. A motion was made and seconded. The Chair asked if there was agreement to unanimous consent for the motion. Hearing no objection, the December TGDC meeting minutes were adopted. (A copy of the official meeting minutes is available at: <http://vote.nist.gov/meeting-03222007/Edited120406MeetingMinutesall.pdf>)

Dr. Jeffrey then asked for a motion to accept the published agenda for the March 22-23, 2006 TGDC meeting (see: <http://vote.nist.gov/meeting-03222007/agenda-Mar22-23.pdf>). A motion was made and seconded. The Chair asked if there was an objection to unanimous consent for the motion. There was no objection and the meeting agenda was adopted (See Table 1).

Dr. Jeffrey then offered preliminary background relevant to the upcoming meeting. He stated that since the last meeting of the TGDC on December 4th and 5th 2006, NIST staff, in coordination with the three working subcommittees of the TGDC, have drafted and edited sections of the next VVSG. "As a Committee, we will review, approve, and where appropriate, provide supplemental direction to the [Human Factors and Privacy (HFP), Security and Transparency (STS), Core Requirements and Testing (CRT)] Subcommittees. This guidance is critical to the refinement of the final draft guidelines to be delivered to the EAC in July 2007."

The Chair further noted that at the December 2006 plenary session, TGDC members highlighted the need for Subcommittees to collaborate on issues of mutual concern to two or more Subcommittees. We will discuss the results of these collaborations on Friday

[March 23rd].” Dr. Jeffrey explained that the time necessary to complete the meeting agenda meant that the Committee could not take public comment during the meeting. However, he emphasized that there continue to be opportunities for the public to comment on relevant issues. “The draft VVSG documents are posted on the web [<http://vote.nist.gov/meeting-03222007/VVSG-SETdraft-20070306v5.pdf>] and are available for the election community, vendors, and the public to provide initial feedback. Please e-mail your input to: voting@nist.gov.” He noted that public comments received to date are posted at: <http://vote.nist.gov/ECPosStat.htm>.

Dr. Jeffrey detailed new measures to ensure that the guidelines would not only be testable but also would reflect the needs of the end users. At the Chair’s request, Ms. Alice Miller agreed to serve as Co-chair of the HFP Subcommittee; Mr. Paul Miller agreed to serve as Co-chair of the CRT Subcommittee, and Ms. Helen Purcell agreed to serve as Co-chair of the STS Subcommittee. “Along those lines it is important that the guidelines be consistent, testable and verifiable as they are implemented. I have requested that the National Voluntary Laboratory Accreditation Program (NVLAP) staff participate in the meetings of the working subcommittees and they have agreed.”

The Chair then recognized the presence of EAC Commissioner Hillman and opened the floor to both her and Commissioner Davidson for remarks to the Committee.

Commissioner Davidson thanked the Chair. She also expressed her continuing appreciation for all the efforts of and guidance from the TGDC Committee members. Commissioner Davidson briefly covered the public process for reviewing the draft VVSG from the TGDC. “The delivery of the TGDC draft version is an extremely important step, but it only marks the beginning of the next part of the process. After reviewing the TGDC draft, the EAC has the responsibility mandated under HAVA to conduct a deliberative and thorough review of the document.” In her presentation she covered elements of the full review process including:

- EAC review and vetting of TGDC draft document
- Publication of EAC draft version in Federal Registrar
 - 90 days to comment
 - EAC/NIST catalog, review and incorporate public comments
 - Brief EAC Commissioners on purposed changes
 - In 2005 over 6500 public comments received
 - Anticipate more comments because new iteration is a complete rewrite
- EAC Board of Advisors review
- EAC Standards Board review

She also noted the need to review the concerns of the various stakeholder groups including:

- Public meetings with major stakeholders such as:

- Election Officials
- Advocacy Groups
- Voting System manufacturers
- Meetings to discuss cost of:
 - Development
 - Manufacturing
 - Testing

Commissioner Davidson concluded with a review of her top priority for 2007. “It is to increase public confidence in the election process. To achieve that goal, we must increase voter confidence in the voting equipment and the certification process: that means establishing a vigorous system of testing and certification of the equipment; educating the public and the voters about the process, and continuing to examine the way we conduct elections, making improvements as we go.” Commissioner Davidson yielded the floor to Commissioner Hillman. (Commissioner Davidson’s presentation slides are available at: <http://vote.nist.gov/meeting-03222007/Pres-Davidson.pdf>).

Commissioner Hillman thanked the Chair for the opportunity to address the Committee. Reflecting on Commissioner Davidson’s presentation, she commented on the enormity of the task ahead encompassing a complete review the next iteration of the VVSG. “Perhaps the two biggest challenges we have are helping our 110 member (EAC) Standards Board and our (EAC) Board of Advisors prepare for the roll that HAVA mandates they perform in reviewing and commenting on the guidelines. Beyond that we have to undertake the task of helping the public digest the process. And I think a predecessor to that is to make sure that the scientists, the technical experts, and the election officials speak the same language. Quite frankly, we are not so sure that is happening right now.” She introduced William Campbell, City Clerk for Woburn Massachusetts and a member of the Executive Committee of the Standards Board. Commissioner Hillman indicated that Mr. Campbell would attend the entire TGDC meeting and serve as a liaison to the Standards Board on the development of the VVSG. Commissioner Hillman concluded with an emphasis on the importance of communication to better understand the VVSG. “We certainly want to make sure that members of the Standards Board and Board of Advisors are adequately prepared to have discussions in their communities with their county officials, state officials, and governors to help everybody appreciate the implications of the Voluntary Voting System Guidelines on the future of voting and democracy in America.”

The Chair thanked Commissioner Hillman. He then called on Mr. Mark Skall of NIST’s Information Technology Laboratory (ITL) to summarize VVSG activities since the December 2006 TGDC plenary.

Mr. Skall outlined the major efforts of NIST and the TGDC over the previous three months including:

- Continued research and drafting of VVSG
- Coordination with the TGDC
- Outreach in support of NIST research

- Resolution Matrix updates

In addition Mr. Skall reviewed the plenary agenda, focus and outreach strategy. “Those of you who have been involved with the TGDC from the beginning know that we really are trying to reach out to as many different groups as possible so we can learn everything we need to perform our research.”

Mr. Skall offered a synopsis of the NIST-TGDC coordination including:

- 21 teleconferences since last December 2006
- Joint teleconferences between committees
- Preparation and review of discussion papers, much draft material
- Numerous individual discussions

He noted that the current draft VVSG build was over 500 pages and approximately 80% complete. He summarized the overall aims of this meeting:

1. to make substantial progress on finalizing existing material
2. to discuss remaining open issues and get consensus

Mr. Skall concluded with the format of Friday’s presentations to include an update on the NVLAP accreditation program and a discussion of important crosscutting issues including: paper rolls; VVSG scope and ballot activation; accessibility and software independence; and the innovation class. (Mr. Skall’s presentation slides are available at: <http://vote.nist.gov/meeting-03222007/Pres-Skall-Update.pdf>).

The Chair thanked Mr. Skall and recognized Commissioner Davidson. She introduced new Commissioner’s Rosemary Rodriguez and Caroline Hunter. They replace Commissioners Martinez and DeGregorio respectively. “Please everybody on the Committee introduce yours to them so they can get to know you.”

Dr. Jeffrey welcomed the new Commissioners and then called on Mr. Wack of NIST’s ITL staff to provide an overview of the current draft VVSG recommendations to the Election Assistance Commission.

Mr. Wack reviewed a number of the chapters of the draft VVSG. He also detailed a timeline for VVSG work thru July 2007 including the following tasks:

- Make changes as per this meeting
- Further define some material including:
 - Open ended vulnerability testing requirements
 - Innovation class requirements
 - Remaining STS and CRT core material
- Make final updates to usability requirements
- Harmonize material, reduce overlaps, review for consistency
- Write introductory and guide material
- Complete final formatting and cross-referencing

“We're highly interested in the final document being as usable and readable as possible for the election community. We want to give the EAC a document in July that doesn't saddle them with a lot of reformatting or restructuring.” Mr. Wack then summarized NIST's work upon delivery of the VVSG recommendations to the EAC. NIST will post the Draft VVSG Recommendations on <http://vote.nist.gov>. During the public review process, NIST will assist the EAC in vetting the document with the Standards Board and the Board of Advisors.

In conclusion, Mr. Wack reviewed progress on meeting the goals of Resolution 23-05:

The TGDC has concluded that the adoption of standard formats for election-related information, such as ballots (both blank and filled-in), has many positive benefits and is worth pursuing. An example of such a standard is OASIS Election Markup Language (EML) Version 4.0, which is an XML-based specification. The TGDC therefore requests NIST to do research and develop standards documents:.

He reviewed two relevant standards development groups working in this arena- the OASIS Election and Voter Services Technical Committee (TC) and the IEEE Project 1622, Voting Systems Electronic Data Interchange. He indicated that NIST has submitted issues that need resolution to the OASIS group concerning EML version 4. He noted that neither standard is ready as a government mandate at this time. As next steps, he indicated:

- The next VVSG will specify the requirements for an election information format without requiring a specific format.
- The VVSG discussion field will mention EML as a possibility, as is done now in VVSG 2005.
- NIST will communicate VVSG requirements to OASIS and IEEE to assist in continued standards development.

Mr. Gannon provided an update on OASIS EML Version 5. “The OASIS Election and Voter services Technical Committee did have some interaction with Dr. Flater of NIST. He has been requesting closer participation from the staff on that committee to move the issues forward. The EML version 5 has been approved by the committee. It is out for 60-day public review. Once that public review is completed, it will then be submitted to become an OASIS standard around the June time frame. Shortly after that, the plan is to submit it to become an ISO standard. There are representatives from the IEEE P1622 working group on the OASIS Election Voter Services Committee. They have reviewed the requirements under P1622 and find that they are a subset of the capabilities provided in the EML standard, and that the new version 5 meets all of those requirements under 1622, even though the P1622 doesn't actually have an adopted standard to meet the requirements. So right now the EML seems to meet all of those requirements. We are looking forward to setting up some testing or interoperability demonstrations in the middle of this year.”

Ms. Quesenbery complimented the NIST staff on the VVSG document layout and structure noting that it appeared quite usable and attractive. She raised a question as to whether the current organization of chapters in the document was final. When Mr. Wack indicated that the TGDC could certainly offer input here, she requested consideration for moving the usability chapters up closer to the beginning of Volume 3. "This is a technical standard equipment standard. Because we are so focused on the details of the equipment, it is easy to lose track of the purpose of the VVSG standard: to support humans and human activity. So starting with that information, and then talking about the technical requirements that support the human activity, I think would help us all remember why we are all here."

Mr. Wack commented that in the VVSG 2005, the human factors requirements were set out earlier in the document- in Chapter 3- and that there may be good reason to continue that location for human factors requirements in the next iteration.

The Chair thanked Mr. Wack and adjourned the meeting for a fifteen-minute break.

March 22, 2007: Morning Session # 2

Dr. Jeffrey called the plenary meeting back to order. He then called on Dr. Nelson Hastings of NIST's Information Technology Laboratory to begin the presentation of the Security and Transparency Subcommittee preliminary draft VVSG sections and related issues.

Dr. Hastings thanked the Chair and indicated that his presentation would provide the Committee with an update on VVSG security requirements. He would then yield the floor to Mr. Burr who will present cryptography requirements. Mr. Kelsey will follow with a presentation covering equipment requirements for auditing.

As background, Dr. Hastings explained that draft security requirements are written based on TGDC resolutions and STS teleconference discussions. The initial requirements are first distributed to NIST staff for review and revision. They are then reviewed by the STS and revised based on comments received. The requirements are subsequently made available to the entire TGDC for review and revised based on their comments.

The rest of Dr. Hastings presentation covered the status of security requirement updates, including:

- Physical Security,
- System Integrity Management,
- Innovation Class,
- Security Documentation,
- Software Distribution & Installation,
- System Event Logging,
- Access Control,
- Setup Validation,

- Auditing, and
- Cryptography.

The Chair thanked Dr. Hastings and opened the floor for discussion. Secretary Gale asked Dr. Hastings if he could succinctly describe the implications of setup validation on voting equipment and election officials who use the equipment.

Dr. Hastings indicated that the purpose of setup validation requirements on voting systems is to allow election officials, through inspection, to be confident that the system is secure for use at the polling place.

Secretary Gale asked if these requirements are directions to be given by the vendor to election officials or, instead, standards to be universally distributed that define how setup of a voting system will be validated.

Dr. Hastings indicated that the goal of the requirement is to provide the validation capability within a voting system. The voting jurisdictions can choose whether to validate the security of various parts of the voting system.

Secretary Gale expressed concern that a singular method of setup validation would be required for local election officials. He inquired whether state law or the EAC management guidelines would apply here. In addition, he asked if setup validation applied to new equipment, upgraded equipment, or setup of equipment before each election.

David Wagner offered his understanding of the purpose behind setup validation requirements. "Software validation requires voting machines to have the capability for election officials to inspect the system to make sure it is ready for use. For instance, it allows you to check and confirm that the certified version of the voting software has not been tampered with or replaced. So the setup validation requirements in the standard would require vendors to provide these capabilities. It is my understanding that you would implement these requirements before every election- for instance, checking consumables such as ink supply. Voting system manufacturers would give the election official the capability to check these." He also noted that initial setup validation requirements are in the VVSG 2005.

EAC Commissioner Davidson clarified the intent that the proposed standards in the draft VVSG currently under review by the TGDC will apply only to future voting systems. "I do not know what the implementation time frame will be right now. As I said earlier, a new VVSG probably will not be adopted by the EAC until 2008. Then we have to meet with the manufacturers and the election community to see how long before they can develop new voting systems that comply, and how long before we expect new voting systems can be purchased by jurisdictions."

Secretary Gale emphasized a need to establish a clear line between election management guidelines and voting equipment guidelines. "There are a lot of ongoing setup

requirements that are going to be election management issues, not equipment issues. So, if I am clear about the proposed VVSG setup validation requirements, we are talking about precisely the voting equipment: to ensure that the system has what it is promised to have post-testing and certification.”

There being no further questions, the Chair asked Mr. Bill Burr of NIST’s Information Technology Laboratory to review proposed cryptography requirements for voting systems.

In his introduction, Mr. Burr indicated that the proposed cryptographic requirements section will be most useful to individuals who implement cryptography and less useful directly to election officials. His presentation provided a high-level overview of proposed cryptographic requirements, including:

- Cryptography Basics,
- Cryptographic Module Validation,
- Public Key Cryptography,
- Digital Signature: Signing,
- Digital Signature: Verification,
- Public Key Certificate,
- Signature Module,
- Signature Key Management,
- Device Signature Key (DSK),
- Election Signature Key (ESK), and
- Election Close Out.

Dr. Schutzer inquired as to the federal government plan for updating cryptographic validation module requirements in 2010. Mr. Burr indicated that the intent is to stop use of older algorithms at that time that are not considered secure enough. Dr. Schutzer inquired as to whether future voting machines would need to be upgradeable in this regard. Dr. Wagner said he believed this was not the case. “My feeling is, no, it should not be necessary to require the ability to do field upgrades on your cryptographic algorithms for voting machines. Cryptography, as Bill explained, is well enough understood that the cryptographic algorithms put in place ought to last for the lifetime of the equipment.”

Secretary Gale inquired whether the digital signature creation was a post-election function. Mr. Burr answered that the digital signing occurred during the election allowing for verification of audit records afterwards. He elaborated, “What we are interested in being able to do more than anything with DRE voting equipment and the voter verifiable paper audit trails is to rigorously cross-check them. We want to be sure that the voting equipment’s electronic records - the electronic audit records- that we are cross-checking have not been altered.”

Secretary Gale asked for further clarification on what is actually authenticated beyond the VVPAT.

Mr. Burr responded. "I am referring to using the cryptography to create electronic records that can be fully authenticated. Then, in a major audit stage, where you are actually comparing typically the paper to the electronic record, making sure that they are consistent, you ensure that the electronic record is authentic. What we are actually worried about being able to reliably catch more than anything is the possibility of malicious code in the voting machine: printing one thing on the paper and putting something else out electronically."

In an answer to a follow-up question, Mr. Burr noted that the cryptography requirements are not trying to actually specify whether one machine is producing records that are somehow tied to a particular polling place through hardwiring of the equipment.

Ms. Quesenbery noted that each voting system has a unique identity like a fingerprint that can be determined. "You are providing a capability that can be used as part of the election process but are not requiring it."

Secretary Gale expressed the need of election officials to have flexibility with respect to the location of specific voting equipment. "I just want to be sure that we are not encrypting machines in such a way where they can only be used in a particular precinct."

Dr. Rivest responded. "The goal here is to give every machine its own identity. So you know that the record comes from that machine. However, there is no restriction on precinct location or on what those machines do, whether they are acting as tabulators or vote-capture devices. All of that is at a higher level of election management. There is absolutely no intent here to alter that flexibility."

The Chair thanked Mr. Burr. (The cryptography presentation slides are posted at: <http://vote.nist.gov/meeting-03222007/Pres-Burr-CryptographySection.pdf>.) He then called on Mr. John Kelsey of NIST's Information Technology Laboratory to present proposed VVSG equipment requirements to support auditing steps.

In his introduction, Mr. Kelsey enumerated the known attacks to be addressed including when voting machines can:

- Change recorded votes,
- Give wrong ballots, or
- Introduce errors favoring one side.

Or when the tabulation computer can:

- Miscount votes, or
- Omit or insert machine totals.

In the remainder of the presentation, Mr. Kelsey covered the following issues related to equipment requirements to support auditing steps:

- Auditing Steps to be Supported,
- Agreement of Paper and Electronic Records,
- Pollbook Audits,
- Hand Audits,
- Reconciling Totals,
- Presentation and Machine Behavior,
- Audit Procedures,
- Observational Testing, and
- Parallel Testing.

Mr. Miller had a question on the ability to unambiguously certify the VVPAT. He mentioned the instances in Cuyahoga County, Ohio, including broken tapes and switching of printer modules. "Are we contemplating some kind of a requirement that the voting machine be able to sense when a new paper roll has been inserted and print the identifying information at that point in time?"

Mr. Kelsey indicated that this kind of reliability requirement was in fact under consideration. "In the paper records requirements, we have been working on one of the requirements we know has to be there: if you change paper rolls, the voting machine has to know that you changed the paper rolls and provide notification."

In an answer to Mr. Gannon's question on the location in the draft document for equipment auditing requirements, Mr. Kelsey commented that these requirements are a big concern, and while there is a placeholder for them in the document, they are still being edited. "This is where we need input from election officials, because they have done these audits and will be able to point out things we are missing."

In a follow-up question, Mr. Gannon inquired as to the requirements for electronic records. So far the only thing we have right now is interoperability and some high-level requirements."

Mr. Kelsey explained that the requirements chapter on electronics records has been sent to the members of the Security and Transparency Subcommittee for initial review. "One of the requirements we have is that electronic records have to be produced in a completely specified format so that, if necessary, you can write your own software and do not have to depend on the vendor's software to get information. There is thought about using the EML specifications. Dr. Flater will address the issues here in his presentation."

Secretary Gale commented that these requirements seem to be in the area of election administration and not guidelines for voting equipment. Thus they would be an Election Assistance Commission issue and not a TGDC issue.

Dr. Wagner noted that this was a fair concern. “The Security and Transparency Subcommittee asked NIST to look at auditing procedures typically used by election officials around the country and to develop requirements to ensure that the equipment can support those requirements. So this is not by any means meant to amend the procedures election officials will use or instruct how election officials have to do the audit. Rather it is ensuring that voting machines provide the information election officials will need to produce the records to do those audits and to make it easier to do those audits. But whether those audits are done and how they are done is entirely up to the election officials.”

Secretary Gale inquired as to how you would test these requirements since this is up to state law.

Dr. Wagner commented that the information is background that will inform the drafting of requirements for equipment specifications to produce adequate records for audits.

Secretary Gale, while agreeing, added a note of caution. “That makes sense to me in terms of helping to ensure that the equipment provides information to do audits. But to also go ahead and say, these are the kind of audits you should do seems like we are beyond the specification.”

Dr. Jeffrey stated that these requirements will not include procedural issues that are done at the state or local levels. These are requirements on the hardware. “Whatever procedures are generated locally, election officials will hopefully have all the data they need. What we are trying to do is capture in the requirements anything you could possibly want in your audits in such a way that integrity of the date is assured.”

Ms. Purcell relayed her recent experience with hand audits. “It would be impossible to do the audit if the equipment- whether Op Scan or DRE- did not give you the necessary identifiers.”

Secretary Gale agreed but cautioned against procedural requirements that go beyond the purview of the TGDC.

Mr. Kelsey concluded his presentation with a review of parallel testing methods. He noted the issues of cost and the necessity of further discussion within the Security and Transparency Subcommittee. (The complete presentation is available for review at: <http://vote.nist.gov/meeting-03222007/Pres-Kelsey-Audit.pdf>.)

Secretary Gale questioned the need for fabricating imaginative defenses when the source code review will in fact be part of the testing and certification of the voting equipment.

Dr. Rivest provided his reasoning. “I think that there are layers of defense here and various kinds of threats. The source code review will be imperfect. The source code is just too complicated. But the primary concern with parallel testing is related to the setup

validation of the voting equipment. The source code may have been manipulated as well. What you have on that machine may not be what you thought you had on the machine.”

Secretary Gale noted that there was no evidence of any of these threats occurring on any voting system anywhere. “So we are really constructing an issue here of how many ways you can protect against an imaginary foe? It seems to me we are going to spend all this money on all these backup ways of warning against source code intrusion. Why not just focus our attention on preventing source code intrusion and not all of the various ways to prevent consequences?”

Dr. Wagner agreed that these issues related to software independence are long and complex. On the immediate issue at hand, some states and jurisdictions have chosen to perform parallel or observational testing on voting equipment. So it is important to have requirements that support this testing.

Secretary Gale remarked that the substantial cost of this testing is passed on by the vendors to the states and counties. He questioned whether these standards are aiming at “zero error perfection” for the first time in 200 years of the democracy. “Is this a new standard we are setting with these guidelines, requiring zero error? We will have everything tested to the point with so many redundancies and audits that nobody can afford it. But it will be a perfect election.”

Mr. Miller shared his concerns from Washington State’s experience with parallel testing. He expressed concerns on the voting machine design costs. He also indicated that the Committee needed to look carefully at the costs and implications of separating machines from a controller device for parallel monitoring on Election Day.

Dr. Rivest noted that input from local election officials here was important. Dr. Wagner explained California’s experience with parallel testing in mock elections. “I would be reluctant to suggest requirements that would constrain the design of these machines in a way that, for instance, prohibits a current voting machine network just on the basis of parallel testing.”

Secretary Gale indicated that it would be helpful if these guidelines were presented as recommendations instead of requirements. “Obviously there are many sizes of counties and election jurisdictions. Some can afford to spend more money to do more testing than others. If these are suggestions, they will be received favorably, but it is not going to work to require one specific system.”

Ms. Purcell and Mr. Miller concurred that currently there are election observers and trouble shooters that manage voting systems in all counties on Election Day. A harder problem is discerning whether malicious software, calibration error, or human interface error causes a DRE to appear to change a vote.

The Chair inquired as to whether the STS has sufficient guidance on this subject to move forward with requirements.

Dr. Rivest indicated that more input from election officials would be helpful in this regard. If there is not a demand for parallel testing requirements here, we should consider backing off.

Secretary Gale noted that the EAC will be issuing election management guidelines in the fall. "I think these specific parallel testing requirements should either be postponed or delayed indefinitely until we have the ability to interface them with the EAC guidelines."

After further discussion and clarification, Dr. Jeffrey entertained a motion to adopt the STS presentations of the preliminary drafts of the VVSG sections on security "with the change that there will be no hardware requirements on parallel testing. However, if a vendor's election equipment has such a capability, then the manufacturer should document how a state could use that equipment for parallel testing."

The motion was made and seconded. The Chair asked if there was objection to unanimous consent. There was no objection, and the motion was adopted (see Table 1).

The Chair adjourned the meeting for a one-hour lunch break.

March 22, 2007: Afternoon Session # 1

The Chair called the meeting to order and asked Ms. Allen to take attendance.

Ms. Allen called the roll and reported ten members in attendance. She notified the Chair that the meeting could proceed with a quorum present.

The Chair called on Dr. Alan Goldfine to present the first part of the Core Requirements and Testing (CRT) Subcommittee draft VVSG sections and related issues.

Dr. Goldfine thanked Dr. Jeffrey. He provided an overview of the following material in both his and Dr. Flater's presentations:

- Electromagnetic Compatibility Requirements;
- Quality Assurance/Configuration Management (QA/CM) Requirements;
- Review of CRT Changes from the previous VVSG draft; and
- Benchmarks.

As a brief chronology of events leading up to a discussion of QA/CM requirements, Dr. Goldfine noted the initial TGDC guidance to NIST from Resolution 30-05. "This was reaffirmed and extended at the December 2006 plenary where the TGDC did reach a consensus that the ISO-9000, 9001 family of standards should provide the future framework for QA/CA requirements in the next VVSG to be recommended to the EAC in 2007." He then provided a summary of the proposed new QA/CM: requirements:

- The draft VVSG 2007 QA/CM requirements:

- require conformance with ISO 9000/9001;
- are more detailed than those in VVSG 2005 in terms of
 - vendor quality and configuration management procedures,
 - required documentation of these procedures, and
 - data to be delivered to EAC/test labs; and
- require the vendor to specify its QA procedures early in the process, not when the product is submitted for certification.

Dr. Goldfine then initiated a lengthy discussion of an unresolved issue - specification of a time frame for approval of a voting manufacturer's quality assurance (QA/CM) procedures. He outlined a possible solution:

- Be explicit, and require that the delivery of the QA/CM procedures for approval “shall occur during the Manufacturer Registration process as specified in the EAC Testing and Certification Manual, and *before the start of the design and development process for the given voting system.*”

As well as an alternative:

- Drop the “*before the start of the design and development process for the given voting system*” condition.
 - There could then be an informative discussion in the VVSG that advises that the vendor submission should be done before the start of design and development.

(Dr. Goldfine's entire presentation is available for review at: <http://vote.nist.gov/meeting-03222007/Pres-Goldfine-Plenary.pdf>.)

Discussion initially focused on the value added to the certification process by the timing of delivery of a quality assurance manual from the manufacturer to the EAC. Dr. Jeffrey and then Mr. Skall framed the question. “Why do we care that quality procedures are in place in general, if in fact the end result is to accomplish the requirements in the VVSG?”

Dr. Goldfine responded that determination of a quality assurance program early on can help to ensure reliability.

In response to a question from the Chair, Ms. Saunders noted that the NVLAP certification process does not reach down into a vendor's quality assurance program.

Ms. Rosenthal clarified the current status of quality assurance in the VVSG. “The quality assurance manual is already required. It needs to be there. It does show what the vendor is doing as far as their design, their development, and their manufacturing processes. That needs to be there so that the testing labs assessing the equipment can determine that all the right manufacturing processes are in place. What is key is that we have a high level of confidence that when they manufacture the next machine and the ones after that, those

machines would be of equal quality and at that same performance level as the one being tested.”

Ms. Quesenbery had concerns with requiring when a vendor should begin a quality assurance program. “To the extent that usability, accessibility, and security for that matter are qualities of a product, all of those need to be baked in from the beginning. I find it very hard to imagine how far we could go back to mandate that. I have to say, I am dubious about the ability of a standard to mandate good behavior. I think we can mandate good outcomes but not good behavior.”

In a response to a question from Ms. Quesenbery, Mr. Hancock of the EAC indicated that the current practice is to review the quality assurance manual as part of the certification process.

Secretary Gale also expressed concerns with the costs and benefits related to a quality assurance manual. “I don't know how that quality assurance document makes any difference to a handmade prototype, because that is not how the manufacturers are going to produce the systems from then on. I can see it benefiting the test labs. When you build a prototype, cost is kind of an open-ended issue, because you are trying to end up with a quality product without regard to cost that you can get certified. Then you start worrying about efficiencies, economies of scale, and how to produce these things.”

Dr. Goldfine remarked that the quality assurance document has a goal of assisting both the test labs and the vendors. “It's a means to help them produce a better product.”

Ms. Rosenthal emphasized that “the VVSG clearly identifies the requirements of what needs to go into the quality manual. So the vendor knows in advance what those best practices are. These are not new. They have been in the earlier standards since 2002.”

Ms. Saunders commented from the perspective of NVLAP and the testing laboratories. “The test lab looks at a particular voting system and configuration. It does not reach back into the manufacturer's process for producing the initial product or the process for producing products in the future. It's a one-time test, and the labs test to the standards. The quality assurance management system is the responsibility of the certification program run by the Election Assistance Commission. Whether you can produce repeatable products and systems over and over and over again is a very simple point. Unfortunately, the procedure as proposed is unenforceable. You cannot enforce the manufacturer to have a QA manual in place before they start design development of a particular system. I don't see how you would be able to enforce that.”

In an answer to a question from Mr. Gannon, Dr. Goldfine remarked that while some voting vendors claim adherence to ISO 9000/9001 standards, there has been no dialogue with them on how quality assurance document delivery would affect them.

Dr. Rivest commented that submitting a quality assurance plan ahead of time specifying certain security tests in no way commits the vendor to providing the results of these tests.

At this time, the Chair reviewed the two QA/CM requirement recommendations put forth by Dr. Goldfine. “Your first recommendation would be to force the hand at making sure that the quality assurance plan is in place before the manufacturer starts the work. I think the discussion has shown that this is a significant burden on the EAC, may be unenforceable, and since we really cannot define when design development starts, it is vague. The alternative recommendation recognizes you have to submit the quality assurance manual anyway as part of the certification process. It encourages the manufacturer to take this seriously - to do QA from the beginning. It turns into a best practice as opposed to just a hard pass/fail requirement.”

Secretary Gale made a motion to accept the alternative (second) recommendation “to require delivery of the QA/CM procedures for approval during the manufacturer’s registration process as specified in the EAC testing and certification manual.”

The motion was seconded. The Chair asked for unanimous consent to adopt the motion. Hearing no objection, the motion to accept the alternative QA/CM recommendation passed (see Table 1).

The Chair thanked Dr. Goldfine. He called on Dr. Flater to complete the CRT Committee’s presentation.

Dr. Flater reviewed reliability and accuracy benchmark issues for the draft VVSG. First, he defined his terms of reference.

- Benchmark Definition: Quantitative point of reference to which the measured performance of a system or device may be compared;
- Plain language: The number specified in the requirement (e.g., the failure rate shall not exceed [*benchmark number*]); and
- The draft VVSG contains benchmarks for:
 - Reliability (failure rate),
 - Accuracy (error rate), and
 - Rate of misfeeds for paper-based tabulators.

His subsequent presentation on reliability and accuracy benchmarks reviewed:

- Benchmark Issues from VVSG 2005;
- Input from the National Association of State Election Directors (NASED) on Reliability and Accuracy Metrics; and
- Consequences for Different Benchmark Standards.

Dr. Flater concluded that determination of a realistic benchmark is difficult but critical to the testing process. “In order to empower test labs to advise rejection of voting systems that perform unreliably during testing, there still needs to be a benchmark for what constitutes an unacceptable rate of failure. There needs to be a number with which to compare the output of the test method. Even though the right answer in practice depends

on many things, and we understand in practice it is very complicated to come back with some benchmark number and say that this is a typical volume for an election, there still needs to be a number in the VVSG in order for the test method to be effective. Regarding feedback from NASED, our tolerance for failure depends on how hard it is to recover from the failures. We cannot know with practical impact what a system's certification time will be from different sorts of failures, because it depends on the practices and procedures put in place by election officials. Election officials in turn will put practices and procedures in place as required to deal with the equipment that they have."

Dr. Jeffrey inquired as to whether there is any reason to believe that an error rate would be greater on a given smaller election volume than a larger volume. "My intuition would be that the bigger the volume, the more errors we'd likely have, and you really don't want to specify what's typical, but you would like to look at what is an extreme."

Dr. Flater described the goal of deriving a rate of failure. "The thought was in a typical election, there would be a way to find out what the volume was. And there would also be a way to come up with a figure for how many errors could have been tolerated before we ended up with an unacceptable result. From that you divide the errors by the volume, and you have a rate. But in fact, raising the question in this way may have caused more problems than it solved." He then described Mr. Miller's recommendation from NASED that we assign different weights to different kinds of failures. There would be a difference between the intolerable kind of errors that could result in the loss of votes, and failures from which the voting system could recover. "So if we can define these different categories of failures in an objectively determinable way, for the test lab needs, then we can assign different weights to them and possibly have a more complex but satisfactory benchmark." He noted that the 1990 Voting System Standards (VSS) defined scoring criteria for failures in Appendix G.

The Chair inquired as to whether the 1990 Appendix G VSS methodology would resolve the failure benchmark issues at hand.

Dr. Flater believed he could address some of the minor incompatibilities in the 1990 VSS. "But what I can't do is tell the election officials what benchmark they want."

TGDC members offered input on the consideration of failure benchmarks. Dr. Wagner believed that the consideration of a distinction between unrecoverable and recoverable failures was valuable. Dr. Schutzer concurred and opined that perhaps with the right policies and procedures in place, a jurisdiction could "work around" non-recoverable failures. Secretary Gale commented that election jurisdictions maintain an inventory of spare parts and supplies for recoverable errors. He noted that even an unrecoverable error on one machine can be solved with the replacement of a spare voting system.

Dr. Flater clarified a definition of equipment failure for the purpose of testing to not include expected maintenance activities. "An unexpected event like a paper jam is probably the least severe thing that qualifies as a failure. An argument could be made, or in fact we could make it so by adding unambiguous requirements, that the notion that any

equipment should fail in a way that makes any vote completely unrecoverable is already nonconformity, regardless of the reliability benchmark. Then we would simply be focusing on everything in the middle. If unrecoverable votes are completely banned, replacing the ink is not relevant. Then everything in the middle is a failure, and those are what we count for the sake of the reliability benchmark.”

The Chair summarized the sense of the Committee that dividing up failures between recoverable and unrecoverable makes sense.

Dr. Flater agreed and moved on to a review of accuracy benchmark recommendations from NASED. “The old standard said 1 in 10,000,000 ballot positions were allowed to be wrong. As the NASED letter discussed, this was a compromise based on the cost of testing. You can’t, of course, prove perfect accuracy in any finite-length test. And on the surface, there is no reason to change this benchmark. But there is a need to review the test methods. As I had mentioned earlier, there was ambiguity with the metric as it was specified. NASED also expressed some concern that the 1 in 10,000,000 ballot positions benchmark might be achievable for perfect test ballots, but maybe not for real ballots.”

Committee members engaged in significant discussion on the validity of this metric. Dr. Schutzer noted the difference in design and use of optical scan systems versus DREs. Ms. Purcell emphasized that accuracy measurement also depends on the user of the voting system. If the voter votes absentee, the voter is not at the polling place, and you cannot determine whether something is wrong with the ballot or they marked the ballot incorrectly.

Dr. Flater briefly raised the issue of using volume testing as a substitute for a potentially unachievable benchmark of 1 in 10,000,000 ballots. “If that is the case, we have already discussed using volume testing with real people and real ballots. There has been a lot of support for doing that as part of the test campaign. If that is what we are going to do, then the benchmark should be something that is achievable in that context unless you want to disqualify everyone.”

Secretary Gale provided a useful illustration on the unrealistic character of the 1 in 10,000,000 benchmark “for voting equipment that maybe has a maximum use in a precinct by maybe 1,500 voters and maybe will be used a maximum of six times a year. So maybe you’re getting 10,000 real ballots cast on that equipment. If you have a ten-year lifetime, you’re talking about 100,000 total votes. It seems like you’re testing equipment at way too high a degree of perfection. The 1 in 10,000,000 benchmark is going to drive up costs and the inherent ability of election officials to buy new equipment if we test this to perfection.” He further clarified that with central count optical scanning, you will have a larger volume of votes cast and will need a higher benchmark than with precinct-based voting equipment.

Ms. Quesenbery raised the possibility of machine testing in addition to volume testing. Dr. Wagner agreed that the 1 in 10,000,000 benchmark was unrealistic as did Dr. Rivest.

Dr. Jeffrey summarized the consensus of the Committee for further research to determine a more realistic benchmark considering the cost of testing and a methodology that clearly delineates basic assumptions.

Dr. Flater indicated that he would continue to work with Mr. Miller and the CRT Subcommittee to reach closure on a more realistic accuracy benchmark.

Dr. Schutzer suggested testing equipment already in the field under ideal conditions to determine a benchmark. Dr. Wagner agreed with this approach and suggested looking at states that are currently auditing their voting equipment. "It may be possible to gather data on the results of those audits. For instance, Ms. Purcell sent around a great document from Maricopa County reporting on results of their audit. And there were a couple of cases in the report where you could identify how frequently there were errors in how the scanners interpreted the ballot."

Dr. Flater thanked the Committee members for their suggestions. He concluded his presentation with a brief review of changes to the draft VVSG since the December meeting, including coding conventions and the benchmarking test methods previously discussed. (Dr. Flater's presentation slides are available for review at: <http://vote.nist.gov/meeting-03222007/Pres-Flater.pdf>.)

The Chair thanked Dr. Flater and noted that the CRT Subcommittee presentations responded to eight relevant TGDC resolutions. He entertained a motion to accept the Core Requirements and Transparency Subcommittee preliminary draft VVSG sections unless there were supplemental drafting instructions beyond the Committee guidance provided with respect to benchmark determination.

A motion was made and seconded. Dr. Jeffrey asked if there was objection to adoption by unanimous consent. Hearing none, the CRT Subcommittee presentations were adopted (see Table 1).

The Chair adjourned the meeting for a fifteen-minute break.

March 22, 2007: Afternoon Session # 2

The Chair called the meeting back to order and opened the floor to Dr. Sharon Laskowski of NIST's Information Technology Laboratory to present the Human Factors and Privacy (HFP) Subcommittee's draft sections of the VVSG.

Dr. Laskowski thanked Dr. Jeffrey. She offered an overview of her presentation covering the following topics:

- Changes and issues in the VVSG HFP section since December 2006;
- Issues requiring further analysis;
- Usability benchmark development progress; and

- Next research steps.

She pointed out that a number of usability requirements have clarified that, in general, when a voter can control or adjust some aspect of the voting station, that adjustment can be done throughout the voting session without loss of information.

Dr. Rivest inquired as to the voter's capability to change languages on the screen during the voting session. "If the voter requests to see English for the first part and then French later on, when they go to the review screen, what happens?"

Dr. Laskowski responded. "For the review screen, they can have it in either language, because now we've said it's controllable throughout the voting session."

Ms. Quesenbery elaborated. "One of the things that we've heard and observed is that a voter who is a two-language speaker might start out going through the candidate races happily, voting for president, senator, and so on, and then get to a complicated ballot question and want to be able to read that in their second language and to be able to switch languages at that point. Of course, the names are always what they are, so that doesn't change."

Dr. Laskowski reviewed the dexterity requirement that would require further Committee discussion on Friday (March 23rd):

- *Requirement 12.3.4-C Ballot Submission*
If the voting station supports ballot submission for non-disabled voters, then it shall also provide features that enable voters who lack fine motor control or the use of their hands to perform this submission.

She remarked that this requirement from the VVSG 2005 supports privacy, but also independence. This has implications for the software independence and accessibility of Electronic Ballot Markers (EBMs) and Precinct Count Optical Scan (PCOS) voting systems.

In an answer to a question from Dr. Schutzer, Dr. Laskowski clarified that the dexterity requirement applied only to accessible voting stations.

Dr. Laskowski reported that NIST has completed the first phase of usability performance benchmark research. "Our goal for the draft VVSG is to have quantitative performance benchmark requirements, with conformance determined by running usability tests with 'typical' voters." She then reviewed the design of the test ballot for the initial trials with "typical" voters. "We have a medium-complexity ballot including 20 contests and three referenda. We asked vendors to implement that test ballot and to show off their system in the best light. The test administrators follow a specific script. No assistance or training is given to the voter. We measure errors and time to vote, and basically those errors are differences from what we expected to see, given how we told the participants to vote and whether they were able to cast or not cast the ballot."

Ms. Queensbery inquired as to whether the test ballot used real parties and candidates. Dr. Laskowski indicated that parties were named as different colors, and candidate names were fictional as well to avoid introduction of bias.

Dr. Schutzer asked whether unfamiliarity with the voting equipment and voting process may have affected the research results. Dr. Laskowski indicated that the error results from the initial trials conformed to results published in the scientific literature where training occurred prior to the experiments.

Ms. Purcell commented on the age range of test participants. "I'm curious about the age range. You said 21 to 30 years old. That is our poorest age range for voter turnout, first of all. And you might see different types of errors maybe from an older population."

Dr. Laskowski agreed that you might see a worse error rate in an older population group. However, she noted "even with the younger age group, we pretty much saw all the kinds of errors you would expect."

Ms. Quesenbery commented on the ballot and test participants. "I was quite surprised. After the 2000 election, there was a lot of speculation among the political science and human factors testing community about how many people you would need to be able to find a subtle error. The way our test ballot and the instructions were constructed was to test different types of conditions; for example, one race has a lot of candidates and they're asked to vote for someone low on the list. And so it's both a little frightening and a little encouraging that with a small group of relatively unchallenged voters who we expect to perform well, that we were nonetheless seeing those errors. It suggests that the threshold at which you begin to see the errors is not thousands of people, but dozens of people."

Dr. Laskowski offered the conclusion that "the fact that we were able to do this with a small number of voters that you would expect would do well, yet you still measured the range of errors with this ballot, supports the validity of the test protocol."

Dr. Rivest inquired as to whether the ballot contained write-in candidate possibilities and how errors were counted for the write-in votes. Dr. Laskowski indicated that the participants were instructed what to write in. "So either it was correct or not." She added that the instructions to vote the current test ballot included undervoting as well. "We tried to be as comprehensive as we could with the different tasks for voting."

Dr. Laskowski concluded her presentation with items for discussion by the TGDC, including:

- Metrics and How to Count Errors for Benchmarks;
- Current Test Repeatability and Reproducibility Experiments to Determine Reliability; and
- Next Research Steps.

(Dr. Laskowski's presentation slides are available for review at:
<http://vote.nist.gov/meeting-03222007/Pres-Laskowski-HFP.pdf>.)

Ms. Quesenbery raised the possibility of an error benchmark as well as three or four other metrics. "For instance, surely failure to cast needs to be treated specially, and we want to see that number as very, very low. We might want to look at how many different people have errors. That is, is this concentrated in certain parts of the population? We might end up wanting to say, we're going to measure three or four different aspects of errors, and the result has to exceed a threshold in all of them."

Dr. Laskowski cautioned that this would have to be a controlled experiment using formal statistical analysis. She also clarified the "typical" participant for the initial trials. "Now, let me point out that we are not talking about participants with disabilities here. These are people using not the accessible but rather the regular voting station. We're assuming that they are typical, but they're not designated as having particular disabilities. One would hope that our baseline for errors would be similar, and that we could still use that."

The Chair inquired as to the time frame for the current testing process. Dr. Laskowski indicated that they hoped to have the current round of experiments finished in early May 2007. After analysis of the results, they want to provide some benchmark input into the next VVSG recommendations due in July.

Both Dr. Rivest and Dr. Wagner complimented NIST and the HFP Subcommittee on their human factors research efforts to date.

Ms. Quesenbery noted her concern on updating the document's benchmarks. "Given the time constraints, I'm particularly concerned that we can add in accessibility benchmarks as they are developed, and that we don't either leave them out entirely because we don't make this deadline, or create bad ones because we are rushing."

The Chair asked Dr. Laskowski for their estimate of a reasonable time scale to attain "defensible" benchmarks. Dr. Laskowski answered that she believed early 2008 was reasonable.

Mr. Gannon referred to the recent research report on the disputed results of a recent Sarasota, Florida, election. "It seemed to indicate that the undervote was not a system issue, but rather how the ballot was actually set up. Is there something that is already in or will be put into the draft VVSG that provides guidelines on better ballot layout?"

Dr. Laskowski agreed that there indeed appeared to be usability problems with the Sarasota ballot. "There is valid design guidance coming from the EAC that may help, but I haven't seen it yet, so I can't speak to that. That's not NIST work. We do have requirements for consistent wording in the VVSG."

Commissioner Davidson commented that the EAC would issue guidance on ballot design shortly. She asked for caution when updating additional accessibility benchmarks beyond

July 2007. "I do have a concern with a moving target. What you're doing is creating continual change in the standards for manufacturers. And that is what we're trying to get away from, because that's where added costs come in."

Ms. Quesenbery expressed her opinion that error and accuracy benchmarks should be the same for sighted versus blind voters. She also noted the fine line between the ballot layout capabilities of the voting equipment and actual laying out the ballot.

Dr. Schutzer brought up the testing of capabilities of different voting systems with respect to ballot layout. Ms. Quesenbery noted the importance of distinguishing between an evaluation that tests the performance of the system under certain circumstances and design guidance back to the vendors. "Ultimately, we are not testing the ballot design capability of election officials, although we are trying to encourage voting systems that provide good design. There are also aspects, especially of DRE voting systems, that cannot be changed by the election official. And we certainly want to make sure that those limitations do not put the officials in a situation where they cannot design a good ballot, where a usability problem is designed into the system."

Dr. Rivest inquired about the adjustability controls for voters. "It seems when you introduce this general adjustability, you introduce some hazards with the voter turning off the audio or changing languages to a language you can't read."

Ms. Quesenbery and Dr. Laskowski commented that there are VVSG requirements to return the system to a standard state.

The Chair addressed a comment to the entire Committee. "I'd actually like to follow up on Commissioner Davidson's comment. I agree with her sentiments, and I think it would be difficult for us to put out the next iteration VVSG that goes to the EAC Standards Board for review and out for public comment with "to be determined" items in there. And if there are possibilities of simply coming up with a consistent way of looking at it while the testing is done, I think what the testing would do at the end could be used to help validate the assumptions. And if there's an egregious error that arises, it may be easier to get forgiveness in correcting an egregious error than having to go back through the process entirely."

Commissioner Davidson raised the issue of usability of paper, especially as it relates to the software independence resolution. "I just didn't see a study being done on usability of paper trails for election officials. And that was one of my concerns. The election officials are complaining that auditing with paper is very difficult. And I know there has been some discussion about bar codes, whether they should be used or not. But I'll tell you what, when the officials have to audit by hand, it is a disaster."

Dr. Laskowski responded. "We know there are difficulties with hand counting paper. There's no sense in running another study when we have a lot of data that already tells us that. There are different ways to help with that."

Commissioner Davidson commented on counting methods proposed by the vendors. There are certain things that the manufacturers are doing right now. Some voting systems are using bar codes. Is that scanning successful? Some studies there maybe would create a difference in the minds of TGDC members if there is some method that would be more successful than hand counting the ballot. I was wondering if that topic was under consideration.”

Dr. Schutzer noted that this concern borders on discussions planned for Friday on ways to improve VVPAT and future research.

Dr. Rivest amplified on the preceding remarks. “I think that is a great issue: the usability of the audit. The audit is very important for the integrity of the elections, and thus being able to make sure that the audit is usable for the poll workers is very important. Bar codes are something we have discussed a lot in STS teleconferences too. If you have a bar code, it is something that the voter cannot check. You’ve got a real issue as to whether verifying the bar codes is providing integrity of verification for the election. But there are approaches to working with bar codes and human-readable text too, lots of interesting approaches. I agree that’s a great area for research and further improvement. I am not sure how much we can put into the standards in the time frame we have got here, but hand counting, in some sense, is sort of the gold standard, as sloppy as it is, for reviewing paper ballots.”

The Chair shared Dr. Rivest’s concern. “So if I can add to what Ron just said, let’s just take this as a plea for input, suggestions, and further comments on this issue, because I think it is a critical one.”

Ms. Quesenbery expressed her issues with framing the kind of research that would be helpful to election officials here. “I think we all kind of understand the general problem, but not how to get down to something specific enough that we can charge somebody with doing informative requirements research.”

Ms. Purcell provided her perspective as an election official. “We don’t want to make the errors that we have made in the past. We were given certain (HAVA) mandates that we had to accomplish by the 2006 election. Both the election officials and, in particular, the manufacturers were given very little time to meet the requirements that we were given for DREs and in some states, we required the DREs to have VVPATs. The poll workers could not handle the big printers with tapes that were difficult to change.” She emphasized the importance of avoiding requirements in the future that have to be met in a short time frame by the vendors and the election officials.

Ms. Quesenbery pointed out that the VVSG 2005 contained general usability requirements “and three groups for testing with different interfaces for people with disabilities. We’ve added another one in this draft VVSG for testing with poll workers. So we would actually be doing usability tests of the system setup and operations. I think some of the things that we’ve heard about poll workers not being able to change the paper, those things would come out in that test. It’s not a test of the audit, but it is

certainly a test for maintenance and operations during the election. How we get to the next phase, which is the audit, is the one that I find a challenge.”

Secretary Gale cautioned the Committee to keep tasks within scope. “I always get concerned when we start talking about the third rail for the election administrators, when we start writing standards for them in terms of poll worker conduct and poll worker training. I think that’s not our jurisdiction.”

Ms. Quesenbery clarified her previous remarks to pertain to instructions and documentation from the manufacturer. Mr. Wack then elaborated. “The intent is not to come up with any requirements for audits or for how the audits have to be conducted. The intent really is to look at the paper itself that gets produced in VVPAT or Op Scan systems and determine what can be done to make it easier for poll workers to handle and for election officials to use in an audit, but absolutely no requirements for how they should be used.”

Hearing no further questions or comments, the Chair asked for a motion to accept the preliminary draft of the human factors sections of the VVSG consistent with the previous discussion. A motion was made and seconded. The Chair asked if there was objection to adoption by unanimous consent. Hearing no objection, the motion was adopted (see Table 1).

Dr. Jeffrey adjourned the meeting until Friday, March 23, 2007, at 8:30 a.m.

March 23, 2007: Morning Session # 1

The Chair called the meeting to order at 9:00 a.m. and welcomed back the Committee members as well as the staff of the EAC. Following the Pledge of Allegiance, Dr. Jeffrey asked Ms. Allen to call the roll. She reported a quorum of twelve in attendance (see Table 1).

Dr. Jeffrey explained that the Committee, today, would primarily discuss important VVSG issues that cut across the three working subcommittees. First, he invited Ms. Mary Saunders, Chief of NIST’s Standards Services Division, to present an informational briefing on the National Voluntary Laboratory Accreditation Program (NVLAP).

Ms. Saunders thanked the Chair. She introduced her presentation with a citation of the relevant requirements from HAVA. “Section 231 of the Help America Vote Act stipulates that NIST conduct an evaluation of independent nonfederal laboratories not later than six months after the EAC first adopts the Voluntary Voting System Guidelines, and that NIST submit a list of qualified laboratories to the EAC for accreditation. I’m going to give you a report on the status of that NIST program next.” She summarized the current status:

- Two laboratories have completed NIST’s comprehensive technical evaluation and were recommended to the EAC on January 17, 2007:

- iBeta Quality Assurance, and
- Systest Labs.
- The EAC accredited these laboratories on February 21, 2007.
- NIST is proceeding with the evaluation of four additional laboratories:
 - BKP Security Labs,
 - Ciber Labs,
 - InfoGuard Laboratories, and
 - Wyle Laboratories.

She then reviewed the NIST technical evaluation program, noting that “in the interest of transparency and openness, we’ve posted on www.vote.nist.gov, information on the on-site assessment of each of the laboratories that passed the evaluation, and their responses to that assessment, as well as our final determination on the technical portion.”

In the remainder of her presentation, Ms. Saunders covered:

- How NIST/NVLAP qualifies laboratories;
- NVLAP Accreditation Criteria;
- NVLAP Accreditation Procedures;
- What NVLAP assesses;
- How the Assessment is conducted;
- Ensuring Continued Compliance; and
- Where NVLAP fits in the Testing Picture.

She noted in closing that, “It’s important to remember that NIST conducts all of these activities on behalf of the EAC and makes recommendations to the commission based on NVLAP’s technical findings.” (Ms. Saunders presentation slides are available for review at: <http://vote.nist.gov/meeting-03222007/Pres-Saunders-NVLAPstatus.pdf>.)

The Chair thanked Ms. Saunders and opened the floor for questions from Committee members.

Dr. Wagner inquired as to the inclusion of vulnerabilities discovered in the field after testing by a laboratory. “During your assessments or during your renewal assessments, is that something that you look at - to determine the root cause of why those defects weren’t detected by the test labs, and use that as an ongoing feedback loop and assessment cycle to determine whether the test labs are able to adequately evaluate for conformance?”

Ms. Saunders answered affirmatively. “We work very closely with the EAC who has the oversight responsibility for these certification programs. And actually, testing is a component of certification. If the EAC discovers issues in the field either reported by a state or otherwise with particular voting systems that have been tested by a qualified voting system testing laboratory that works under the EAC’s certification program, we would take that information into account in future assessments of the testing laboratory’s capabilities, as with the EAC in oversight of their certification program.”

Dr. Wagner recommended broadening the feedback loop beyond the EAC because defects have been discovered by other independent reviews. Ms. Saunders replied that the EAC has oversight for the certification program, and so they would take responsibility for looking at the overall issues in the field with voting systems and then consult with NVLAP to determine how to tighten up technical review to address the testing portion. Dr. Wagner and Ms. Saunders agreed that independent reports are relevant to the certification and recertification process.

Mr. Hancock of the EAC indicated that if either the EAC or NVLAP were made aware of inadequate testing, then the laboratory would go back for NVLAP review.

Ms. Quesenbery noted that NVLAP will be working more closely with the TGDC subcommittees as the draft VVSG moves towards completion. "Obviously if we see a requirement that is not easy to test or that has ambiguity in it, then that fact would reflect on the test that comes out. How does that situation impact lab accreditation in terms of things like knowing whether the lab is competent to assess the requirement or choosing the relevant expert in order to make sure the lab has appropriate expertise?"

Ms. Saunders thanked Ms. Quesenbery for raising the issue. "First, I will confirm what Dr. Jeffrey said yesterday that the NVLAP Program Manager, Jon Crickenberger, and where possible, the technical assessors, will meet with each of the TGDC subcommittees to talk about essential field experience and where it's been easier or more difficult to assess the laboratory's competence to test particular parts of the VVSG 2005. It's true that the assessors have said some of the chapters of the VVSG 2005 are easier for a test lab to demonstrate that they conduct tests that meet the specification. And that's what they'll be discussing specifically with the subcommittees."

In answer to a question from Secretary Gale regarding the length of time for which the initial certification applies, Ms. Saunders replied, "The NVLAP technical evaluation is renewable every year. At the end of the first year of accreditation, there's another on-site assessment, and then an on-site assessment every two years. The lab pays fees and renews its accreditation every year essentially. Then every two years, the assessment team actually goes out and looks in depth at the laboratory's facilities and how they are conducting tests."

In a follow-up response, she noted that any time the laboratory makes a staffing change that affects their ability to conduct the testing for which they are accredited, they have to notify NVLAP. "So any change in facilities, or a significant new piece of testing equipment requires notification to NVLAP. If they sell a piece of equipment, if the laboratory manager leaves, if the quality manager leaves, or if there is a change in staffing, that all has to be notified because the changes can affect the accreditation."

Ms. Quesenbery inquired as to the quality control procedures for voting system testing laboratory (VSTL) subcontractors. Ms. Saunders explained that, "The VSTL is also responsible for having a process in place for ensuring that the subcontracted laboratory is doing everything it says it is going to do for non-core testing. And that is part of the

VSTL's management system. If it is a core test, though, the labs cannot subcontract that test. For example, the VSTLs must do the usability and accessibility testing in-house currently."

Dr. Jeffrey again thanked Ms. Saunders and called on Mr. Mark Skall of NIST's Information Technology Laboratory (ITL) to moderate the TGDC discussion of crosscutting subcommittee issues.

Mr. Skall asked Mr. William Burr of NIST's ITL to provide the Committee with initial background on innovation class requirement issues. In his introduction, Mr. Burr referenced TGDC Resolution #03-06 (see <http://vote.nist.gov/TGDCAdoptedresolutions0307.pdf>) as guidance for the STS Subcommittee to investigate:

- High-level, guiding requirements for defining a path towards certification; and
- Approaches for reviewing, testing, and certifying systems.

Mr. Skall offered clarification on the intent of the resolution relative to the scope of NIST's work on the VVSG. "I believe our job here at NIST is to put requirements in the VVSG that allow us to follow a path toward determining conformance to those requirements. Certification is the next level up. It's the EAC's domain and as such, it's a separate procedure above and beyond what we are doing. I believe when we have resolutions that talk about achieving certification or working toward certification, we run afoul of what the EAC is doing. We also lose focus. My suggestion would be to talk about conformance rather than certification."

Dr. Jeffrey concurred. "I think it's very clear under HAVA that we do not do certification. We develop the guidelines and the ability to do the conformance to the guidelines. I think that was just a poor choice of wording on the resolution. It's definitely out of the scope of the TGDC to be doing this certification."

Mr. Burr noted that the general intent of the resolution included furtherance of the goals of holding fair, accurate, transparent, secure, accessible, timely, and verifiable elections in a way that helps rather than hinders election administration. He then reviewed a potential evaluation process for innovation class submissions. (Mr. Burr's presentation slides are posted at: <http://vote.nist.gov/meeting-03222007/Pres-Burr-InnovationClass.pdf>.)

Dr. Schutzer remarked on the practices in the financial community where new cryptographic algorithms are not implemented without considerable public vetting.

Mr. Skall proposed "that the proposals in general for the innovation class would be made public, and people could get a chance to bang on them and review them." Ms. Quesenbery agreed. A discussion ensued on entering into nondisclosure agreements with inventors.

Ms. Quesenbery offered an alternative way to look at the innovation class separate from and inclusive of the security aspects. “It seems to me that one of the things that we struggled with as we drafted the VVSG 2005, and as we’ve continued to work the draft of this version, is what we really want to do. We want to tell the manufacturers to make a system that makes for good elections, and here are some aspects of good elections. However, we can only write a standard. You cannot test ‘be good.’ You can only test specific requirements. So what has kept us here working for a couple of years has been trying to get down from ‘do good elections’ to what Ms. Saunders noted is a document with over 1,000 specific requirements. One of the ways to think about the innovation class, it seems to me, is as an equivalent way of meeting the high-level requirements. In Section 508, which covers the Federal Accessibility Procurement Requirements for Electronic and Information Technology, there is a concept called ‘equivalent facilitation.’ In Section 508, there are some very specific guidelines about what makes a piece of technology conformant. However, under equivalent facilitation, a vendor with an innovation could also say, ‘I believe that I’ve met the high-level goals of Section 508 in that my ‘innovative’ system shall be accessible to people with a list of disabilities, in a different and new way.’ Under equivalent facilitation, there are some ways of evaluating that claim. And I think what we’re saying in the innovation class is that someone could come back to us and say similarly, I have a different way of meeting this requirement. The crux of our problem is how we write a piece of this standard that says, ‘If you can prove that there’s a good reason for considering your new solution in an alternative way, we’ll be interested in hearing it.’ I think that the questions that the election community, in general, has been wrestling with are inevitably going to turn up new and innovative ideas. And we want to be able to assure that they’re not precluded simply because we didn’t think of it and write requirements specifically for it.”

Mr. Skall and Dr. Jeffrey both indicated their concurrence with Ms. Quesenbery as a sense of the Committee that the purpose of the innovation class resolution is to meet high-level requirements in the VVSG through new and innovative technology.

Dr. Rivest concurred and offered a reference point. “I think we are in agreement that the innovation class is there to allow vendors who come up with other ways of meeting the high-level requirements of what a voting system should be about to get a system tested and eventually certified. And I commend NIST on the work that they put into thinking about this issue. There is a white paper that’s posted on the TGDC web site which outlines a proposed testing procedure. (See: <http://vote.nist.gov/meeting-03222007/InnovationClass7.pdf>.) The testing framework evaluates a multistage procedure beginning with a prototype stage and ending with a final conformance testing stage.”

Considerable discussion ensued on an innovative voting system that may meet a requirement for independent dual verification but not software independence. Committee members indicated the need for meeting high-level requirements with flexibility to entertain new voting system ideas. Mr. Gannon raised the issue of transparency, public review, and possible conflicts with nondisclosure agreements (NDAs) for intellectual property (IP).

Mr. Skall summarized the immediate tasks at hand. "Our job over the next month is to develop requirements for this innovation class which would include substantive requirements as well as procedural requirements, a template, if you will. We have taken a stab at it with an initial draft paper." He stated a question still on the table is whether there shall be a requirement that innovation class submissions shall be made available to the public.

Mr. Miller inquired, "Are we talking about a different path for the innovation class that their source code would be made public?" Dr. Wagner offered his understanding that the innovation class involves public review of only some aspects of the submission such as the approach. "One of the things their submission should include is a description of how their approach meets those high-level goals."

After further discussion of the scope of the requirement for innovative class submissions, the Chair recommended that the Committee move on to other issues and return to this matter later in the meeting with a focused approach to the relevant guidance needed by NIST staff. He recognized Secretary Gale and then Mr. Skall for concluding remarks on this issue for the time being.

Secretary Gale provided the analogy of the Automark electronic ballot marker as an example of an innovative solution that allowed states like Nebraska to keep the paper Op Scan ballot and meet the HAVA requirements for access by the disabled voter. Five years ago, nobody ever dreamed about this voting system. Yet, this innovation class requirement under the next VVSG iteration may not become effective until 2010. Do we have this in the 2005 iteration? What happens between now and 2010 or 2011? Is there no ability for an innovative voting system to emerge in that period of time?"

Mr. Skall addressed Secretary Gale's concerns. "What we are doing is writing a standard, and we are concerned with the requirements in that standard and how one conforms to the standard. How things progress in the marketplace, how systems get certified, and how they get phased in is out of scope. Nevertheless, you certainly want to encourage innovation. With respect to the VVSG 2005, we allow additions to the functionality in the standard. That's in our conformance clause. In that way, vendors always have the ability to work on innovative things. There will hopefully be tremendously innovative solutions that come across in the interim. So we have to scope the issue for the next iteration of the VVSG. We are talking about what's allowed in the standard and what vendors can claim when they claim conformance to the standard. If they have an innovative solution that fits our requirements for an innovation class, they can claim conformance to our standard: nothing more, nothing less."

The Chair then called on Dr. Rivest and Ms. Quesenbery to present the crosscutting issues related to accessibility and software independence from the perspectives of the HFP and STS Subcommittees.

Ms. Quesenbery offered a comment by way of introduction. “We are not talking about the voting systems that are available today. We are not even talking about systems that will be certified under VVSG 2005. This is really a look forward to where we want voting systems to go to meet both the security and accessibility requirements.”

The presentation covered the following material:

- Response to TGDC Resolution 6-06;
- HAVA Section 301 (A) Definition of an Accessible Voting System;
- Four Approaches to Creating an Accessible and Software Independent system;
- Software Independence: A Global Property;
- Voter Verification Capability;
- Independent Dual Verification;
- Observational Testing;
- Review versus Verification;
- Analysis of Characteristics of the Four Approaches
 - Approach #1: Paper + Audio Review (with observational testing)
 - Approach #2: Paper + Audio Recording
 - Approach #3: Paper + Read-back Device with observational testing)
 - Approach #4: Frog System (IDV);
- Use of Assistive Technology in Verification;
- Ballot Privacy and Assistance;
- Dexterity Standards in the VVSG; and
- Accessibility of Paper-based Vote Verification.

Dr. Schutzer noted that audio recordings are used in the brokerage industry along with speech recognition technology to verify trades. Ms. Purcell commented on the impracticability of individual audio cassettes for each voter. Dr. Wagner noted other challenges that would make auditing of audio recordings difficult at best. “If you want to make it auditable without relying solely on technology, that’s probably very burdensome both because there are many records and because it takes a long time to listen to all of them.”

After discussion of the four approaches, Dr. Schutzer offered a resolution. “Based upon the analysis of HFP and STS, the most straightforward and easiest way to accommodate somebody who is disabled and cannot read the paper trail as verifiable would be a device that could take in that paper device and render it into audio so the person could hear it. And that indeed would be a device that would not be software-dependent.” The motion was seconded for discussion.

Ms. Quesenbery offered alternative language as a friendly amendment that had been drawn up by the HFP Subcommittee and achieved the same purpose as Dr. Schutzer’s motion while accommodating disabled voters with dexterity issues.

Dr. Schutzer accepted the rewriting of his initial motion with the language proposed by Ms. Quesenbery to read:

*Resolution # 01-07 Accessibility of Paper-based Vote Verification Requirement
Offered by Dr. Schutzer and Ms. Quesenbery*

It is the recommendation that the TGDC accept this language as a requirement: If the Accessible Voting System (Acc-VS) generates a paper record (or some other durable, human-readable record) for the purpose of allowing voters to verify their ballot choices, then the system should provide a mechanism that can read that record and generate an audio representation of its contents. The use of this mechanism should be accessible to voters with dexterity disabilities.

Discussion proceeded on whether to replace “should” in the resolution with “shall.” Dr. Rivest expressed his concerns. “My personal feeling is that language like this with a ‘should’ allows you to choose whether you want to support the individual verification of all voters of the paper ballot in terms of cost. I am concerned about the cost if we made this a ‘shall.’ This is one of the few issues where I have had both election officials and vendors call me up, worried about a Committee decision because of the cost and complexity of mandated read-back mechanisms. So while I’m not an expert on the cost and implementation here, I’m sensitive that there are concerns out there that this is a difficult one to implement and make work well.”

Ms. Mason and Mr. Pearce presented reasons to change ‘should’ to ‘shall’ in both instances in the resolution. Ms. Mason commented. “When we look at paper rolls as well as cut paper and some of the challenges that both of them present to very different populations, I am really in favor of this sort of requirement that does say that it shall encompass everyone. It is very difficult to exclude someone with dexterity issues.”

Ms. Miller agreed with Ms. Mason’s points. She noted that in the District of Columbia, there are dual systems - an accessible DRE and Op Scan. “So the voter gets to elect what system they want to vote on. The accessible unit obviously is there for individuals with disabilities and other kinds of limitations. The optical scan is there for voters who want to use it as well. But I think Tricia has a very good point. It needs to be a ‘shall’ if that is what we are looking at in terms of only the accessible voting system.

Mr. Pearce provided an additional line of reasoning. “The problem I see if you keep the first one a ‘should’ and make the second one a ‘shall,’ you guarantee the first mechanism will never happen, because why would you ever provide a mechanism that can read the record and generate the report if it shall always have to be accessible for voters with dexterity disabilities when that technology may or may not be available.”

Secretary Gale initiated a discussion of the current Automark accessible voting system. “In Nebraska, we provide one at each polling site. And not every piece of equipment at a polling site needs to be handicapped-accessible or visually impaired accessible. I assume what we’re talking about here is that one piece of equipment at each polling site. We are not talking about every piece of equipment that is going to be implemented in a voting system. So it is really a specialized class of equipment, in which case it makes a lot of

sense to go with the paper and read-back device, because you are focusing on a very specific category of voters who need the additional facilitation allowed by the read-back device.”

Dr. Schutzer added that an accessible voting system as described in the resolution would provide benefits to the elderly and voters with impaired vision.

Mr. Pearce amplified on this perspective. “I would like to direct us toward not looking at this solution as something that makes access available for what we usually narrowly describe as persons with disabilities. Another class of people that really will benefit from this assistance are voters with language barriers where English is not their primary language. The printed ballot may not be something that they really are able to confidently say captures the intent of their vote, as opposed to being able to hear it from an audio system and then verifying their vote in the language that they so choose.”

Dr. Wagner offered his understanding of the proposed resolution’s implications for vendors and costs. “So Secretary Gale and the others who mentioned this, you are absolutely right. This requirement would only apply to machines that were submitted for use as that accessible voting system. On the other hand, I just want to make the pragmatic point that if we’re talking about what vendors are going to build, I think it’s entirely plausible that vendors who are going to build, let’s say, a DRE, that they may well decide they’re going to build one DRE product and submit it for use as the accessible voting system, or for use for jurisdictions who want to use DREs for all their voters. I think it’s very plausible that vendors might do that rather than say, I’m going to build two separate DREs and I’m going to put them both through certification separately. Pragmatically, for folks who are worried about costs, I think it’s likely that this would have a follow-on effect more broadly on this broader class of machines, even though that requirement is specifically crafted to only apply to the ones that are submitted as accessible.”

Mr. Miller stated his concerns. “First of all, it would be my understanding that there is no voting system currently available that meets this proposed requirement as written, including the Automark. And so that is precisely why it places us in a quandary as to whether the language should include a ‘shall’ or a ‘should.’ On the one hand, I would agree that if it is not a ‘shall,’ it’s not likely to get developed. On the other hand, if it is a ‘shall,’ it isn’t clear that the system can be developed or in what time frame it can be developed and be a product that is usable, reliable, and durable for elections.”

Ms. Quesenbery provided her perspective. “We know that the current equipment out there won’t meet this requirement, but we also know that there are technologies out there that could meet it. And this is supposed to be a forward-looking version. So if we want to talk about pointing forward, I think that two ‘shalls’ is the way to point forward. The vote-by-phone systems also have a mechanism by which the paper ballot can be read back and which also meets dexterity requirements. So maybe we’re not as far away from this as we think. Maybe looking at something that has that four-to-six-year window is feasible. One of the related issues that has come up before the STS Subcommittee is cognitive disabilities. While we acknowledge them, it’s very hard to write specific

requirements for the broad range of cognitive disabilities. But we also know that making systems more usable for everyone and more accessible for everybody also helps people with cognitive disabilities by simply lowering the barriers.”

Dr. Wagner offered a reply to Mr. Miller’s comments on current electronic ballot marker devices on the market and their conformance to the proposed resolution. “Automark would meet the requirement, because it has the capability to take a marked ballot, insert it, and read the marks the ballot had generated, i.e., representation of the contents.”

Mr. Miller disagreed. “I would not consider the Automark to be software-independent as it actually is using the same election definition when it is verifying the ballot that it used to mark the ballot. So what you would have is, if somehow the candidates were in a different order on the ballot than the feedback given to the voter, the system would both mark and verify the ballot differently from the way that ballot would actually be counted. And so I do not believe that the Automark would meet this definition of software independence.”

Dr. Rivest responded. “An electronic ballot printer like the Automark would be software-independent in the sense that the paper is there as a record, independent of what software produces it. The fact that the software may be shared with the verification system introduces a real concern, but it doesn’t technically violate the definition of software independence because you could audit by other mechanisms. However, I think you’re raising a great point, which is what the point of this auditing step is. If you’re leery of software problems and technological bugs, verifying the ballot with the same software essentially that you created the ballot with, as you correctly suggest, doesn’t add any additional confidence to the fact that the ballot correctly expresses your intent. However, observational testing that the ballot creation procedure is producing the right kinds of ballots in my mind adequately satisfies the security needs. We do have to be clear about what we are trying to accomplish here and why. Is it really giving us the kind of confidence, is that what we’re looking for? That’s what you’re looking for out of the step. You are right to say that without some sort of independent system, you’re not getting it.”

Mr. Miller offered his conclusion on the resolution. “I think the question is, what means can we provide to people with disabilities who can’t read the ballot an opportunity to verify their own ballot? That was my understanding of where we’re going here, and I will continue to assert that the Automark only provides that verification ability to someone who can manipulate the ballot and who can see the ballot.”

Ms. Mason moved an amendment to change the ‘shoulds’ to ‘shalls’ in Resolution #01-07. The motion to amend was seconded.

The Chair opened the floor for discussion of the amendment.

Mr. Miller shared a practical concern with the Committee. “I truly am in a quandary here, because I definitely believe that these ‘shoulds’ should be ‘shalls.’ But about the implementation of the resolution, is it giving the vendors the time to engineer, test,

develop, and so forth? I am not sure that I understand the framework in which this requirement would be implemented.”

The Chair expressed his opinion that the arguments are compelling for the amendment. “There will be opportunities for public comment as well as to really extract out the feasibility as an evaluation step. But I think we’d be sending a very strong message as to what our intent is by having ‘shalls.’ ”

Secretary Gale reminded the Committee that the amendment and resolution would apply to future voting systems. “And so this sets a higher mark for vendors to seek to achieve for accessible equipment. And I think it makes good sense to me.”

M. Skall concurred and offered the paradigm for the current draft of the VVSG. “We’ve always said that this VVSG is a complete rewrite intended for the next generation of voting systems. It’s not necessarily intended for ones available right now.”

Ms. Mason concurred and elaborated. “Yes, I think that that’s exactly the point. If we wanted things to remain the same and use what was available now, then none of us would really be here talking about this.”

Dr. Wagner expressed one final caveat. “If this resolution should be interpreted so that something like the Automark which reads back the ballot and uses the election definition to provide the read-back is not acceptable, I just want to mention what I think some of the consequences would be. That interpretation would mean that presumably the EBM machines would have to use optical character recognition (OCR). The OCR would then have to be followed by text-to-speech conversion, which would have to use synthesized speech and not recorded human speech that was provided as part of the election definition. So for instance, that would have consequences for your DREs with VVPAT, because those systems’ read-back would use synthesized computer voices which some people might like less. One other consequence: there are some systems on the market that take precinct count optical scanners and use the mark sense capability of that to produce an audio read-back, so that a voter could plug in head phones as they are scanning their ballot and hear what the scanner thinks is going to be there. That system would also, I think, be prohibited under this interpretation, because that device would be using mark sense rather than OCR.”

There being no further discussion, the Chair asked for unanimous consent to adopt the amendment. Dr. Rivest objected, and the Chair called for a roll call vote. The amendment to Resolution #01-07 was adopted by a vote of 9 yes, 1 no with two abstentions (see Table 1).

The Chair opened the floor for further discussion of Resolution #01-07 as amended.

Resolution #01-07 (As Amended) Accessibility of Paper-based Vote Verification Requirement, Offered by Dr. Schutzer and Ms. Quesenbery

It is the recommendation that the TGDC accept this language as a requirement: If the Accessible Voting System (Acc-VS) generates a paper record (or some other durable, human-readable record) for the purpose of allowing voters to verify their ballot choices, then the system shall provide a mechanism that can read that record and generate an audio representation of its contents. The use of this mechanism shall be accessible to voters with dexterity disabilities.

Ms. Quesenbery initiated considerable discussion amongst the TGDC on acceptable read-back for a device as defined in the resolution. She explained, "To me the read-back device is a piece of assistive technology that acknowledges the fact that there are people who cannot directly use their eyes to read the paper or for whatever reason to do it, and we allow assistive technology although it pushes the boundaries of SI somewhat."

Dr. Rivest clarified. "It seems that the point here is to check that the intent of the voter has been correctly recorded on the paper. That's what SI is all about. You have the two stages of trying to check that the paper is at least as good a record as you can make it, and then you have a process for checking the electronics versus the paper because you are going to be counting electronics primarily. So the point of voter verification from a security viewpoint is to check that the voter intent is correctly captured."

Ms. Quesenbery responded. "One of the problems that we're facing is that it's hard to check an electronic system marking the ballot, and it's hard to check the computer memory. So in a VVPAT system, we have a paper record that can be verified against the computer memory. If you're talking about checking the paper record itself, when I scan a ballot, I take that record and I use assistive technology to scan it back to me. At that moment someone has to trust the equipment, but that equipment is easier to test than the match with the electronic memory because it's reading the permanent artifact."

Dr. Rivest referred to the value of observational testing here. "I think that if you're talking about observational testing and so on, you've got two things that are being potentially tested here. One is the process that produces a printed ballot, and the other is the process that reads back the paper ballot. Both of those can be checked by observational testing quite easily by voters who can see. And I think that from a security viewpoint, you could use either one."

The Chair suggested consideration of the amended resolution separate from the question of interpretation of the potential pitfall raised by Mr. Miller.

Dr. Wagner agreed and offered the following recommendation. "Why don't we take the interpretation as something to go back and review in the subcommittees, and restrict our discussion here as to this resolution without trying to settle that interpretation question right now."

Secretary Gale argued to adopt the resolution as is and proceed with the VVSG vetting by process by the EAC.

Ms. Quesenbery called the question. Dr. Schutzer seconded the motion. There was a request for further discussion and Ms. Quesenbery agreed to withdraw the call.

Dr. Wagner requested to clarify his remarks. "I understand the sense of the TGDC, which is intended to help NIST draft their standards. In that light, we should, rather than trying to make a decision now about whether NIST should draft additional requirements to further support acceptable mechanisms in light of Paul Miller's comments, take that issue off the table and separate it from the question of whether the TGDC supports this resolution or not."

At this point, the Chair adjourned the meeting for a fifteen-minute break.

March 23, 2007: Morning Session # 2

The Chair asked the Committee if there was objection to unanimous consent to call the question on the motion on the table. Hearing none, the question was closed. As a review, he reminded the Committee that there was a motion and second to adopt Resolution #01-07 as amended. Upon hearing an objection to unanimous consent, Dr. Jeffrey asked for a roll call vote. Ms. Allen recorded the vote and reported that Resolution #01-07 as amended was adopted with 9 voting yes, 1 no, and 2 abstaining (see Table 1).

Dr. Jeffrey then yielded the floor to Dr. Schutzer to discuss issues related to paper rolls on voting systems.

Dr. Schutzer presented an overview of paper rolls used with VVPAT systems, including:

- Problematic Issues;
- Paper Rolls and the VVSG 2005;
- Paper Rolls and the Next VVSG; and
- Proposed Solution.

In conclusion, Dr. Schutzer recommended that rather than banning paper rolls outright, the TGDC could offer more useful guidance by encouraging approaches in future voting systems that improve upon today's paper roll devices. He then offered a resolution to develop requirements for more usable approaches. (Dr. Schutzer's complete presentation is posted at: <http://vote.nist.gov/meeting-03222007/Pres-Schutzer-PaperRolls.pdf>.)

Secretary Gale seconded the motion for the purposes of discussion.

There was considerable discussion and addition of friendly amendments to the resolution's preamble. The final resolution then read:

Resolution #02-07 Improving Paper Records, Offered by Dr. Schutzer

Whereas, the TGDC recognizes that paper rolls can be a challenge for voters, poll workers, and audits:

- *They can be difficult to handle in an audit or recount,*
- *The voting order preserved on the roll can be a danger to ballot secrecy if good election management processes are not followed, and*
- *It can be difficult to make them accessible for blind, low-vision, low-literacy, second-language, or non-written language voters.*
- *Whereas, therefore, the TGDC has determined that the current paper roll solution is acceptable until an alternative, new technology becomes available.*

Resolved: The TGDC directs the subcommittees to develop more demanding requirements for future paper audit trails that can solve the problems posed by today's paper rolls.

For the sake of clarity, the Chair noted that the definitive resolution directing the subcommittees appears as the last paragraph. The preceding bullets describe motivation for the resolution.

Hearing no further discussion, the Chair requested unanimous consent to adopt Resolution #02-07. There was no objection, and the motion was adopted (see Table 1).

Dr. Jeffrey then informed the Committee that the staff believed that they had received sufficient guidance during the morning discussion on the innovation class. He indicated that there would not be a need to revisit this crosscutting issue at the meeting.

The Chair then called for a five-minute intermission allowing for setup of the slide presentation on ballot activation and e-poll books. After the intermission, the Chair opened the floor to Mr. Wack.

Mr. Wack thanked the Chair. He indicated the genesis for the discussion of this crosscutting issue as a request from the EAC to address e-poll book issues. His background presentation covered:

- Definition of a Voting System;
- New Equipment and the VVSG;
- Options for E-Poll Book Requirements in the VVSG:
 - 1) Always allow e-poll books to activate the ballot.
 - 2) Allow e-poll books to activate the ballot if they are not externally networked.
 - 3) Beef up privacy requirements for ballot activation.
 - 4) Require simultaneous paper record for each activation.

Mr. Wack then opened the floor to discussion of the four options. (Mr. Wack's slide presentation is available for review at: <http://vote.nist.gov/meeting-03222007/Pres-Wack-BallotActivation.pdf>.)

Dr. Wagner offered initial comments in support of options (3) and (4). "I think that the e-poll books do introduce new privacy concerns, because they have a lot more information about the voter. And it makes sense to make sure that there are privacy requirements and

then make sure the voter's identity isn't linked to the vote capture device. I might propose adding one more option, because the reliability of your voting system is dependent on the reliability of e-poll books. I think it would make sense that the volume tests, which are intended to test the system as a whole, should include e-poll books if they are part of that system."

In answer to a request from the Committee, Mr. Wack elaborated on option (4). "Every time a voter checks in, the e-poll book prints out on a piece of paper, 'this voter checked in and they are authorized to vote.' Then in essence, you have the same situation as if a poll worker is using a hard copy poll book and writing down that such-and-such a voter showed up. Then you can use that record at the end of the day to reconcile the e-poll book versus the number of electronic records recorded."

Mr. Miller indicated that he was in favor of option (3) and against option (2). He noted that the state of Washington already requires a signature of a voter at the poll, satisfying option (4).

Commissioner Davidson raised issues related to voter privacy and provisional voters using e-poll books. "Somehow or another, we have got to know enough about that individual, without knowing the name, because some counties in some states require you to vote part of the ballot but not all of it, if the voter is not qualified to vote on everything. Therefore, provisional votes have to be held at bay in the DRE until after the election." She indicated that the vendors are working on maintaining the privacy of the vote within their e-poll book systems for provisional voters.

With regards to ballot activation, Ms. Quesenbery responded. "If the e-poll book activates a smart card and it's got privacy protections, I don't see an issue." She had concerns with a direct connection to the DRE.

Dr. Rivest agreed with Ms. Quesenbery. "I think the e-poll books networked together is fine. But it's the information channel from the e-poll book to the voting machine that's the critical one for privacy. We need strong regulations on the privacy of that channel. That really should be a one-way flow of information. There should be no information flowing back. So I worry about you recycling the smart cards used for ballot activation."

Dr. Wagner addressed a reliability issue related to option (4). "Today, election procedures for sign-ins involve voters signing paper poll books typically. If we had equipment that's intended to replace that procedure and to automate it with a machine so that there is no human who is signing on a paper poll book, we have to ask about the reliability of the records. We understand the reliability of the records of signed signatures and a paper poll book. The reliability of the records and the number of voters in an e-poll book that's intended to replace that is quite tricky."

Mr. Miller emphasized the need for networking of e-poll books, especially in areas in the western United States that are migrating to regional voting centers.

In answer to a question from Secretary Gale, Mr. Wack explained some risks of external networks for e-poll books. "From a security perspective, thinking in terms of the threats if you allow external networks, the question really is how you can be certain you are not externally networking up to the Internet. So it would be wise to find out the requirements for these external networks. Another way of handling it would be to say, go ahead, allow these external connections and ballot activation, but make real sure that all you can do is activate the ballot. That would probably force some changes in the smart card processes that we use right now. But it would also allow you to have externally networked e-poll books activating the ballot."

Ms. Purcell raised the issue of the main purpose for e-poll book automation. "If you are automating a process and then you are going to add paper, it sounds to me like you're defeating that process of trying to automate, because now you've added an additional task for the poll worker. Not only have you got this automation, but then you've got the poll worker maintaining an additional paper record."

Dr. Jeffrey added his main concern for the privacy issues as many of the security issues are handled outside of the scope of the TGDC by state and local election procedures. "I believe the real issue here that we need to address, and I think Ron captured it really well, is privacy, not the security issue. If you have a smart card that is physically touching the machine that you're voting on, then ensure that it's a one-way transfer of information and not a two-way. We need to essentially address that information transfer requirement to ensure that it's testable, and that a machine will not have a two-way communication."

In answer to Commissioner Davidson, Mr. Wack indicated that the one-way communication would not limit the capability to pull out the provisional votes.

The Chair summarized consensus on the issues from his viewpoint. "I sense general consensus that e-poll books should be allowed to activate ballots. I sense general consensus that e-poll books should be allowed to be externally networked and to activate the ballot. I sense very general consensus that privacy needs to be assured. And I sense that most of the people are either agnostic or in favor of simultaneous paper records for ballot activation."

Mr. Wack indicated that he believed he had captured the Committee's direction. "What I've heard then is general agreement that we will allow option (1) and do option (3). We will throw out option (2). The Committee is agnostic on option (4)."

Dr. Jeffrey elaborated on the Committee's consensus on option (4). "I think the consensus was agnostic or in favor. So I think there probably is a need for continued subcommittee discussion to really flush out the benefits and disadvantages of option (4)."

The Chair adjourned the meeting for a one-hour lunch break.

March 23, 2007: Afternoon Session

The Chair welcomed the Committee members back for the final session. He asked the parliamentarian to take the roll. Ms. Allen reported eleven members in attendance (see Table 1).

Dr. Jeffrey opened the floor to introduction of additional resolutions and recognized Secretary Gale.

Secretary Gale thanked the Chair. He indicated that he had originally intended to offer several resolutions for adoption. Instead, he would rather offer his proposals as issues for discussion. He deferred first to other members who might wish to introduce resolutions.

Hearing no requests from other Committee members, the Chair asked Secretary Gale to proceed.

Secretary Gale thanked Dr. Jeffrey. He commented that his seven years as chief election official for the state of Nebraska included the entire period when the states were preparing for and implementing the mandates of HAVA. His tenure both on the EAC Standards Board and the TGDC have helped him focus on broad areas of concern for all election officials. He invited his fellow Committee members' thoughts on them. He related his first concern to the disparity between states with small populations and the states with dense populations. "Nebraska, for example, has 500 communities of 300 people or less. Many of the rural areas of America had no choice except a hand count of votes. These small counties did not have the ability to buy any kind of equipment at all, and had to rely on election administration to provide the security for and the public confidence in the voting process. To a very large degree, it was successfully done. I think most of the controversial election issues that arose in America, arose out of large urban areas with highly complex demographics. I do compliment NIST and all of their staff for their hard work and obviously their competence to bring us to this point. Yet in many ways, I think of this draft VVSG as setting standards for fairly complex equipment. There does not seem to be a segmenting of requirements that allows either the Standards Board or the EAC flexibility to determine optional requirements for those counties that are more sparsely populated, as long as they are replaced by election administration best practices or EAC election management guidelines. For these smaller jurisdictions, vendors can develop certain kinds of equipment that could opt out of certain requirements, as long as they're replaced with best practices. This would bring the cost of equipment and poll worker training down to the level of issues that are most likely to be met in more rural areas."

Ms. Quesenbery thanked Secretary Gale and the other election officials on the TGDC, including Ms. Miller and Ms. Purcell, for bringing to the floor these issues for the other Committee members. "When we consider a requirement, we need to think not just about what the requirement says, but what unintended consequences of that requirement might be or how it might impact election practices. And I know that that's probably in their wisdom why Congress insisted that this Committee have representatives of many different specialties. Perhaps you might be looking for ways that we could get input in a

more effective way, and that especially, we make sure that we are framing the difficult questions clearly enough that we're getting good input."

Secretary Gale offered an illustration. "In the innovation class, you can choose the class of standards that you're going to follow developing your innovative equipment. If your equipment falls into these classes, then you have to meet them. But other standards, if they're irrelevant, then they're optional and you can opt out. Now, we haven't figured out who's going to make that 'opt out' decision, but there obviously is built into that some discretion of what's relevant and what's not relevant to a particular piece of voting equipment. So, for example, if that piece of equipment is a simpler design for the less populated states and their simpler needs, it seems like there's a certain parallel there. If you're going to allow an innovation class, can't you also allow a kind of digression class that provides the EAC the flexibility to balance levels of guideline complexity and sophistication against levels of election management best practices, to realistically address equipment costs to meet various state-specific equipment needs in the future?"

Dr. Schutzer indicated his agreement with the concept of voting center classes for jurisdictions with a sparse voter population.

Secretary Gale asked consideration that future voting system guidelines for the digression class be considered within the innovation class.

Ms. Purcell outlined the state procedures in Arizona for sparsely populated precincts. "To that point, Mr. Secretary, just as we have in our state law the ability to handle certain size precincts that are smaller than 200, we can deal with those precincts in an all-mail category rather than going to the expense of setting up a polling place and poll workers and so forth. This would seem to me to fall in that class where you handle the requirements much differently with a smaller population."

Secretary Gale concurred and commented on Nebraska's procedures. "I have that option as Secretary of State to designate certain precincts to be mail-only ballots. This saves us having to put expensive equipment into those precincts, and it eliminates some compliance issues with the Americans with Disability Act. So we can merge precincts and do mail-in ballots. It's very fair and equitable. That is the kind of flexibility I hope America will still continue to have in the future, even for counties that do want to have some form of technology but maybe not precisely what the next VVSG iteration is addressing."

Secretary Gale indicated that while his second issue had been addressed at the December plenary, he wished to reemphasize a sensitive point. "It seems we've had a systemic attack on government for so long that there's virtually little public trust in public officials or in the efficacy of representative government, especially so because of a heightened sensitivity with regard to elections. The unfortunate leak of information that the TGDC had found that all forms of DRE equipment virtually were too vulnerable, too unreliable, too undependable, and too subject to attack to be usable, resulted in the media and the public leaping to the instant conclusion that if they were using DRE equipment, it was not

a system that could be relied upon. I am just hoping that as this next VVSG iteration goes to final press, that we avoid any language implying that current voting equipment that is HAVA-compliant, HAVA-funded and certified to the 2002 Voting System Standards is so fundamentally flawed that the public will lose confidence in it. I think you did address that at the plenary in December of 2006. And I just want us all to continue to be alert to the issue to be sure we don't cast that kind of pall over existing voting equipment."

Secretary Gale's third issue dealt with voting-related technologies that will evolve during the period of time before the next iteration on the VVSG becomes effective. "We're looking at an iteration of the guidelines that probably won't be effective until 2010. With design and development testing, we're probably not going to see this new generation of equipment until 2012 or so. I think the innovation class was a piece of genius. There's going to be a lot of new ideas, new technology, new science, particularly in the IT area, that may take us far, far away from the standards that we are developing."

Secretary Gale indicated an additional concern on upgrading the standards as new technologies evolve before 2012. "I guess that's a question for the EAC to decide, how flexible those standards will be between now and then, or whether the innovation class will be the only place where we can address evolution as we approach 2010 or 2012. And part of that probably is also a concern with the equipment we all now have, newly installed by January 2006 for most of us. You are not going to get ten years of life if you don't have upgrades, updates, and new firmware to address these technology evolutions that are going to occur. You don't want to replace the whole piece of equipment. If there's something that will make it a little better and preserve the life of the equipment, that would be, of course, economical and tremendously efficient, unless you have to send that entire system back through for certification to the new standards. This is a hard question. I don't know how that is resolved, but it's going to be a real issue for election administrators all across America. They have this equipment, and there's a new piece of firmware that will really enhance its performance, its reliability, and security, and they can't add it without having to send everything back through certification and testing, whether it's the 2005 VVSG or the next iteration. So that's another area of concern that just somehow needs to be addressed as we move into this new era of testing and certification."

Dr. Schutzer raised the possibility of a different architectural framework for future voting equipment. "Eventually one might want to think of some kind of an architectural framework where the modular components are broken out in such a way that it would make it easier to phase in and phase out different aspects without disrupting the whole system."

Secretary Gale stated that this was an excellent idea. "I don't know if it's possible for the TGDC to have much of an extended life. But if upon completion of its work with this iteration and submission to the EAC, it could have at least another extension to address these issues, it might be helpful to the EAC. It certainly would be helpful to the election administrators of America."

Secretary Gale's final issue concerned assistance from NIST staff to the Standards Board. "As a member of the Standards Board, I'm concerned with the approaching submission and review of the next iteration of the VVSG by the Standards Board. That is where election administrators of America will have an opportunity to address this document. I frankly am concerned whether they are ready to address it. As the Standards Board representative on the TGDC along with Alice Miller, I think at some forthcoming Standards Board meeting, we need a day or two of the expertise of NIST and the TGDC to walk us through the final draft of the VVSG to enable us to discuss policy implications and get this clear understanding that I've certainly gotten."

Ms. Miller concurred and noted that NIST staff provided this interaction with the Standards Board reviewing the VVSG 2005. "I felt that the review was very helpful. I think it occurred over two days and was broken down so that everyone got to go to every TGDC subcommittee's standards presentation. Secretary Gale, I think that is an excellent suggestion, and we need to do that again."

Dr. Jeffrey fully supported NIST staff's participation and certainly believed that they are passionate in their work to make the VVSG usable and understandable to election officials.

Ms. Purcell stated that these presentations would be useful to the Board of Advisors as well.

EAC Commissioner Davidson stated that the EAC was planning to provide this opportunity for review of the next iteration VVSG with NIST staff and TGDC members by both the Standards Board and the Board of Advisors.

The Chair thanked Secretary Gale for the thoughtful presentation of important issues to keep under consideration. In closing, Dr. Jeffrey offered perspective on the current draft of the VVSG. "If you look at what was presented at this meeting, a 500-page standards document that is almost readable, this is amazing in and of itself when you think about that feat. It's a complete rewrite of the previous versions, and it significantly enhances the usability, accessibility, security, reliability, and transparency of voting systems. I would very much like to thank each and every one of the TGDC members for the incredible amount of time and effort that they have already invested in this effort, and also the NIST staff for their support, and finally the EAC for helping to clarify and work with us in making sure that we end up with a product that is hopefully going to have the best possible results."

There being no further business, the Chair adjourned the eighth plenary session of the Technical Guidelines Development Committee. (Note: At the conclusion of the meeting, the Committee members were asked to submit preferences for a ninth plenary session to be held in late May or early June.)

TGDC Resolution Voting

Plenary meeting

Mar. 22-23, 2007

Resolution Number	Williams	Berger	Wagner	P. Miller	Gale	Mason	Gannon	Pearce	A. Miller	Purcell	Quisenberry	Rivest	Schotzer	Turner-Bufe	Jeffrey	Tally	Y-N-A
3/22/07 AM Roll Call	*	*	✓	*	*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	11 present (Gale arrived late; P. Miller by telcon late)	
Meeting Agenda																Adopted by Unanimous Consent	
12/02-05/2006 Meeting Minutes																Adopted by Unanimous Consent	
STS Subcommittee Report																Adopted by Unanimous Consent	
3/22/07 PM Roll Call	*	*	✓	*	✓	✓	✓	✓	*	*	✓	✓	✓	✓	✓	10 Present (Purcell late)	
CRT Subcommittee Report																Adopted by Unanimous Consent	
Q/CM Recommendation																Adopted by Unanimous Consent	
HFP Subcommittee Report																Adopted by Unanimous Consent	

Y=Yes N=No A=Abstain

*=Not Present for Vote

Table 1

TGDC Resolution Voting

Plenary meeting

Mar. 22-23, 2007

Resolution Number	Williams	Berger	Wagner	P. Miller	Gale	Mason	Gannon	Pearce	A. Miller	Pürzell	Quesenbery	Rivest	Schutzer	Turner-Stale	Jeffrey	Tally	Y-N-A
3/23/07 AM Roll Call	*	*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	*	✓	✓	12 Present (Schutzer Late)	
Resolution 01-07 Amendment																9 Yes,1 No,2 Abstain	
Resolution 01-07																9 Yes,1 No,2 Abstain	
Resolution 02-07																Adopted by Unanimous Consent	
3/23/07 PM Roll Call	*	*	✓	*	✓	✓	✓	✓	✓	✓	✓	✓	✓	*	✓	11 Present (Miller Late)	

Y=Yes N=No A=Abstain

*=Not Present for Vote

Table 1