Meeting Minutes (Unofficial)
Technical Guidelines Development Committee (TGDC) Meeting
May 21-22, 2007
National Institute of Standards and Technology (NIST)
Gaithersburg, MD 20899

Members in Attendance:

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

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

May 21, 2007: Morning Session # 1

Dr. William Jeffrey, TGDC Chair, called the ninth 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. He welcomed the Committee members back to NIST's Gaithersburg campus.

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). Eight 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: Dr. Brit Williams and Ms. Alice Miller joined the meeting via teleconference shortly after the roll call. Secretary Gale also arrived during the morning session.)

Dr. Jeffrey thanked the Parliamentarian. He welcomed Election Assistance Commission (EAC) Chair Donetta Davidson, Executive Director Mr. Tom Wilkey, and Mr. Brian Hancock, Director of Voting Systems Certification. He thanked them for attending and remarked that Commissioner Davidson and Mr. Hancock would address the Committee shortly.

The Chair then asked for a motion to accept the published agenda for the May 21-22, 2007, TGDC meeting (see http://vote.nist.gov/meeting-05212007/agenda.htm). 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 entertained a motion to adopt the March 22-23, 2007, 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 March TGDC meeting minutes were adopted. (A copy of the official meeting minutes is available at: http://vote.nist.gov/meeting-03222007/TGDCMinutes-032207-official.pdf.)

The Chair noted that the Committee would review a substantial amount of material developed since the March 20007 plenary. "Hopefully, we will be adopting much of the VVSG material and clearly identifying that material that is yet to be adopted." He then opened the floor to Commissioner Davidson.

Commissioner Davidson expressed the EAC's appreciation for the TGDC members' commitment to the Voluntary Voting System Guidelines (VVSG) development project. She then introduced Mr. Brian Hancock to provide a summary of the EAC Election Management Guidelines.

Mr. Hancock thanked the Commissioner and the Committee for the opportunity to present an overview of the preceding year's work on the Guidelines (see http://www.eac.gov/eac_qs_guides.htm) and plans for the next year's Guidelines. "The long-term goal of this project is to provide a complete set of election management guidelines, a complement if you will to the VVSG, consolidated into one document to assist state and local election administrators to effectively manage and administer the election process."

He indicated that the Guidelines should be complete at the end of 2008. However, due to the urgency for the information, guideline topic chapters are released as soon as they are complete. "Just in the past several weeks, a binder containing the first chapters of the full document has been sent to all of the election officials throughout the country. We are aware that they have reviewed them and so far, they seem to be very pleased."

He then enumerated the four EAC's Quick Start Guides developed for poll workers: ballot preparation; logic and accuracy testing; voting system physical security; and managing voting systems.

He recognized the project co-leaders for the Guidelines: Dr. Brit Williams and Ms. Connie Schmidt as well as 11 state-level election directors, over 35 local election officials from 19 different states, and representatives from the EAC Standards Board and Board of Advisors. "The Management Guidelines do not endorse one method of election administration over another, and they are not intended as a "one size fits all." State and local jurisdictions are not required to implement the recommendations or practices contained in the Election Management Guidelines. They are solely designed to serve as a source of information for election officials and not as requirements by which they must abide."

Mr. Hancock described plans for development of future Management Guidelines and Quick Start Guides. "Over the next year, Guideline Chapters will be completed on military and overseas voting; voting by mail and absentee voting; contingency of disaster planning; ballot design; audit trails; acceptance testing; pre-election logic and accuracy testing; and parallel testing. Quick Start pamphlets will cover certification; contingency and disaster planning; and dealing with change of management in an election office."

He concluded his presentation with a description of the EAC Standards Board review of the ballot design recommendations from Design for Democracy. He noted that the public can review the individual comments of the Standards Board on the EAC website (see http://www.ebp4.us/document-review).

Mr. Pearce asked Mr. Hancock where the EAC sought input on accessibility issues for the management guidelines. Mr. Hancock indicated that the Commission had consulted with the U.S. Access Board and would continue to seek their assistance and input from representatives of the broader accessibility community with future chapters.

The Chair thanked Mr. Hancock. Dr. Jeffrey remarked that due to the full agenda, the Committee would not take public comment at the meeting. "However, all of the draft material is on the website http://vote.nist.gov, and I strongly encourage the public to look at that material and to provide comments. We do take those inputs very seriously."

The Chair called on Mr. Mark Skall of NIST's Information Technology Laboratory to review progress on VVSG tasks since the March 2007 plenary.

Mr. Skall thanked Dr. Jeffrey. He updated the Committee on the continuing research and development in the drafting of the VVSG. He summarized NIST's close coordination with

the working subcommittees through 23 teleconferences. He summarized the optimal outcomes for the current plenary session. "So the overall aim of the meeting is to approve the completed portions of the draft VVSG material with final editing instructions to NIST, and secondly, to decide how to have the TGDC approve the remaining new material." He concluded with a review of the subcommittee presentation strategy for the two-day meeting including:

- Day 1: Subcommittee presentations:
    - Summaries of all material by each subcommittee
    - Discussion of new or updated material
    - Final approval discussions and resolution

- Day 2: Subcommittee presentations continued and next steps:
    - Future teleconferences for discussing and approving remaining material
    - Steps towards delivery of the draft VVSG to the EAC.

(Mr. Skall's presentation slides are available for review at: http://vote.nist.gov/meeting-05212007/Skall-overview.pdf.)

Dr. Jeffrey opened the floor to Mr. John Wack for an overview of the draft VVSG document including final production issues. Mr. Wack thanked the Chair. "I am going to do a very high-level overview of the VVSG document, and each subcommittee will go into more detail. We will start out with an overview of the most significant material and focus on the significant issues and the big changes." His presentation covered the following topics:

- Meeting Goals: Approval of Completed VVSG Material
- VVSG Material to be Completed
- Introductory and Informative VVSG Material
- Plans for Final Document Production
- High-Level VVSG Document Review
- VVSG Document Delivery

(Mr. Wack's presentation slides are available for review at: http://vote.nist.gov/meeting-05212007/Wack-overview.pdf .)

The Chair thanked Mr. Wack. Dr. Jeffrey echoed Mr. Wack's comments on subsequent review of the final VVSG document delivered to the EAC. "The next step is extensive public review. Though I am sure we think that we have got everything exactly perfect and made all the right trade-offs, we certainly would expect a lot of public comment on the VVSG, and we look forward to that." He asked Mr. Wack to briefly summarize a future companion document to the VVSG that would explain the document to the general public in less technical terms.

Mr. Wack described a companion document to the VVSG recommendations "that would give a comprehensive statement of what's in the document in a way that's understandable to most audiences, and would talk about major differences between this VVSG document and

VVSG 2005 in certain areas. The TGDC could weigh in if there were pros and cons to some issues and explain why one particular approach was chosen."

Ms. Quesenbery expressed her concern that the VVSG recommendations be as complete as possible including introductory material. Mr. Wack agreed and Ms. Quesenbery elaborated. "I just want to make sure that what you're talking about is clarifying the VVSG document as we are looking at it rather than something new. If the TGDC and NIST would like to draw the public's attention to the following sections, that information would go in the referenced companion document outside the VVSG."

Mr. Wack and Dr. Jeffrey agreed that there was no intention to alter the VVSG format or provide an incomplete document to the EAC. Dr. Jeffrey also suggested the inclusion in the companion document of white papers that were generated in the development of the VVSG.

The Chair opened the floor to Dr. David Flater of NIST's Information Technology Laboratory to initiate a review of the Core Requirements and Testing (CRT) Subcommittee Draft Sections for VVSG. Dr. Flater covered benchmarks in the VVSG including:

- Benchmark Definition
- Benchmark Conformity Assessment
- TGDC Guidance on Benchmarks from March 2007 Meeting
- Terminology review
    - Failure
    - Reliability
    - Accuracy
    - Misfeed Rate
    - Volume Testing

Dr. Wagner asked Dr. Flater to explain the intent of the accuracy benchmark. "I understand we are not trying to capture human factors here, but for instance, for a paper-based voting system, consider a marginal mark that was read one way by your mechanical scanner. If the human indicates the intent is something else, do you consider that an error for the purposes of the accuracy measure?"

Dr. Flater replied that this was not the case. "This accuracy benchmark applies to non-marginal marks that while not perfect in the sense of completely filled in per the oval instructions to the voter, are still well within the range of what voting system vendors document as being reliably readable. If it is documented as being reliably readable and the voting system does not read correctly in a repeatable and reproducible fashion, that is an error."

Dr. Wagner asked Dr. Flater to differentiate between repeatable and correct. Dr. Flater explained the difference in terms of votes and non-votes. "If a mark is within the documented description for what constitutes a reliably readable vote, then it should repeatedly be read as a vote. Similarly for non-votes, marks that are below the marginal range should reliably, repeatedly, and reproducibly count as non-votes. The behavior in the

marginal range is a separate issue that, in general, wherever possible in the precinct count case, if the ballot is fed in that contains a marginal mark that is ambiguous, it should be given back to the voter, because the system is not going to repeatedly count the ballot the way the voter intends."

The Chair asked Dr. Flater to elaborate on the volume testing accuracy benchmark. Dr. Flater commented that the VVSG 2005 accuracy test required a minimum of 1,549,703 ballot positions as a simulated volume on DRE systems. The Op Scan voting system volume test benchmark now specifies a minimum of 75,000 ballots. A rough ballot style estimate gives 1,500,000 votes and 6,000,000 ballot positions. Most of the other parameters for the DRE volume test came from the California volume reliability testing protocol."

Ms. Quesenbery asked whether Electronic Ballot Markers (EBMs) are tested like DREs. Specifically, are the ballots produced also tested?

Dr. Flater answered affirmatively. "You have a voting system that includes both the EBM and the optical scanner, but the EBM devices themselves would be operated like DREs in terms of the volume produced."

Dr. Jeffrey summarized. "At least with the optical scan systems, the bottom line is we ended up close to the original result as existed historically, but now we can actually defend why that number makes sense as opposed to an arbitrary number."

Dr. Flater then reviewed the Core Requirements and Testing Subcommittee changes to the VVSG draft since the March 2007 plenary version. Most changes clarified previously written requirements and definitions without changing their intent. In addition, procedural "requirements" were changed to informative assumptions. He covered substantive changes to the conformance clause including:

- Added classes for activation device, audit device, Central Count Optic Scan Systems
- Brought back system-level classes for Independent Dual Verification and Election Verification
- New subsection describing innovation class submissions
- Durability of paper defined with government paper specification standards.

Dr. Flater concluded with a review of major changes from the VVSG 2005 document. (His complete presentation is available for review at: http://vote.nist.gov/meeting-05212007/Flater-CRT.pdf.)

Ms. Quesenbery asked Dr. Flater for a specific reference to the location in the draft VVSG for the volume testing requirement. He stated that the volume testing is covered in Volume 5, Chapter 5.2.3-D.

The Chair called on Dr. Alan Goldfine of NIST's Information Technology Laboratory to complete the review of the CRT Subcommittee sections of the draft VVSG.

Dr. Goldfine thanked Dr. Jeffrey. He initially reviewed changes to the quality assurance/configuration management requirements from the VVSG 2005. These included:

- In 2005 VVSG
    - Volume I: Sections 8 and 9
    - Volume II: Section 7
- Replaced in new draft VVSG
    - Volume 3: Section 16.4.2
    - Volume 4: Chapter 2
    - Volume 5: Section 4.4

As a result of TDGC guidance from the March plenary, he noted revised requirements dealing with the timing of the vendor delivery of the quality assurance manual. In conclusion, he summarized changes to the electromagnetic compatibility requirements from the VVSG 2005 and since the March 2007 plenary. (Dr. Goldfine's presentation slides are posted for review at: http://vote.nist.gov/meeting-05212007/Flater-CRT.pdf).

Dr. Wagner asked if a list of changed CRT requirements was available for specific review by the TGDC. Dr. Goldfine indicated that many of the changes included incorporation into the current draft VVSG from previous white papers. Dr. Wagner asked if there was a list of other changed CRT requirements that have not been approved by the TGDC as a Committee. Mr. Wack noted that all the CRT material presented by Dr. Flater had been reviewed at previous TGDC meetings.

Ms. Quesenbery framed the issue more concretely, indicating the Committee's need to know the specific chapter and section that covers each of the previously covered CRT requirements in order to determine material ready for TGDC approval.

On that note, the Chair called for a fifteen-minute break, after which he indicated that Dr. Flater will provide a slide with the specific references in the current VVSG draft.

May 21, 2007: Morning Session # 2

Dr. Jeffrey called the plenary meeting back to order. At this suggestion of Secretary Gale, the Chair recommended that approval votes for the VVSG would be postponed until tomorrow (May 22, 2007), since many of the various subcommittee sections are interspersed throughout the document. "Each of the speakers will try to be more specific as to the VVSG sections they are referencing." There was no objection to the Chair's plan of action.

Dr. Flater then reviewed the VVSG by volume and chapter to identify sections for which each TGDC subcommittee is responsible. The sections included *Volume 2* (all), *Volume 3* (Chapters 2, 16, 17, 18.1, 18.2, 18.3), *Volume 4* (all), *Volume 5* (all except 3.4, 5.4, 5.5), and Volume 6 (1st set of References).

Dr. Flater pointed out an inadvertent admission in Volume 5 that would be corrected. "The 'shake and bake' tests that were supposed to have been carried over with only minor revisions from the VVSG 2005 standard were dropped inadvertently from this volume. There are a series of tests like the bench handling test, the temperature variation test, and a non-operating test for humidity that's specified in the old standard. The intent is to carry it over with minor revisions from VVSG 2005."

The Chair thanked Dr. Flater and called on Dr. Sharon Laskowski of NIST's ITL to present the Human Factors and Privacy (HFP) Subcommittee's VVSG draft sections.

As a point of clarification, Ms. Quesenbery noted that the HFP material was contained in *Volume 3*, Chapter 3, of the current VVSG draft.

Dr. Laskowski thanked the Chair. In her presentation, she reviewed 13 significant changes to the VVSG draft from the March version. She summarized significant changes from the VVSG 2005 and gave a progress report on the usability benchmark research and development project. (Dr. Laskowski's presentation slides are posted for review at: http://vote.nist.gov/meeting-05212007/Laskowski-HFP.pdf.) Significant changes in this draft VVSG from the VVSG 2005 include:

- Improved usability
- Plain language guidance, cognitive requirements
- Accessible voter verification
- Low vision more fully addressed and moved to general usability section
- Require availability of choice of font size and contrast on all Voter Editable Ballot Device (VEBD) voting machines, not just the accessible voting station
- Paper legibility
- General adjustability throughout voting session
- Poll worker usability
- End-to-end accessibility
- Timing requirements
- Performance benchmarks
- The safety requirement now refers to UL 60950.

In response to a question from Dr. Rivest, Dr. Laskowski clarified which of the requirements applied to the accessible voting station (Acc-VS) and which requirements apply to all voting systems. Requirements in Section 2 of Chapter 3 are usability requirements that apply to all voting stations. Section 3 includes accessibility requirements that apply to the Acc-VS only.

Dr. Wagner expressed his concerns regarding voter verifiable paper records (VVPR) requirements in *Volume 3*, Chapter 6, Section 6.3.4. "I think that probably what's more important here is to enable the voter to compare what's on those records to his or her intent to make sure that is how he or she intended to vote, rather than necessarily allowing comparison of the paper record and the electronic summary at the same time."

Ms. Quesenbery responded. "If the VVPR is the ballot, then all that matters is the voter's intent because that's the thing that will be counted. But if the first count is going to be made off the electronic record, and the VVPR is a duplicate record of that record, then you really do have to determine not only that what is on the VVPR is right, but also that what is on the VVPR matches the electronic record."

Dr. Williams recommended not changing the VVPR requirement (6.3.4.1.3.4-B). "I think we should leave the wording the way it is. The important thing here is that the two records agree. It's up to the voter to determine whether or not they both reflect his or her intent, and there's no way in the standard that we can determine what the voter's intent is."

Dr. Wagner amplified on his understanding of the requirement. "If we had a voting system that made it easy to check that the electronic record was correct and then separately to check that the paper record was correct, I think that should be satisfactory and the system should not be prohibited. Right now, we have a little bit of strategic ambiguity in the requirement language, and if the ambiguity was intentional to permit flexibility where that kind of system should be permitted, then I think sticking with the current language is fine." However, he expressed concern if the intent was to subtly prohibit this kind of voting system.

Extensive discussion ensued. Ms. Quesenbery emphasized that the main importance for the voter is the capability of the voting system to allow comparison of the records.

Dr. Williams elaborated. "Surely when the voter looks at that record of his or her vote, he or she is going to decide whether or not it matches his or her intent, and if it does not match his or her intent, the voter is going to call the poll worker over and point out that there's some error. What we are talking about here is something that has to do with a later auditing process. The two vote records have got to match or they are no good for later auditing purposes."

Dr. Wagner responded. "It is important that the voting machine be designed so that if it is working correctly, it prints the same thing on the paper that it showed in the summary screen, no question about that. I would also say it is important from a usability perspective, that the machine be designed to facilitate rapid and accurate checking to ensure that each of those records matches the voter intent."

The Chair concluded that the issues related to this VVPR requirement would require resolution at a later time.

Secretary Gale inquired into the perceptual issue requirements in Chapter 3, Section 3.2.5. His concerns focused on the effect of larger font sizes on the use of reel-to-reel VVPAT printers. Dr. Laskowski noted that the larger font size was a voting system configuration item, as were magnification devices for printers. She noted that the intent of requirement 3.2.5-G was to provide options but not require both magnification and

larger font sizes in a voting system. "While this requirement may be satisfied by one of its sub-requirements, other innovative solutions are not precluded."

Secretary Gale inquired into an accepted definition for "low vision." "If I take my glasses off, I may have low vision, but that doesn't mean I'm not capable of putting my glasses on and that replacing any need for other magnification. So are we talking about a form of impaired vision that can't be corrected easily?"

Dr. Laskowski indicated that the term does not refer to voters with corrected vision, but rather visual impairment. Dr. Williams elaborated. "I have always looked at this as a matter of voter choice. If the voter thinks they have impaired vision, then they have impaired vision, and if they want to use the audio ballot, then we don't argue with them about that."

Ms. Quesenbery agreed and added, "There are specific assistive technologies that we are mandating for people who are completely blind, but there are other things like large font size requirements that help people who are not completely blind but nonetheless have a wide variety of visual problems."

At the request of Secretary Gale, Dr. Laskowski agreed to review and determine a consistent use of "low vision" in the requirements versus "partial vision."

In response to a question from Dr. Williams regarding adjustability of the voting system controls, Ms. Quesenbery clarified the requirement. "A voter can select large font on their own, and they can get back to that selection screen at any time during the voting session."

In conclusion, Ms. Quesenbery and Dr. Laskowski initiated a discussion on the time to vote performance benchmark. They noted that the error rate does not correlate with the time to vote in the initial tests. "You've got voters that can cast a perfect ballot but they're very careful. Other people that are sloppy and spend a lot of time voting that still weren't able to achieve a good error rate. Finally, you have voters that are very quick and accurate. So is this a true measure of usability difference between voting machines? We're not sure. The question that we're going to be dealing with in the next month is do we set an upper limit on time to vote that you must pass or fail, or do we just report time to vote? "

Ms. Purcell commented. You are trying to set up a situation that is similar to Election Day for a number of different voters, and some of them may take an unreasonable amount of time in order to vote that ballot. It also would depend on whether your ballot issues are just candidate issues or are they actual propositions, which would, of course, take longer to vote."

Ms. Quesenbery noted that for the test situation, the metric is average time to vote. "If you have some people voting very quickly and some people voting very slowly, you're looking at where that average is, and the question for the researchers is, should we be controlling for the average time to vote with this ballot in this test situation?"

Mr. Miller inquired as to whether the data indicated that one type of voting system took longer for voters to vote than another. Dr. Laskowski indicated that the next set of usability tests would provide data relevant to answering this question.

Dr. Jeffrey commented. "As long as the statement that time does not correlate to error rate is a true statement, it would seem like the information on how long it takes to vote a specific ballot for different machines is something only relevant potentially for procurement issues for state and local officials, in which case it becomes an interesting number but not a requirement. It becomes something that an election official may want to know if they're trying to decide between multiple vendors, but the crux to me seems to be whether or not time causes an error rate, and if that's uncorrelated, then it's an interesting number but not critical."

Dr. Rivest noted the cost and expedience issue. "It seems it's primarily a matter of cost. If you're trying to handle so many voters per hour, you can buy more machines if they're twice as fast or something like that. That's the cost from the election official's point of view. From the voter's point of view, of course, it's certainly a lot preferable to have a faster voting experience."

In an answer to a question from Dr. Rivest on choosing an accuracy benchmark threshold, Dr. Laskowski responded, "We are going to look across voting systems and ask what is reasonable for systems to achieve. We'll pick a benchmark based on average performance across systems. Now we have a methodology for computing whether a system meets that benchmark."

Dr. Williams asked if the voters in these experiments were instructed on time. "Did you request them to vote as fast as they could, or did you give them any indication that time was being measured?"

Dr. Laskowski responded that the participants were instructed to vote accurately.

Dr. Williams agreed with the comments of other TGDC members that time to vote was not necessarily a useful performance metric. "Time to vote [as a metric] is insignificant here as it relates to accuracy because you'll find tremendous variability in voting time between voters, more so than you would between voting systems. In fact, I would even discourage telling voters to try to vote fast."

Ms. Quesenbery elaborated on the rationale for the choice of measurement metrics. "The reason why we were looking at accuracy, time efficiency, and satisfaction is because the International Organization for Standardization (ISO) standard definition of usability is "efficient, effective, and satisfying." We changed "effective" to "accurate," because that's what's appropriate here. Time is simply time, and way back in 2003 at the NIST Symposium before the TGDC was even on board, you had already proposed that confidence was the important measure in the satisfaction arena."

Dr. Wagner initiated a discussion of subjective satisfaction measures. "I could imagine that this could be swayed by public opinion or general attitudes. Let me be a little more concrete and elaborate a little bit. So you could imagine someone coming up with a brand new voting system that the public has never seen before. It's actually very good and that after it was used for a little while, people would feel confident. But, because no one has ever seen it before, you're getting test subjects who have never seen or heard of this system. Would we be putting those kinds of voting systems at a disadvantage because those test subjects might say, 'well gee, I wasn't confident in this because I've just never seen anything like this before'?"

Dr. Laskowski noted that a number of the participants in the current tests had not voted on a particular voting system. "We didn't notice any anomalies with respect to that."

Ms. Quesenbery elaborated. "I have no doubt that the satisfaction data is worth collecting. I think we have something of the same problem as we do with time to vote, which is how do we set a boundary for it. And I would assume that no election official would purchase a new system without doing some sort of due diligence and approval within their own jurisdiction that would sort of supersede any of this."

Dr. Rivest reiterated his interest in the process for setting benchmarks. "I would just like to hear about those discussions, more of a description of the philosophy for setting the benchmark. If system A tends to cause voters to make 2 percent more accuracy errors than system B, is that enough to make it unacceptable or how do we pick numbers here?"

Ms. Quesenbery responded. "I do know that one of the discussion items we've had on the HFP subcommittee is that we're not looking for fine distinctions. We're not trying to cut off between 4 and 5 on a scale of 100, but looking for 20s or 30s on a scale of 100."

Dr. Laskowski commented. "And the way to set the benchmark is to look across the systems."

Mr. Miller asked for clarification on how these results relate to the usability testing in the 2005 standards. "In the 2005 standards, the vendor was required to do the usability testing and provide those reports as part of the certification process. Will they continue to be required to do that or have we taken on that role?"

Dr. Laskowski indicated that the VVSG 2005 requirements were intended "to ensure that the vendors think about doing their own usability testing. We're not judging the results, but in order for them to pass the benchmark, they need to have been doing some in-house usability testing, and so they ought to be able to supply that information."

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

May 21, 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 (see Table 1).

Dr. Jeffrey asked Dr. Laskowski to lead the TGDC in a resolution of the outstanding HFP issue.

Dr. Laskowski summarized. "The general issue was how strictly we word a requirement that asks the voter to compare two distinct records. Is it just verification, in particular with EBMs, because the ballot is printed out after the choices are made? We would not want to rule those out in a requirement that too strictly asks for that comparison."

The Committee discussed at length a rewording of the ease-of-comparison requirement (6.3.4.1.3.4-B) to read:

> *'If the voting system offers the opportunity for the voter to compare two distinct records of the vote as in VVPAT systems, the format and presentation of these records shall be designed to facilitate a rapid and accurate comparison.'*

With agreement reached on the HFP requirements in the current draft, the Chair asked Mr. Bill Burr of NIST's ITL to begin the presentation of the Security and Transparency Subcommittee's (STS) requirements in the draft VVSG.

Mr. Burr initially provided the TGDC with some background into basic IT-related security vulnerabilities with voting systems. "The truth is, I believe, that security-critical IT systems usually rely on strong audit systems, and I think the salient problem with voting systems has been in the last few years in that respect. How do you meaningfully audit a DRE voting system?" He outlined the general approach followed in drafting security requirements for the VVSG including:

- Simplify – complexity greatly complicates security analysis
    - No Internet connection of voting stations during polling
    - No wireless (except for IR when shielded) for voting stations
- Software Independence
    - Detect election fraud or errors even if code has bugs or is tampered
        - A good metric for this is the size of the conspiracy needed to defeat the audit system.
    - Need a strong audit system
    - Paper audit trails
        - Voter verification
- Do the obvious- design and configure voting systems to make it harder to attack them with respect to:
    - Setup Validation
    - Physical Security
    - Documentation
    - Software Distribution

- o   System Integrity Management
- o   Communications Requirements
- A strong (paper-centric) audit regime:
    - o   Security and Audit Architecture
    - o   Electronic Records
    - o   Voter Verified Paper Records
    - o   Cryptography – mainly intended to secure electronic records
    - o   System Event Logging
    - o   Voter Verifiable Paper Records (VVPR).

Mr. Burr summarized the security requirements in this version of the draft VVSG:

- VVPR requirements in this chapter support auditing and address attacks from threat work.
    - o   Human-readable VVPR sufficient to count votes
    - o   Machine-readable information allowed with restrictions
- New requirements on VVPAT:
    - o   VVPAT contents
    - o   Error handling/recovery
- Paper-roll privacy requirements
- New SHOULD for Precinct Count Optical Scan (PCOS)
    - o   Breaking into batches for easier auditing

(Mr. Burr's presentation slides are posted for review at: http://vote.nist.gov/meeting-05212007/Burr-VVPR.pdf.)

Ms. Purcell echoed Ms. Quesenbery's concerns with requirement 6.3.5.1-E requiring paper ballot verification records to fit on one sheet. "Just, for instance, in our last election, we had a two-page ballot which was actually four sides with 93 questions on it. How are you going to put this on one sheet of paper?"

This question initiated a lengthy discussion of split-page ballots. Ms. Purcell elaborated. "We identify the ballots as number one and number two, so we can easily identify which portion that ballot is. Some people may not vote the entire ballot, the four pages. The machinery that we use to count the ballots understands that these are two separate pages of ballots; however, they're identified as page one and page two. You may not always have both pages returned either at the precinct or in the mail, but what we're talking about here is the entire ballot being on one page. I don't know how, in the 2006 election, I would have accomplished that."

Mr. Miller offered his interpretation. "I'm not confident that that specifically would create a real problem. The reason that ballots become more than one page is the length of the text of initiatives. We're talking about the verification record at this point, in which case, presumably what we're talking about isn't printing out the entire text of measures and so forth, but simply indicating which selection that they made. However, I admit to some nervousness about confining it to one page."

Dr. Wagner suggested that the STS Subcommittee take the requirement back for further review and stated his analysis. "I can see some pros and some cons of this particular requirement. On the one hand, a requirement to be on a single sheet simplifies various aspects of design. If you have multiple sheets with a VVPAT, then you have to decide what happens if the voter accepts the first page and rejects the second page, for instance. Do you now go back into the selection mode, which allows you to change a subset of the selections but not a different subset? So there are some complexities there in supporting multipage. Also, if you support multipage VVPAT, that may make auditing more challenging. On the other hand, this requirement does reduce flexibility for the vendors. It's not clear to me whether it would be needed."

Dr. Williams stated his perspective. "You're only printing the candidate that's selected; I don't think it is accurate anymore to say you are only printing the candidate's name, because you're requiring now that you list all the undervotes. Be that as it may, I think that the germane thing here is not whether or not you split the record in two sheets, but that the sheets be identical: that sheet number one contain certain races and sheet number two contain certain races, and that you do not overlap one race on sheet number one on one ballot and sheet number two on another ballot. That would create a nightmare in trying to handle these things after the election. When you're talking about the multiple-ballot issues, those breaks are not arbitrary. You've got the same identical ballot races on each sheet of the paper. So if you had the requirement that the sheets had to be internally consistent- that is, that the races that are on sheet number one are well-defined and are always on sheet number one, and the races on sheet number two are well-defined and are always on sheet number two- that would solve the problem. The concern about a voter rejecting one and not the other is not valid, because if the voter rejects any, he or she is rejecting the entire ballot."

The Chair agreed with Dr. William's analysis, but believed the requirement required more work by the subcommittee as well. Ms. Quesenbery also offered a suggestion for rewording. "We might want to have a slightly more ability-neutral language than 'in view of the voter or in sight of the voter.' It might be something like 'in the presence of the voter.' "

Dr. Wagner offered a final requirement option for consideration by the STS Subcommittee. "The recommendation I would make would be not to require that all voting systems support multi-sheet. One option that could be considered would be to require vendors to specify whether or not they support multi-sheet, and if they do support multi-sheet, here are some of the requirements that they must meet."

Considering this and subsequent comments from TGDC members, the Chair noted that STS had an action item to follow up. He asked if the STS Subcommittee had a recommendation on a requirement linking the electronic and paper records.

Dr. Rivest responded. "My recommendation is that the linkage be supported. Clearly the election officials, if they want to get linkage information there and run some potential

risk of voter privacy violation in return for the potential cost savings in an audit, we should allow them that choice."

Dr. Williams offered a solution. "What if you printed the linking information on the paper ballot after the voter had voted and as it was scrolling off where he couldn't see it?"

Dr. Rivest agreed with this approach. "That would be a good solution, Brit, where it's either physically impossible for the voter to see the number as it's written on the paper, or it's written in some format that the voter can't easily digest and memorize, either one of those I think would be reasonable approaches."

Dr. Williams initiated a discussion of the 'should' PCOS requirement creating small batches of ballots for later auditing. "If this is left as a 'should,' it will never get done because it's quite complicated to build a receptacle under an optical scan system that will keep things in nice orderly batches. Most of the existing systems run every ballot through a standard big hopper unless there is a write-in vote on it. Then it diverts that ballot into a separate hopper. I don't know anybody that's got an approach to separate things into batches."

The Committee discussed the practicality of this requirement. Mr. Miller noted that there is a counterargument as to whether or not this is a desirable feature. "One of the arguments for using cut-sheet PCOS ballots is that there is some randomization that happens."

However, it was also noted that if a manufacturer can figure out a way to separate the ballots, it would be a convenience from an auditing point of view. Dr. Williams recommended keeping the 'should' requirement. Ms. Purcell recommended consideration of ballot batching just for absentee or early ballots.

Dr. Wagner offered a clarification. "We've made a distinction between VVPR and VVPAT. VVPAT is the printer attachment to a DRE. VVPR is the broader category that includes both optical scan and the VVPAT. And so there are some requirements that apply to both systems. This requirement is just saying that the precinct optical scan inherits all those requirements that apply to all VVPR systems."

The Chair summarized the discussion over the batch requirement in Section 6.4. "I am still hearing that keeping this as a 'should' mitigates people's concerns that it may be too complex or too costly but may be a good goal in some cases, with the exceptions of the automatic randomization that can occur with current voting systems." Discussion followed on the sub-requirement in Section 6.4 that appeared arbitrary including a batch size of 50 ballots. The Chair concluded that these requirements in Section 6.4 should be referred back to the STS Subcommittee for further clarification.

Dr. Williams expressed concern over the inability to develop standards for paper-free voting systems. "It's reasonable to assume that we're going to have electronic paper-free

voting systems for the next two, three, four, or five years. Whereas STS couldn't come up with any secure standards you're happy with, could you come up with some kind of guidance?"

Mr. Burr replied. "From my perspective, at least, I think we could design relatively secure electronic paper-free voting systems here at NIST. But we're probably not the world's best voting system designers."

Ms. Quesenbery interjected. "Perhaps the answer is that there are security requirements in the VVSG 2005 for guidance. What we might want to do in the period while this VVSG is being enacted is to leave well enough alone."

Dr. Rivest agreed. "I think that grandfathering systems that were certified under the older 2005 standards would be the appropriate approach here."

Dr. Williams expressed his opinion that this draft of the VVSG should not be silent on the ability to use current electronic voting systems securely along with accepted best practices and management procedures from the EAC.

Dr. Wagner offered his interpretation of these draft standards. "I think we should view the VVSG as designing a set of standards that determine whether voting equipment will be compliant to the next-generation VVSG, and I think we shouldn't enter into this debate in the text of the standards."

Dr. Williams recommended that 'verified' be changed to 'verifiable' in VVPR and VVPAT. TGDC members agreed. The Chair so moved.

Dr. Williams initiated a lengthy discussion on machine-readable paper records. "Has the human-readable portion got to be machine-readable or the machine-readable portion be covered by a bar code?"

Dr. Rivest offered his interpretation. "The intent, I think, is that the human-readable portion also be machine-readable. The NIST staff did a lot of investigating of OCR technology, and it really seems to have advanced tremendously in the last few years, so that having a requirement that the human-readable is also machine-readable is the intent here, I believe."

Dr. Wagner read the requirement (6.2-B) for clarification. "It says the paper record should be created in a manner that is machine-readable and then lists sub-requirements that apply to the machine-readable representations. But I'll note that it does not include the word 'shall' in the current form."

Dr. Williams responded. "Well, I guess the question is whether it should be a 'shall,' because to me, if the machine-readable portion is going to be that bar code, then you're reading something that the voter was not able to verify. The bar code is not voter-

verifiable. The only way this requirement makes sense to me is if the human-readable portion be machine-readable."

Considerable discussion ensued amongst the Committee. The Chair asked if there was consensus for changing the 'should' to a 'shall.'

Ms. Quesenbery replied. "I was one of the few supporters of bar codes, and I was a supporter of bar codes because I was looking to make sure the paper record has as many hooks for accessibility as possible. And requiring that the text be formatted in a way that's machine-readable will not only facilitate audits and so on, but will facilitate accessibility. I felt the same way about bar codes. I think bar codes are a well-known, easy, and inexpensive technology. OCR has come a long way, but there's the possibility that bar codes might be helpful to accessibility, and the HFP Subcommittee didn't want to see it ruled out. I do agree that if the main intent is to audit off of the text, that that text ought to be machine-readable for both audits and accessibility."

Mr. Miller expressed his concerns. "I, like Whitney, am a supporter of at least the option of having bar codes on the verifiable record, and in particular, I think this impacts the EBM technology, because it would be very difficult, I believe, to make that text truly OCR-readable, given the amount of text that would be on that ballot and given that it would also have to be able to read the location where the oval was filled in. I don't know how that would be done without bar codes. So it is my thinking this time with the knowledge I have of the technology, which may not be fully up to date, that the bar code would almost be necessary or required to be able to provide a feedback mechanism for people with disabilities."

Lengthy discussion continued. Dr. Jeffrey offered and withdrew a motion that the requirement be changed to read, "The paper record shall be created in the manner that is machine-readable." The Committee also considered separate requirements for VVPAT and PCOS. The final resolution proposed by Ms. Quesenbery and accepted by the Committee returned the requirement to the STS Subcommittee for further work. "And I think we're clear on what we want, which is to make sure that the vote records we produce are readable in as many unambiguous ways as possible without creating divergence of the information."

Dr. Williams concluded. "What I'd like to see out of this review is a requirement that covers a machine recount of VVPAT as a machine count of what the voter verified."

Dr. Jeffrey called on Dr. Hastings of NIST's ITL to continue the presentation of the STS Subcommittee.

Dr. Hastings thanked the Chair and presented a review of the STS Subcommittee changes to the VVSG draft since the March 2007 plenary. His overview included:

- General Update
- Cryptography Requirements

- Setup Validation Requirements
- Software Distribution and Installation Requirements
- Access Control Requirements
- System Integrity Management Requirements – New Material
- Communications Requirements – New Material
- System Event Logging Requirements
- Physical Security Requirements – New Material
- Security Documentation Requirements – New Material

(Dr. Hasting's presentation slides are posted for review at: http://vote.nist.gov/meeting-05212007/Hastings-STSoverview.pdf.)

Mr. Gannon asked for clarification on whether the electronic records requirements had changed since the March 2007 meeting. Dr. Hastings indicated that they had not changed.

Ms. Quesenbery inquired as to the software distribution and installation requirements for voting system testing laboratories (VSTLs). "Doesn't what the test lab shall do, sound like a test method rather then a requirement on the system? I think we've tried to be pretty rigorous in other places that the requirements and product specification are things that either the product must be able to do or the vendor must supply as a component of the product."

Dr. Rivest responded. "This is a somewhat different situation where you want the VSTL to participate in the authenticated build of the software so it's not testing a capability that the vendor supplied. They're just providing an authenticated piece of software in the end. It's a service capability they're providing to the election community."

Dr. Wagner elaborated. "This requirement describes the procedures that the test lab will use to build an executable software module that will then be distributed to all of the jurisdictions. So this procedure is needed to ensure that what the jurisdictions are using matches what the test labs actually tested and inspected."

Dr. Hastings noted that these software build requirements are based on requirements in the EAC Testing and Certification Program Manual. "In general, the requirements that are here are a lot more specific than the ones in that handbook, in that manual."

Dr. Rivest concluded. "So I think the question is whether this is the right way to do things. I think it is the right way. We want the system to work. The question is which part of these fit in the VVSG."

Ms. Quesenbery asked whether the National Voluntary Laboratory Accreditation Program (NVLAP) should comment on them. Mr. Skall replied. "Let's not confuse procedural requirements for voting officials with procedural requirements for testing because clearly we're not putting procedural requirements for voting officials in the VVSG. However, it seems to me that many of the instructions for test labs are procedural in nature. 'They shall supply this. They shall do this.' To me, it's perfectly appropriate to

put the software build requirement in the VVSG. It's a requirement on a test lab. So we have two sets of requirements in the VVSG: requirements on vendors which are much more specific and requirements on test labs which are typically procedural because they are telling the labs this is what they need to do in order to conform. This is how they test. This by definition is a procedural requirement. To me, it's perfectly appropriate to be in the VVSG."

In response to a Committee request, Dr. Hastings agreed to review the appropriate location in the VVSG for this and other requirements in Section 9.3.6.

With respect to the physical security requirements, Dr. Hastings asked Dr. Williams to comment on physical lock requirements for voting systems. "The thing that's generally talked about here is the compartment where the on-and-off switch, the memory card, and things like that are on the voting station. It is well known, for instance, that one key opens all the other voting stations. But the point is, that lock is not a security feature. It's a barrier. It's like putting a four-foot chain-link fence around your backyard. You're not telling yourself that you've secured your backyard. All you're doing is keeping the neighbors' dogs and cats out. And that little lock is there to keep voters and voters' children from tampering with what's in that compartment during an election."

Dr. Wagner offered a suggestion, "that vendors specify, for instance, if they have locks that are not a barrier security feature and the voting system's security does not rely upon the security of that lock, to specify for their locks whether they are relying upon that for security or not, and have the testing lab check those claims. So if the vendor says we're not relying upon the security of this lock for the security of our system, to then permit them to use a weak lock but to require the testing lab to double-check that, indeed, if that lock is picked, nothing bad happens."

Dr. Williams and Ms. Purcell initiated a lengthy discussion of keys for multiple jurisdictions and subsequently the definition of 'jurisdiction' in this requirements section.

Dr. Hastings explained. "The term 'jurisdiction' was used to provide a delineation to determine at what granularity non-common keys should be available. It doesn't necessarily say that, across jurisdictions, you could not use it. It says that the equipment could be configured such that, at the jurisdiction level, you could do that."

Dr. Williams responded that he agreed with the way the requirement is currently written.

Dr. Jeffrey summarized. "The way I read this requirement is, if a state wants one unique key for the entire state across all jurisdictions, that this requirement is consistent with this. It's up to the state. It's just that the vendor needs to have the ability to go down to the jurisdictional level if the customer desires. And I think that's the way that it's written now."

Dr. Williams agreed and noted that the jurisdiction is defined in this instance as the entity that owns and is responsible for the equipment.

Dr. Jeffrey asked for more clarity on Dr. Wagner's previous recommendation for a check by the testing laboratory. "If we have the clause in the requirement that the testing labs need to verify- if they said it's not a security feature- the testing lab needs to verify that. I am not sure what the testable piece is here, and we put the burden on the test labs without the ability to test."

Dr. Rivest responded. "Presumably that requirement would fit well within the open-ended vulnerability testing (OEVT) portion of the testing. So the testing requirement could say: we can assume that this lock is a meaningless barrier or trivial barrier in terms of testing. If the labs can launch an attack that presumes that that lock be picked or actually pick it in the lab, I don't care. Then that would be one way of testing it. The question is what attack you can mount given that that lock can be picked easily."

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

May 21, 2007: Afternoon Session # 2

The Chair called the meeting back to order and asked Mr. Wack to resolve the issues raised by Mr. Gannon in the previous session with respect to electronic records requirements.

Mr. Wack noted that the electronic requirements section is currently in Chapter 5 of the draft VVSG. He noted that NIST staff needed to review electronic records requirements presentation slides from the March 2007 presentation. If there are indeed new items for the TGDC to review, they will be raised at the plenary on Tuesday. Mr. Wack then asked Dr. Flater to review the CRT Subcommittee changes to the VVSG section entitled previously 'Interoperability' and now titled 'Integratability,' that deals with the integration of electronic records.

Dr. Flater noted that the relevant sections in the VVSG are in *Volume 3*, Section 16.6 and Section 16.7. "It is not titled 'Integratability.' We had a discussion about this on an STS Subcommittee conference call, and the wording changes that I made to this section made things possibly more precise but did not make a substantive change to the intent of the section. I believe that the language that was agreed upon in that conference call now appears in this section. I would call your attention to the bottom of the informative text. It mentions that the barriers to interoperability are further reduced if all systems support the same commonly agreed-upon industry standard format. Similar changes have been made to the requirements that follow. Additional informative text has been added to reduce the barriers to interoperability. Vendors should strive to use the same commonly agreed-upon industry standard format." He noted that Mr. Wack is continuing to make edits to the informative text for this section to add specific references to standards and standards work that is ongoing at this moment, including Election Markup Language (EML) and the effort that is ongoing in IEEE.

Dr. Wagner inquired whether STS had discussed a requirement for the voting system to have the capability to export cast vote records (CVRs) in a royalty-free, open published format. "I see looking at this text that that's not currently a requirement. Is there an expectation that that requirement will be added or is it somewhere else?"

Dr. Flater noted that this capability offers one approach to satisfying the 'integratability' requirement. "We have a 'shall' requirement here saying all DREs shall maximize 'integratability' with respect to ballot image data, which are the CVRs. And one way of satisfying that requirement is by providing the capability to export that data in a royalty-free published open format. However, there's another way to satisfy it listed here, which is use of an open database."

Extensive discussion ensued on the benefits to export of CVRs in a royalty-free published open format. Dr. Wagner stated, "I think, if this enhances interoperability, the number-one potential benefit for users might make it easier for new voting technology to enter the market and interoperate with the existing systems that you already have. So it might make it easier for you to extend your voting system with solutions from other vendors. It might potentially increase the ability to mix and match systems across multiple vendors. So it might reduce the barriers to entrance for small vendors." He then noted that there was a downside to the requirement of added cost. "Any time you add a new requirement, of course, there is some additional burden on the vendors, which translates into some additional cost for officials."

Mr. Miller noted the current lack of a defined public markup language export of records by vendors.

Dr. Wagner clarified his suggestion. "It might be worth considering a requirement that vendors have the capability of export in some publicly defined format of that vendor's choice. So that's not picking any particular standard per se. It's allowing the vendor to choose the export format. Right now, today, I believe that many systems have the export capability, but I'm not sure that they're in a publicly documented format."

Dr. Williams cautioned that this requirement would require recertification of an interoperable voting system, "because right now, there's no provision for certifying a component of a voting system. In addition, you couldn't get it certified unless one of the major vendors would allow you to make it part of their voting system."

Mr. Miller elaborated. "This interoperability using components from one vendor in combination with other vendors would first of all have to be tested and approved at the federal level before at least my state (Washington) could look at it."

Dr. Flater noted the need to avoid false promises. "In fact, what we have is not an interoperability testing regime. What we have is a conformity assessment process, and interoperability cannot be achieved through conformity assessment alone."

Mr. Gannon offered perspective. "The comment Dr. Flater was making about being published in open format is what's specified in requirement 16.6-A3. In our STS discussions, I pointed out that you'll never achieve interoperability simply allowing vendors to use formats that are simply open and published without agreeing upon a common set of formats. And so the solution was to remove reference to interoperability as opposed to getting to commonly agreed-upon open published formats. Certainly it has a cost issue as I've heard from vendors, that today there are requirements to export in multiple formats, because different states have chosen different formats and they're doing that today. So there's an added cost that vendors incur in creating and providing an export function and then having to do it in multiple different formats. As new equipment comes on or a new format comes up, then it's multiple output capabilities. So the issue of having the common agreed-upon formats can be seen as one that tends to drive down the cost. It's something that is seen in many, many different industries that have gone to that step of agreeing upon common data formats to achieve interoperability between different systems, whether it's components or just different systems. In the case of voting where you have systems in a precinct or a county that have to have data rolled up and sent to a state level, you know, often times there are different systems involved there. So that kind of tabulated data export capability comes into play there. My understanding was as precincts and counties are changing out equipment with the need to provide accessibility features, the mixing and matching is increasing as opposed to having a single vendor solution throughout an entire state. So the need for this export capability is increasing. I will note one other point of cross-referencing in *Volume 5*, Section 3.5, we have a section on interoperability testing that says at some point, here's what's required to do interoperability testing."

The Chair received no recommendation from the Committee for a change in the requirement at this time. "The discussion of interoperability testing was informative background to clarify this distinction between conformity assessment and interoperability testing."

Dr. Jeffrey called on Mr. Wack and Dr. Rivest to provide a presentation titled "E-poll books: Ballot Activation with External Network Connectivity."

Mr. Wack prefaced his remarks. "At the March 2007 TGDC meeting, I did a presentation on ballot activation. Ballot activation is now being done by e-poll books. We don't have requirements for e-poll books in the draft VVSG. We have requirements for ballot activation. So I just want to make that clear to you, what we're really talking about here is ballot activation requirements and not e-poll book requirements per se."

Mr. Wack provided the VVSG working definition for a voting system:

> *Voting System: Equipment (including hardware, firmware, and software), materials, and documentation used to define elections and ballot styles, configure voting equipment, identify and validate voting equipment configurations, perform logic and accuracy tests, activate ballots, capture votes, count votes, reconcile*

> *ballots needing special treatment, generate reports, transmit election data,*
> *archive election data, and audit elections.*

He noted that, in general, voting systems are not externally networked. "There are voting system arrangements that could involve networking of components within the voting system, but in general, these voting systems are not networked outside of the polling site."

He then summarized STS recommendations related to e-poll book requirements:

- At the March 22-23, 2007, TGDC meeting, the TGDC did not object to allowing e-poll books to activate the ballot while they are connected to external networks/databases at precinctless voting centers.

- STS has reconsidered this and now recommends that e-poll books not activate the ballot if connected externally due to :
    o Threats to security
    o Threats to reliability and integrity

- Various workarounds are possible so as to continue using e-poll books and not unduly affect voting centers.

Dr. Rivest then commented on the recommendations from the STS Subcommittee. "I think we realized that the issue of attacks over the network is not just hypothetical. We have seen real instances where voting systems have been brought down at least temporarily by a network attack. I think it was slammer worm that was attacking some of the databases in Sarasota County on the day of election that caused a serious disruption of services. There is an important trade-off here of trying to ensure that voters don't vote twice. So some connection with a statewide database may be important, as well as ensuring that the operation of voting can be robust and continue working in spite of various attempts to hack in over a network. In the end, the STS came to a consensus that e-poll books should not both be able to activate ballots and be connected over an external network. So if you've got a machine that's connected to the network, you assume that machine is able to be compromised basically, and therefore, you don't allow it to play an essential role in the voting procedure by activating ballots. So the STS Subcommittee is recommending that we draw a line and say that if the poll book is networked externally, then you need to have some other mechanism to activate the ballot which may involve the poll worker using a separate device to activate a token. Clearly there's a trade-off. You may have accuracy issues with the poll worker performing that function."

The Committee then engaged in a lengthy discussion of potential threats verses the advantages of networked e-poll books.

Mr. Miller emphasized the advantage of e-poll books from his viewpoint. "We are addressing a very specific situation. I think the major advantage when these e-poll books are externally networked- they are available in a wide area. The primary advantage that I

would see allowing this connectivity would be ensuring that the voter gets their activation device activated correctly. If the poll worker is going over to another device and typing in what the code is, I think that that feature is actually a move forward. Right now, election workers have you sign for that paper ballot, and the poll worker has to either hand them the right ballot, which they don't always, or issue the voter the right code. Mistakes are made there. So being able to activate it directly off of the database is an advantage. Now really the only environment in which I see this coming into play is in regional voting centers or early voting, because usually on Election Day, you've defined who can go to that polling place. So you could either have a device that has the names of only the people that are eligible to vote at that polling place. Then the e-poll book could now issue the activation code and still meet your requirements, because it's not connected to the outside world." He then inquired into previous discussion on the possibility of limiting the amount of information on the editing token.

Dr. Rivest responded. "Yes, we talked about that too at the last meeting and in the STS Subcommittee. It's not inconceivable that you could do something there. But, even then, you have got a corrupted poll book feeding information to voters about what precincts they belong to and so on. It's a major threat to the integrity of what's happening on the election. So I felt an air gap was probably a better mitigating mechanism."

Dr. Williams inquired. "Did the subcommittee delineate the threats that could occur to the voting system from this network database? For instance, I don't see how anybody could introduce any fraudulent code into a voting station through this mechanism. All I can see that they might do is corrupt the registration database."

Dr. Rivest explained. "If the ballot activation station is totally corrupted, and you've got a one gigabyte thumb drive as the ballot activation device, then you've got a channel there for passing large amounts of information to the voting station, and if there is a buffer overflow attack on the voter station, you've got a real problem. Security systems have been broken with much sort of narrower windows of vulnerability."

Dr. Williams expressed his doubts. "Sometimes I think we are seeing ghosts. Wasn't this question vetted extensively in the election community? Didn't NIST send this issue out for comments to a number of elections officials?"

Mr. Wack recalled. "That's right. The Election Assistance Commission helped us out. We got some good feedback. I think that a number of the election officials who responded mistook it as basically a question as to whether e-poll books should activate the ballot, period. I'm not sure that the question of whether e-poll books should activate the ballot and simultaneously hook up to an external network was well considered. I recall some discussion in STS meetings of feasible alternatives that did not necessarily preclude having an e-poll book at a voting center, where that e-poll book is periodically being refreshed and refreshing the central database."

Dr. Rivest responded. "It certainly was the case that there was no discussion of banning e-poll books. Those provide a valuable service in these contexts. With respect to denial of

service attacks, if all the e-poll books can be deactivated by some attack over the network, you have to have some backup procedure for activating the voting stations anyway."

Dr. Williams noted that election officials always have backup procedures. He offered another threat scenario. "Let's say that you do not connect the e-poll books during the election, but you do connect them up to download the data. Then I subsequently connect it to a voting system to activate the ballot. Isn't that just as dangerous? Couldn't this contain malicious code in the e-poll book waiting for me to connect it to the voting station?"

Dr. Wagner responded. "From a security point of view, what you are talking about, I believe would likely happen within a county warehouse. The e-poll books might be connected up within a county network, and if it was under the county's control, that would obviously be much less of a security issue. I would like to suggest we do not get too caught up in just the security aspects of this. I think an even more serious concern is the reliability concern. If you are relying upon the network and that central database to be working correctly to activate that ballot when the e-poll books are externally networked, then if your network fails or the central server fails throughout the jurisdiction, you can no longer activate ballots, and you may not be able to use your voting system. That single point of failure is a reliability risk."

Dr. Williams emphasized that election officials should always have a backup for registration data. "You don't allow single-point failures anywhere. It concerns me that you're taking a simplistic approach. You're saying because it would be difficult to secure this device, we're just not even going to attempt it."

Secretary Gale concurred. "I am opposed to attempting to go back and address the security of e-poll books. I think we need to maintain flexibility for our election workers, both on the precinct level and on the state level. We are talking about future guidelines here. We are talking about guidelines for equipment four or five years from now. Every time there is any kind of attack, the industries always come forward and figure out ways to address them whether they are viruses or whatever the attack might be. If there is vulnerability here, I think it will be addressed in the course of time by industry or by experts. The e-poll book has served as a very valuable and useful tool on the local level by those who are handling both the voter registration and the ballot validation. So I think I agree with Brit, we are worried about ghosts. I think you can take any of these things to a theoretical level and find things to fear, but life goes on. We've been dealing with challenges on a lot of different levels in over 200 years of elections. We have got to focus not on what is going to be a perfect voting machine, but instead on how to interface your election community with the voting equipment they are using on many different levels across the country. I think the e-poll book is a very valuable tool, and we should allow it."

Mr. Miller agreed that the e-poll book is a valuable tool. "I think none of us are arguing on that one. The networked e-poll books are needed for regional centers and early voting.

I think that's been a boon to our election process. The question is how to secure it." He referred back to Dr. Wagner's comments. "There has to be a contingency plan if that external network gets slammed, and you get a denial of service attack on it."

Dr. Rivest responded. "So the argument is not about the value of networked e-poll books. I mean those definitely have value. The question is whether they should also be the ones that are creating these ballot activation devices."

Dr. Wagner interjected. "I want to make sure we don't have a perception there that we're talking about academic, theoretical, or hypothetical scenarios. The reliability risks here are real, and in fact, they happened in one of the first few jurisdictions to deploy network e-poll books on a wide scale. In Denver, we had a well-publicized incident where they had a very serious failure. The servers got overloaded, and as a result, there were large delays that had a significant impact on the election. So I think we need to think carefully about the reliability implications of networked e-poll books that are also used for ballot activation. There's no question the network e-poll books have value. I think the issue is should we be using them for activation."

Dr. Williams noted that the Denver incident was not a security issue. "It was an operational issue, and operational issues can be addressed and solved.

Dr. Wagner agreed. "This is not a security issue at all. That's why I described this as a reliability issue. Unfortunately, it's challenging when you have a single point of failure that is an inherent risk from an engineering point of view, based upon relying on the network to be working. That is a challenge."

Ms. Quesenbery inquired as to the possibility of allowing private network connections as opposed to public network connectivity. Dr. Wagner responded. "In principle, it could potentially make a significant difference. Unfortunately, the direction we're heading is that there really are no private networks anymore."

Dr. Jeffrey posed a question to Dr. Williams. "You mentioned that no system should have a single-point failure, and David made a compelling argument that we've introduced a potential single-point failure. Based upon that, it seems that if we ignore security for a second, there may need to be a requirement that the voting system should be able to operate independently of a networked e-poll book system. If that network goes down, there needs to be a backup system. And I think that's sort of what you described."

Dr. Williams agreed. "You can provide backup for your registration database, and that's what you're talking about if the network goes down. What this means is that if you vote in one polling center, I won't know about it in another polling center. Well, there are ways to get around that, and there are ways to transmit that data in the event that the network goes down. But the point here is that the e-poll book is a very, very significant part of the future of elections."

The Chair agreed. "So the question is whether or not we have overprescribed in some sense the situation. We may want to back out a bit by specifically calling for the fact that there needs to be a backup if the network goes down."

Dr. Williams responded. "Yes, there needs to be a backup. And by the way, there are some states that still have private dedicated networks. We have one in the state of Georgia. Be that as it may, to just summarily say that you can't use the e-poll book the way it's intended to be used, to me is unacceptable. We've got to do better than that, folks. We've got to come up with ways to help people get their job done."

Dr. Jeffrey concurred. "What I might recommend is that the STS Subcommittee goes back and crafts a requirement that talks about the backup capability. So if the network goes down, regardless of why the network goes down, whether it's due to power failure, whether it's due to a denial of service attack, or whatever reason, that the voting system should still be able to be activated. What I'm suggesting to STS is that they solve the reliability issue and that would still allow networked e-poll systems."

Dr. Williams noted another omission. One of the things that has not been taken into consideration here is the external ballot-activating device where a human being intervenes to identify a ballot style and activate a ballot. This is the weakest link in most DRE voting systems. To have that function automated where the poll book automatically goes into the voter registration database, looks at where you live, determines what ballot you're entitled to, and automatically issues it without introducing the human error is considered a great boon to elections."

Dr. Wagner agreed that there was the potential for significant advance here in election administration. "The really tricky part is when you have vote centers that are multiple early voting locations where voters can choose to go to any of a multiple of different locations. If you want to be able to prevent someone from voting at more than one place on the same day, for instance, then you need some kind of communication between the vote centers. So I think that is where we are really struggling to find a solution that can accommodate that and that answers all the security and reliability issues."

Secretary Gale inquired. "Dave, does it make any difference if the local jurisdiction is using a closed system, in other words, only accessible by password from each of the locations that have the e-poll book? Does that reduce the risk that you're talking about, or is it just as vulnerable in that kind of a closed system as if it's just open to the Internet?"

Dr. Wagner responded. "They are closed systems in the sense that authentication is required to get around them, but they still are networked and these systems have vulnerabilities. Sometimes communication channels are connected to the Internet that you didn't know were connected."

The Chair concluded the afternoon session with the review of a table that would provide members with the status of various chapters of the VVSG for their review. "One of the things that I asked if the NIST folks could put together for your homework assignment

for tonight is a list of all of the chapters and sections that we believe are ready to be approved and then those sections that still have further discussion that cannot be approved tomorrow."

Before adjournment, the Committee reviewed and edited the table. (The VVSG Volume Status table is posted for review at: http://vote.nist.gov/meeting-05212007/chapter-status-052107.pdf .)

Dr. Jeffrey adjourned the meeting until Tuesday, May 22, 2007, at 8:30 a.m.

May 22, 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 ten members in attendance (see Table 1).

Dr. Jeffrey reviewed his expectations for this second day of the plenary meeting. "Each of the VVSG chapters still requires a significant amount of technical editing, cleaning up, and cross-referencing. What we would like to do is get a vote today on whether or not the TGDC feels comfortable with the draft technical guidelines in general for the CRT sections and for the HFP sections. With respect to the STS sections, there are obviously a number of action items that went back to the subcommittee yesterday so we should wait on that. And following that, then the technical editing should really begin. We should clarify all the sections, making sure that all the definitions are accurate, and that all the material is captured in the right place. And then what we plan to do at the next TGDC meeting, which hopefully will be around the end of June, by public teleconference, we will do the final chapter-by-chapter confirmation and affirmation of approval. So again, today I would like to try getting the top-level affirmation that we are sort of on track on the HFP and CRT material."

Secretary Gale offered a motion for preliminary and conditional approval of the HFP sections of the VVSG. The motion was seconded for discussion.

Mr. Gannon inquired. "This was one of the chapters that in the Volume Status Table was marked as partially complete, except for cast ballot recommendations, performance numbers, language consistency, and partial vision. Can somebody explain how that's being handled or taken care of if we are giving this conditional approval?"

Ms. Quesenbery responded. "I think the approval is conditional on the finishing of those sections for our final review."

After several friendly amendments were accepted by Secretary Gale, the Chair read the resolution.

Resolution # 03-07 HFP Preliminary Approval
Offered by Secretary Gale

The TGDC grants preliminary and conditional approval for the TGDC HFP Subcommittee to complete the HFP sections of the VVSG (Volume 3, Chapter 3) subject to final review of the edited and updated materials.

Dr. Jeffrey inquired as to whether there was objection to unanimous consent to adopt TGDC Resolution #03-07. Hearing none, the motion passed unanimously (see Table 1).

Dr. Laskowski expressed her appreciation. "Let me just thank everyone on the TGDC for all of your great comments, and I hope to get some more comments to complete this, but you have all been very helpful."

Dr. Jeffrey asked if there was a similar motion for CRT. Ms. Quesenbery offered the motion for CRT preliminary approval. The motion was seconded. The Chair read the motion for discussion.

Resolution #04-07 CRT Preliminary Approval
Offered by Ms. Quesenbery

The TGDC grants preliminary and conditional approval for the TGDC CRT Subcommittee, working with other subcommittees, to complete the CRT sections of the VVSG (Volume 2, Chapter 2; Volume 3, Chapters 2, 16, 17, 18; Volume 4, All; and Volume 5, All) subject to final review of the edited and updated materials.

Dr. Rivest asked for clarification. "I was wondering if somebody could comment a little bit more about the current state of Volume 5."

Dr. Flater elaborated. "Volume 5 is the testing standard that, for the most part, specifies what the test labs must do as part of the conformity assessment process. Both Volume 4 and Volume 5 have material that is yet to be integrated from the other subcommittees. For example, in Volume 5, anything about open-ended vulnerability testing that is going to be contributed from the STS Subcommittee needs to be integrated into that."

Mr. Gannon commented. "I have one question about the inclusion of Chapter 16 in this granting of preliminary conditional approval. We had a discussion yesterday on the changes from 'interoperability' to 'integratability.' There were still some questions raised that we didn't get to complete. I think that is probably an area that getting further public commentary will be helpful."

Secretary Gale agreed. "That needs another serious look by the TGDC and ultimately by public comment, but this is preliminary and conditional. Whatever is accomplished between now and the final teleconference will be redlined. We will have a chance to see what may be a much improved version of 'integratability.' "

Ms. Quesenbery concurred. "I think, for me, the key point is that nothing we're doing here cuts off discussion or work on any section. So if there are sections we find, as we read them, where we have issues, they can still be raised. I think the important thing is we are not closing any doors here. We are simply allowing the subcommittees to continue the work of drafting. I think, in particular, the work of harmonization and technical editing will make reading it a lot easier."

Hearing no further comments, the Chair asked if there was objection to adopting TGDC Resolution #04-07. Hearing no objection, the motion was adopted unanimously (see Table 1).

Dr. Flater expressed his appreciation. "I, too, would like to thank the Committee for all the great input and review that has occurred on the teleconferences and in e-mail, and I look forward to working with you to finish these guidelines."

Dr. Jeffrey asked Mr. Wack to lead a discussion on open issues where NIST requires further guidance.

Mr. Wack thanked the Chair. He enumerated the open issues and added additional ones suggested by Committee members.

- CRT:
    - Changes to glossary and ramifications to changes
- STS:
    - Status on bar codes: Shall human-readable on VVPR (for EBMs) be machine-readable?
    - Requirements to support multipage cut sheet VVPAT summaries - clarification
    - Where selected material in Software Distribution, 9.3.3 - 9.3.6, goes in Volume 5
    - Thermal paper and paper roll issues
    - Electronic records
    - E-poll books.

Dr. Rivest added. "There were a couple of other things that STS was explicitly chartered to think about yesterday. There was an issue in Section 6.4 about batching of ballots."

Mr. Wack responded. "We had the impression that should be a 'should' requirement and not a 'shall' requirement. That it is something that may be difficult to support, but the idea was good." He then asked Dr. Flater to comment on glossary changes.

Dr. Flater cited his concerns. "We have heard comments to the effect that folks want to possibly change some of the definitions that are in the glossary. And I am here primarily to sound a note of caution about how this is to be conducted. I want to read a paragraph that appears in the scope and applicability section of the VVSG terminology standard.

'Terminology for standardization purposes must be sufficiently precise and formal to avoid ambiguity in the interpretation and testing of the standard. Terms must be defined to mean exactly what is intended in the requirements of the standard, no more and no less. Consequently this terminology may differ from plain English and be unsuitable for applications that are beyond the scope of the guidelines. Readers are especially cautioned to avoid comparisons between this terminology and the terminology used in election law.'

In other words, the purpose of the terminology standard is to provide well-formed terminology as a foundation for the VVSG. So consequence number one is that the terminology standard is not an end of itself. We are not trying to define a standard terminology for all 50 states to use. We understand that all 50 states have terms defined in their own election law. And in all likelihood, there are inconsistencies among them so we cannot try to do that here. We need to focus on what is required for this standard. A second consequence is that we have to be very careful when modifying the terms that appear in the terminology standard. When the norm of text of a definition is changed, it changes the meaning of every single requirement in the products standard that uses that term. So the consequences can be drastic by changing a single word in a definition. As the Committee discusses the changes that need to be made to the terminology standard, we need to pay attention to these consequences and have a full discussion and consideration of what those consequences are and whether they are, in fact, intended by the change that is made to the terminology standard."

The Committee engaged in extensive discussion of terms that would benefit from redefinition, clarification, or a word substitution including such terms as: voting system (device), general election, and partisan contest. Dr. Jeffrey summarized. "What I would like to do is follow up on Whitney's suggestion and actually task the TGDC to review the definitions to try to identify those definitions that they believe are, to use David's phrase, 'damaged' in the sense that they would be confusing to the broader audience. Try within one week to contact David with those definitions that you believe to be 'damaged' or 'ruined.' So there is a higher threshold ruined on that. And then David, on a case-by-case basis, will deal with each term."

Mr. Wack then initiated a discussion of bar codes. "I believe we have requirements in the VVPR section (6.3) that currently permits the use of bar codes. There are caveats on those requirements including the use of a fully disclosed industry standard public format (pdf 417)." In response to a question from Dr. Williams, Mr. Wack noted that use of bar codes (nonhuman-readable information) was optional.

Dr. Wagner then noted that the option, in fact, extended to both the vendor and the election officials. "I believe it is doubly optional, in the sense it is optional for the vendor whether or not they want to include the nonhuman-readable information. If it's included, then the vendor must provide the capability for election officials if they choose to turn it off."

Secretary Gale expressed his concern over a possible conflict in the use of the term 'durable ballot' in pending legislation if the receipt becomes the official ballot versus a piece of paper with a bar code that is simply used for efficient and rapid random auditing.

Mr. Wack indicated that a rewording of the requirement changing the term 'ballot' to paper record would be useful here. "We're trying to stay completely away from that and simply just assume that the paper record shall be fully usable in audits or recounts."

The Committee engaged in a long discussion of bar code usage. Dr. Rivest cautioned against use of bar codes on paper ballots if not used carefully in audits. "When you are doing an audit, you want to check the record that the voter verified directly, and the voter will not be verifying the bar code."

Dr. Williams sought closure on this issue. "There are two steps here. One is using the voter-verified information to verify the recording of the vote. The other is to use the bar-coded information to verify the accuracy of the voting system. In the kind of audit Secretary Gale is talking about, you would first run a test of the voter-verified information. If that's successful, then you're safe using the bar-coded information in a high-volume audit to verify that the accuracy of your voting system hasn't been challenged."

Mr. Miller concurred. "I essentially agree we need to make it clear from all perspectives that it is necessary to verify the human-readable information against the bar code. The bar code should not be used without having gone through that step."

Discussion ensued on whether the human-readable text on the voter-verified paper record should also be machine-readable. Dr. Wagner indicated this applied to VVPAT only. Ms. Quesenbery indicated that this was a 'should' requirement for EBMs.

Mr. Miller raised concerns and concluded. "If the issue is simply should the font on the VVPAT be machine-readable and the font on the paper ballot type of media doesn't need to be machine-readable, then I agree with that. If the issue is whether or not the VVPAT should be accessible and verifiable to people with disabilities, but the EBM technologies do not need to be, then I have a problem there."

The consensus of the Committee echoed by Mr. Wack agreed with Mr. Miller's former interpretation of the issue. "The way we drafted the requirement is not with reference to the type of device but rather the type of record it produces, because I think that would more clearly address that we care what the record is."

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

May 22, 2007: Morning Session # 2

The Chair called the meeting back to order and recognized Mr. Wack to continue a discussion of issues for Committee guidance.

Mr. Wack thanked Dr. Jeffrey. He briefly reviewed the current paper roll requirements ensuring durability, fitness for audit, and the 22-month record retention. "We have a number of paper rolls requirements that apply to the quality and thickness of thermal paper."

Secretary Gale asked for clarification on whether paper rolls were in fact rendered obsolete by these requirements. "I feel the same way about the paper rolls as I felt about the bar codes. I think it is an effective technology that should be allowed in future election equipment planning and design, particularly if it's going to be used for the purpose of a voter verifiable paper roll and not for the purpose of a durable ballot. You can then have a bar code on that paper roll, and you can use it with a scanner for purposes of audits. You gain a lot of election administration efficiency that way. I think this means that there is going to be this enormous divide between equipment that is used for a verifiable paper trail and equipment that is used for durable ballot. But I just want to preserve the paper roll option as much as possible."

Mr. Wack indicated that the requirements currently preserve the use of paper rolls in the future. He asked Mr. Burr to provide an overview of the electronic records requirements. Mr. Burr noted that the electronic records must be in an open format, digitally signed, and produce tallies that support an audit.

Ms. Quesenbery initiated a discussion on the consolidation of electronic record requirements. "I presume the requirements were written largely from the perspective of security of those electronic records. It seems to me they also have a core requirement function, which is supporting the work of the election officials. It would be nice if all of the requirements for the electronic records were gathered in one place. I think, specifically, those on the Committee who actually use this information in the field need to make sure we have a record that is not only secure but useful."

Dr. Rivest noted some inconsistencies with terminology here as well. "In a couple of discussions, some of the terminology like the final election tally report, I think, may not be consistent with the way these reports are used in the field." Mr. Gannon also noted inconsistent and inaccurate use of terms between Chapter 4 and Chapter 5, such as final election tally report.

Mr. Burr indicated that NIST staff would review all terms for accuracy and consistency.

Mr. Gannon inquired as to the stated purpose of the electronic records chapter. "What is the intent of the use of electronic records as they are described in the specific set of requirements? Are these requirements specifically to support auditing or should we expand this chapter to include requirements for electronic records that would support 'interoperability' or at least 'integratability,' going back to Volume 3, Chapter 16?"

Mr. Burr responded. "At this point, this is all in the security section. It was done to facilitate an audit, as we said in the introduction of the section." He deferred to the TGDC on their intent for the scope of these requirements.

Mr. Gannon noted the need to be clear on the scope of the requirements in Chapter 5. "I do believe that the introductory section of this chapter should be expanded to include a statement on usage of electronic records to support interoperability between election systems or system components- whatever the appropriate definition of that is- and that may be qualified in terms of not specifying interoperability testing, but instead, to support that feature so that it falls in line with the definition under the 'integratability' requirement. That is, it may be met by providing the capability to export data in a royalty-free published open format. So this section would then be in harmony with the 'integratability' sections. I would at least request that this be harmonized with that and then determine how this is expanded or whether this is meant to follow up on TGDC Resolution #23-05."

Mr. Skall offered a point of clarification. "All we're doing in the testing section, all we can ever test for, is conformance to the standards. We can't test for interoperability. I believe everyone is comfortable with that. So the only real issue here is would we define the requirements differently because that is a goal? Are there requirements in this section that should be worded differently because of this 'integratability' goal?"

Mr. Pearce responded. "Given that it is a choice to not specify interoperability in this VVSG , then yes, we need to figure the lower-level requirement of 'integratability,' and in the electronic records section, put appropriate sentences in that section that state that this set of electronic record requirements includes definitions that would enable some of the 'integratability' capabilities."

Addressing the question from Mr. Skall on whether there was a need for different electronic record requirements wording, Mr. Gannon responded. "The answer, I think, is dependent upon feedback from experts in the marketplace during public review. There was an action item stated at our last meeting that NIST would be sending out the requirements to the IEEE P1622 and the OASIS Election Voter Services Technical Committee for review. What is the plan to do that and be sure we get the feedback in a timely manner?"

Mr. Wack responded. "We do plan to add informative text to the requirements that essentially says the export records format should be along the lines of a publicly available interoperable format. We would point to IEEE and OASIS as groups where that work is under development. At a future time, probably post July 2007, working with the IEEE and OASIS, we are on tap to make sure that those standards development groups have all the materials they need in order to judge whether their formats are going to be able to fully support requirements in the VVSG. I would prefer to focus more on what should actually be in the VVSG right now. And as I understand it right now, we do need to put in some informative text along the lines of pointing to these standards development committees."

After further discussion, the Chair noted the need to harmonize the language in Chapter 16 on 'integratability' with electronic records requirements in Chapter 5. He then summarized. "Unless a TGDC member disagrees with me, I will propose the intent of the TGDC is to maximize 'integratability' across all systems and across all records. With that, one should then look at Chapter 5 as to the additional text necessary to try to harmonize that with Chapter 16."

Dr. Rivest concurred. "I understand Patrick's presumed disappointment that we weren't able at this stage to pick a particular format to recommend as a requirement for the vendors to use. I would certainly expect at the next incarnation of this Committee, and I am sure there will be one, we would be in the position to be able to mandate a particular format. I would hope that the election industry and NIST work towards achieving this as soon as possible, because there are lots of benefits to be obtained."

Mr. Gannon inquired as to the intent of the Committee for public comment on these chapters.

Dr. Jeffrey emphasized that the VVSG development process has been entirely public. The various versions of the VVSG are posted at http://vote.nist.gov. Public comment has been requested at each plenary meeting addressed to voting@nist.gov. "So we encourage the public to provide comments during this period. This is not to take the place of the formal public comment period, which happens after this document is formally delivered to the EAC. But we always benefit from the input from the public on this."

Mr. Miller offered some feedback to Mr. Gannon and then a question to Mr. Burr. "Election officials are concerned with 'integratability' and interoperability. The key issue from an election standpoint that would need to be resolved is the ability to do a ballot layout once. Then the different voting equipment would need to be able to use that ballot layout to initialize their ballots for presentation. And I think that that is the area that has been the most difficult to solve. It would also require a definition of the fields and the kinds of information that are needed by the different systems in order for them to initialize a ballot definition on their system. I think that is a fairly complex issue that we are probably not going to solve in the near future." He then asked Mr. Burr, "I would like for you to verify for me that the public key election certificate does not require complex calculations by the poll workers: that it is simply what the machine does."

Mr. Burr responded affirmatively. "It is what the machine does. We do not expect poll workers to do complex math problems, even on paper."

Dr. Rivest introduced the last open issue for discussion: reliability and security for networked e-poll books. He noted the possibility of Committee agreement on requirements specifying an air gap for e-poll books that also activate the ballot. Also, he offered the possibility of a switch on the e-poll book that would allow it to be used as a ballot activation device or to turn off the function. "That is another way of handling some of these difficult issues where there are obviously benefits to election officials having the

poll books perform the ballot activations but also affords risks. Maybe that judgment call is one that we need not make here, and it could be passed on to the election officials in each state as appropriate to judge. They would assume that risk. They have suitable backup procedures and so on to take that risk or not. That to me is maybe a very workable proposition. And let me put that on the table for discussion."

Ms. Quesenbery responded. "I think we heard yesterday about a lot of the benefits that these e-poll books could offer for the accuracy of elections, and I think as you stated it as a switch option on the device. But I think we could certainly offer the option in many other cases for election officials to make determinations about which capabilities they use and don't use. I think that is essentially what we are saying here. I hope that we are not so afraid of technology that we don't take advantage of the opportunities it gives us and what we can do to figure out ways to create a protective environment in which we can take advantage of them."

Mr. Miller commented. "I appreciate Ron's discussion, and I do think that what we have here is a clear policy issue in terms of balancing the very clear prospect of having more accuracy in an election with the security risks. Ron has very persuasively presented a security risk, and I think we have a clear policy decision here, and the suggestion, as I understand it, is basically to move it forward allowing the election administrators to make that policy decision."

Ms. Purcell agreed. "I think what we are looking at is greater accuracy in our polling places. It is difficult to get the poll workers on a general basis to do everything exactly right. And this would facilitate making sure that that voter got the right ballot."

The Chair added one other element for consideration. "I heard accuracy, reliability, and security, and I just want to add privacy to that list. Whatever is fed into the machine is sort of a one-way feed. I know we talked about that in the last meeting, and I believe the subcommittee is still working through some of that." Dr. Jeffrey then asked Dr. Rivest about the possibility of requirements limiting the data storage capabilities of the voter activation token.

Dr. Rivest responded. "There are some engineering considerations as to what is available on the market, and these days even the smallest chip seems to have so much memory that you could violate thousands of people's privacy on one small chip."

Mr. Gannon commended NIST for the updated TGDC Resolution Task matrix that is updated and distributed before each meeting. He inquired as to where the final matrix would go within the VVSG.

The Chair noted that the specific resolution indicated it should exist as an appendix to the VVSG document. He also agreed that a review of the matrix should be an agenda item for the next plenary meeting of the Committee.

Dr. Rivest offered a resolution for preliminary approval of the STS Subcommittee VVSG material. The resolution was read into the record.

Resolution #07-07 STS Preliminary Approval
Offered by Dr. Rivest

The TGDC grants preliminary and conditional approval for TGDC STS Subcommittee, working with other subcommittees, to complete the STS sections o f the VVSG (Vol. 3, Chapter 4-15) subject to final review of the edited and updated materials.

The motion was seconded. The Chair asked if there was unanimous consent to adopting Resolution #07-07. Hearing no objection, the motion passed (see Table 1).

Mr. Hastings thanked the Committee members for their comments and contributions.

Secretary Gale expressed gratitude to the staff at NIST. "Mr. Chairman, on behalf of, I think, all of the members of the TGDC, we likewise would like to reciprocate our thanks and appreciation and gratitude for all of the very, very fine and very, very hard, dedicated work by all of you, which we may never know the full extent to which you go to make happen what you make happen. But thank you for all your help. It is obviously a team effort and a partnership, and we appreciate all you contribute."

Dr. Jeffrey reciprocated. "On behalf of NIST, obviously I would like to thank all of the TGDC members, because it is absolutely unbelievable the number of meetings, telecoms, and information that are being passed back and forth. These 750 pages just didn't come out of thin air. It was from a tremendous amount of time and effort, and since you are all volunteers and conscripted into this, thank you very much. It is definitely appreciated."

The Chair adjourned the ninth plenary meeting of the Technical Guidelines Development Committee at 11:30 am EDT.

TGDC Resolution Voting   **Plenary meeting**   **May. 21-22, 2007**

Resolution Number	Williams	Berger	Wagner	P. Miller	Gale	Mason	Gannon	Pearce	A. Miller	Purcell	Quesenbery	Rivest	Schutzer	Turner-Bale	Jeffrey	Tally Y-N-A
5/21/07 AM Roll Call	√	*	√	√		√	*	√		√	√	√	*	*	√	9 (plus 2 late arrivals)
Late Arrivals					√				√							Total Attendance 11
Adopt Meeting Agenda																Unanimous Consent
Adopt Minutes of March 2007 Plenary																Unanimous Consent
5/21/07 PM Roll Call		*	√	√	√	√	√	√		√	√	√	*	*	√	10 (plus 2 late arrivals)
Late Arrivals	√								√							

Y=Yes   N=No   A=Abstain   *=Not Present for Vote

Table 1

TGDC Resolution Voting   **Plenary meeting**   **May. 21-22, 2007**

Resolution Number	Williams	Berger	Wagner	P. Miller	Gale	Mason	Gannon	Pearce	A. Miller	Purcell	Quesenbery	Rivest	Schutzer	Turner-Bale	Jeffrey	Tally Y-N-A
5/22/07 AM Roll Call		*	√	√	√	√	√	√		√	√	√	*	*	√	10 (plus 2 late arrivals)
Late Arrivals	√								√							Total Attendance 12
Resolution 03-07:HFP Section Prelim. Approval																Unanimous Consent
Resolution 04-07: CRT Section Prelim. Approval																Unanimous Consent
Resolution 05-07: STS Section Prelim. Approval																Unanimous Consent

Y=Yes   N=No   A=Abstain   *=Not Present for Vote   <u>Table 1</u>