

Final Report of the Moderator's Ad Hoc Committee on Electronic Voting

Committee Charge, Membership and Meetings: The Committee on Electronic Voting (E-voting) was established by the Moderator in late November of 2011 and charged with examining the feasibility, utility and probable cost of implementing a system of E-voting for use at Brookline Town Meeting. Membership consisted of Joel Shoner (representative of the League of Women Voters), Stanley Spiegel (TMM Pct 2), Robert Stein (past chair of Selectman, Adv. Committee, 2005 Voting Technology Committee), Kevin Stokes (Brookline Director of Information Technology), Pat Ward (Brookline Town Clerk), Neil Wishinsky (TMM Pct 5) and Sandy Gadsby (Brookline Moderator and non-voting ex officio member). At the committee's first meeting, Mr. Stein was elected Chair, Mr. Spiegel as vice Chair and Mr. Ward as Secretary by unanimous vote. The Committee met seven times between late November and mid February. It interviewed the IT Director and the Moderator of the Town of Chelmsford, which has recently implemented E-voting for its representative TM. Both spoke very highly of its use, with no problems once TMMs got used to it the first night. The Town of Framingham (representative TM) is in the process of implementing E-voting and Wayland (open TM) has used it at one meeting to date. Also interviewed were various E-voting and Audio Visual equipment vendors.

Summary Recommendation of the Committee: The Committee recommends, by unanimous vote, that Brookline adopt the use of E-voting at Town Meeting and upgrade the AV equipment in the Brookline High School (BHS) auditorium as required to facilitate the use of E-voting.

Background: The issue of Town Meeting (TM) potential adoption of electronic voting is not new to Brookline. It was first examined in the 2001-2002 Moderator's Committee on Alternative Voting Methods and the 2005 Moderator's Committee on Voting Technology. Neither of these previous committees (both were established by vote of TM) presented a specific recommendation on E-voting, although both examined the pros and cons in relation to other methods of roll call voting, as well as cost. In the 2001 examination the cost was estimated to be about \$69000 (rental about \$6200 per day) and in the 2005 review between \$20,000 and \$25,000 for simple one way hand-held devices (which transmit the TMMs vote to a centralized computer but provide no feedback as to what vote was actually recorded). We will discuss more on this feedback issue below. The 2001 Committee recommended a "colored card"¹ experiment to be tried on all votes at the 2003 Annual TM, but that recommendation was never acted upon. More recently

¹ The colored card method consisted of red, green and white cards, signifying Nay, Yea and Abstain respectively, being pre-printed with individual TMM names on it, and handed out prior to TM. When a vote was taken, TMMs voting in the affirmative would stand, as they do now for recorded votes, holding up their green cards. The tellers would count the votes and collect the green cards. The same procedure would be followed for the No votes and then for the abstentions. The following day the names and votes as signified by the collected cards would be entered into the record. Only one such vote was taken, as an experiment, at a 1984 Special TM on recommendation of the League of Women Voters.

“ballot” voting has been employed when an accountable vote is requested, in which, instead of colored cards, blank ballots are handed out to each TMM. The ballots are filled out and are collected by the tellers, who count them and give them to the Town Clerk, who records them into the record after Town Meeting.

The 2005 Moderator's Committee report provides a good review of the various methods of recorded voting, including E-voting, together with an assessment of cost, risk, time to vote, etc.² The report that follows herein will take a closer look at the issues of E-voting process, its current usage in Massachusetts TMs, the cost of implementation (both for the E-voting equipment as well as necessary upgrades to the Audio Visual (AV) equipment at the High School auditorium) and the timing associated with E-voting as compared to other methods of recorded votes.

How E-voting works: E-voting works by providing each voting participant with a hand-held device. Each device has a unique code which identifies the specific unit. The identifier is associated with a particular participant by pre-assignment. When a vote is to be taken, the participant presses one of three buttons -- #1 for an affirmative vote, #2 for a negative vote and #3 for an abstention. The votes are sent via a wireless network to a nearby computer. The computer instantly tabulates the votes, creates an electronic record of the voting and provides the user with the ability to present the results in any standard format (e.g., Word, Power Point, Excel, or free form).

Recommended E-voting Process for TM: Much of the discussion at the Committee's meetings centered around the issue of how E-voting might be used. We recognize that the process for use at TM is not up to the Committee to determine, but something that falls under the purview and discretion of the Town Moderator. We also note that whatever process we recommend here will likely change over time as TM learns from its initial experience with E-voting. Nevertheless, since the process significantly impacts the timing, risk of error, methods to be employed, operating cost, and acceptability to Town Meeting Member (TMM) users, the Committee felt strongly that a suggestion to the Moderator and TMMs on a preferred initial process was both useful and informative, and a necessary component of our recommendation. In examining potential methods, the Committee experimented with various forms of representative tally screens that might be projected at TM for the review of votes. For each type of screen the Committee assessed the legibility, time for name and vote recognition, and whether or not the current A/V equipment at BHS was useable for such purposes for a TMM at a distance from the screen representative of the distance to the back row of the TMM section in the BHS auditorium. Aided by this review, our recommendation on a suggested process, arrived at by unanimous vote at our meeting on Feb 13, is provided below.

² For the reader interested in the details of that review, it is attached to this report as Appendix 1.

- *When should E-voting be used:* Initially under three conditions
 - If 35 or more TMMs ask for an E-vote
 - If the Moderator is in doubt of the count on either a vote or a quorum count
 - If seven or more TMMs challenge the Moderator's count – can apply to a quorum count as well as a vote
- *When should a record of TMMs votes be kept:* Only under condition 1. At all other times an E-vote is taken the purpose is solely to provide an accurate count and the record would not be preserved.
- *Process for E-voting at Town Meeting:*
 - Shortly before the first evening of TM, Town staff will ensure that all hand held devices are working properly. They will also make sure that a hand held device is assigned and properly labeled for all current TMMs as well as for any new members to be sworn in at the meeting. The devices will be divided into groups, depending upon its assigned TMM's precinct.
 - At TM, TMMs will check in at four stations, according to precinct, and receive their assigned hand held voting device.
 - When an E-vote is to be taken, the moderator will call for Yea votes, those voting Yea will stand for 20 seconds and push the "1" button on their handheld device. They may push it anytime and as often as they wish, until, after 20 seconds, the moderator tells them to sit down. The moderator will then call for the Nay votes and the same process will be followed, except that the Nay voters will push button "2." When the Nay voters sit down, the Moderator will call the voting closed (those abstaining may push button #3 whenever they choose during the two voting periods). Buttons may be pushed at any time during the entire 40 second voting period – it will be the final push before the Moderator calls the voting closed that will record their vote. The purpose of the standing vote simulation is to provide visual feedback to TMMs in the existing tradition of Town Meeting and will not constitute the official and binding vote.
 - Following the 40 seconds of voting, the moderator will call the voting closed and the precinct by precinct TMM recorded votes will be displayed on the screen at the front of the auditorium. Four precincts at a time will be displayed per screen, each screen for about five seconds.³ A final fifth

³ The committee experimented at three different meetings with various screens displaying TMM votes. The purpose was to determine how many precincts could be displayed on a single screen, how to represent Yea, Nay and Abstain voting, how much time was required per screen for name and vote recognition, etc. We scaled the size of the screen in the conference rooms in which we met to that which would represent the screen size and distance to the rear row of the TMM section in the BHS auditorium. The result of all of that experimentation and examination was that four precincts (60 names and color coded votes) with a five second recognition period worked well. In the meeting that we held in the auditorium, it was clear to make this work, the projector would have to be upgraded to modern standards.

screen will display the votes of at-large members, as well as the final tallies.

- The moderator will then call for any TMM who feels that his/her vote was recorded in error to stand and ask that their vote be changed. The moderator will instruct the IT assistant to make the change, who in turn will acknowledge the change and make it visible on the screen. The moderator will also ask any TMM who believes that a vote was cast by a member who was not present to make that challenge and the member who was challenged will rise to acknowledge his/her presence. Failure for the member to stand will result in the vote being removed from the tally. If there are no changes or challenges requested, the results will become final.
- If any changes or challenges were requested, the results, as amended, will be displayed on the screen a 2nd time in the same manner in which they were originally displayed. The only challenges that will be permitted this 2nd time will be ones that were requested after the first screen but that were not properly corrected. After this final screen, with corrections if required, the results will become final.

E-voting equipment recommendation: There are basically two types of E-voting hand holds – a less expensive option (about \$10K – \$15K for 250 devices plus peripheral equipment and software) that simply allows its user to record his/her vote on a remote computer, and a more expensive option (up to \$34K) that provides feedback to each user as to what vote (yea, nay, abstain) was received and recorded. The more expensive option also contains some security enhancements as well that, depending upon one's concern about jamming or hackers, may add some functionality. The Committee had mixed feelings about the added value of the more expensive option. Some members believe that the less expensive option is adequate, given the review process for validating TMM votes described above, and some believe that the individual feedback is worth the added expense because of the added surety it provides. They also believe that eventually the feedback might eliminate the need for the two screen review process outlined above, thereby reducing voting time. After considerable discussion the committee as a whole agreed that there was some potential value in the feedback option although it was not unlimited, and thus the Committee voted unanimously to recommend the feedback option, with the proviso that its cost to the Town was no higher than 50% more than the non-feedback option or, based on current estimates, a ceiling of about \$25K.

AV recommendation: It was clear at our meeting in the High School auditorium, as well as the experience of the Committee's TMMs, Moderator and Town Clerk that if all of the above were to work, the AV equipment in the auditorium would have to be upgraded so

that the voting screens were clear and legible. The Committee, with the help of the Town's IT Director and the High School Audio/Visual Coordinator Mark Vanderzee, solicited upgrade options and pricing from two AV vendors, both of which provided the Town with some specific options. Based on those inputs and the experimentation the Committee conducted in examining representative presentation screens, the Committee recommends that the Town and School Department upgrade the AV equipment in the HS auditorium. In terms of E-voting needs, the minimum upgrade should include a new projector of at least a 7000 lumens intensity (for reasonable contrast at an auditorium ambient light level of about 65 lux, which would obviate the need to dim the lights every time the projector was used), a minimum resolution of 1280 x 800, a zoom lens capable of filling a 16 x 10 foot image from the existing projection booth (about 75 feet from the existing screen position), electronic distortion correction (key stoning, etc.) and provision for wireless remote operation. Since this will benefit both the High School auditorium educational users as well as Town Meeting, the committee felt that some kind of school/municipal sharing of this cost might be appropriate.

Approximate Purchase Cost (assuming 50% ceiling for feedback option): Summary costs to implement the recommended options above are provided below. It is our assumption that the E-voting equipment will be carried in the IT Department CIP for FY2013 and the AV upgrade will be part of a more complete upgrade that is currently being discussed within the School Department. We note that the AV upgrade listed here is that necessary for the proper adoption of E-voting at Town Meeting, but that it will also substantially improve any AV educational use for school purposes as well.

E-voting Equipment: \$15K (without feedback) \$25K (with feedback)

AV Upgrade for TM users: \$14K

 Projector (7000 lumens): \$10K (incl. lens)

 Linkage for remote ops: \$2K

 New lectern and audio tie: \$1.5K

Annual Operating cost: \$2K per year, assuming 10 days of TM annually

1. Prior to 1st session of TM (3 per year), 3-4 person hours for checkout of the handheld devices: \$240 (GIS intern for 12 hours per year)
2. At each TM session, one additional check-in station for the duration of each session: \$800 (a 33% increase over current allocation for TM in Town Clerks office)
3. At each TM session, the presence of an IT staff member for the duration of the session: \$800 (one GIS intern for 40 hours per year)

4. Battery replacement once per year: \$200 (500 batteries @ a bulk buy of \$0.40 per battery)

Assuming a high of 10 TM sessions a year and using maximum 2012 part time salaries in the Town Clerk's office and in the IT department, this would amount to approximately \$2000 per year.

Summary: In summary the Committee unanimously recommends that the Town move to implement the use of E-voting at its Town Meetings for situations in which recorded votes are requested or more accurate voting counts are needed. There are three primary benefits that accrue to the use of E-voting:

1. The time required for recorded votes or accurate count votes will be reduced significantly. Approximate times for the various methods are:
 - a. Roll call vote: 25 minutes⁴
 - b. Ballot vote: 10+ minutes⁴
 - c. Standing count by tellers: 8-10 minutes
 - d. E-voting – no challenge: 1 ½ minutes
 - e. E-voting with challenge: 2 minutes
2. A highly accurate vote is easily and quickly obtained under any situation that demands increased accuracy over counting hands or standing heads
3. It allows the Town to take advantage of today's IT technology in essentially a risk free environment. Given the process outlined above, with or without the use of feedback, the potential for miss-counts of even one vote through various kinds of "mischief" is reduced to near zero. Although Brookline would have been a pioneer in this type of TM voting a few years ago in the previous examinations, this is not longer the case, as at least two communities with representative TMs have adopted it. The one that has actually used it at a multi-session representative TM has given it rave reviews, the other one that used it last year at one TM is negotiating its purchase with a vendor and other towns are currently in the process of considering and evaluating its use.

The obvious downside is that there is a cost associated with both purchasing the equipment and using it at town meetings. The Committee cannot, of course, "prove" that the expenditure for the purchase of the equipment and annual operation provides a value commensurate with the cost. That will be a subjective assessment for the Selectmen, the Advisory Committee and TMMs to determine for themselves. But as an input to this determination, the Committee believes that this small price (\$15000 - \$25000 amortized over an assumed E-voting equipment life of five years plus \$2000 per

⁴ These methods also require 2 hours after TM to transcribe the results for each standing or ballot vote taken

year in operating cost for a total of \$5000 - \$7000 per year annual cost – less than 0.003% of the Town's total budget) is well worth the added benefit in efficiency, time savings and accuracy it will provide to the Town's legislative body as it debates, votes and establishes the nearly \$250M total budget and all of the other critical legislative issues that arise each year. We believe that enhancing that process by speeding it up, enhancing accuracy and making the process less burdensome is in the best interest of the town.

Respectfully,

Joel Shoner

Stanley Spiegel

Robert Stein

Kevin Stokes

Pat Ward

Neil Wishinsky

Sandy Gadsby (ex officio)

Appendix A

Final Report of the Moderator's Committee On Voting Technology for Town Meeting

The Moderator's Committee on Voting Technology for Town Meeting was established under Article Twenty in the Warrant for the November 15, 2005 Special Town Meeting. The vote, passed by a majority of Town Meeting Members, read as follows:

Voted: That Town Meeting authorize the Moderator to appoint a committee to investigate and report to the 2006 Fall Town Meeting the available options for forms of voting that record and/or display the votes of each Town Meeting member on matters at town meeting, without the necessity of a so-called "roll call" vote.

The committee met a number of times since its inception in the late fall of 2005. It reviewed the long history of examination of, and experiments with, different methods of recording individual Town Meeting member votes, including the introduction of the roll call vote in 1970, the various changes in the number of Town Meeting members required to request such a vote, the 1985 Moderator's Committee on Roll Call Votes and their recommended experiment with colored cards, and the 2001-2002 Moderator's Committee on Alternative Voting Methods.

In all of these examinations, four issues were commonly seen as the Measures of Effectiveness of any proposed scheme:

1. **Time:** The time required to take a vote that provides a lasting record of how each Town Meeting Member present voted on a given warrant article or amendment
2. **Security and Assurance:** The degree to which each Town Meeting Member's recorded vote resulted from the action of that particular member on the floor – i.e., no proxy voting by another member for someone who has left
3. **Cost:** The cost of implementing the proposed scheme, both in terms of initial start up and the recurring cost at each Town Meeting
4. **Other:** Any other issue of significance, particularly procedural complications at Town Meeting related to signing in and out, taking the vote or displaying the results so that each member can be sure that his/her vote was recorded correctly.

We believe that these measures are indeed the correct ones for proper evaluation and will thus use them below to evaluate on a relative basis the various options currently available to Town Meeting. We also believe that any recommendation that we might make on whether or not Town Meeting should adopt one or an other of the schemes below would provide no more value than what any Member might feel is the right course after reviewing all of the facts. With that in mind, we will endeavor below to lay out the facts surrounding three alternative schemes – the current method of roll call, the color cards and current generation wireless electronic voting. We will refrain from making any specific recommendation but will leave that decision to each member as he or she sees fit.

1. Standing Roll Call: This is the current scheme used by the Moderator today to record the individual votes of each Town Meeting Member. Upon the request of 50 or more Town Meeting Members the Moderator reads the names of each Member, who then answers "Yes," "No" or "Present" (equivalent to an abstention). As the members respond, the Town Clerk records the votes against a printed list of the names and the votes are so recorded for posterity. The time required to take such a vote is typically in the order of 30 minutes or so. There is essentially no cost associated with this method nor is the procedure complicated in any regard. Since each

member verbalizes his/her response in the vicinity of other Members, it would be difficult for anyone to proxy vote and the chances of “getting caught” would be high. The only chance for error would be a mistake made by the Town Clerk in recording, and although there is no method of providing an immediate check on what was recorded for each Member, there has never been, to our knowledge, any case of either proxy voting or a recording error.

2. Colored cards: The color coded card system was first suggested by the League of Women Voters in 1984 and was tried on one vote at a Special Town Meeting in January 1985. The procedure for the color coded card system is as follows:

- A quantity of red, green and white cards with individual Town Members' Names were pre-printed prior to Town Meeting.
- As each Member entered the auditorium and signed in at the teller's station, he/she was given some of each kind of card containing that Member's name.
- The vote to be recorded was taken as a “standing vote.” All members who were voting in the affirmative stood in response to a request by the Moderator. The tellers would both count the vote and collect the green (yes) cards. Those members would sit down, those voting against would stand and the same procedure was followed using the red (nea) cards. Lastly, anyone wishing to be recorded as “present” would stand and hand in the white cards.
- The next day the names of the members and their votes as signified by the cards that they had handed to the tellers would be recorded into the record.

The time required to take this type of vote was between 10 and 15 minutes, not including the time to transcribe the votes the following day. No startup cost was required and the recurring cost was minimal – essentially being the cost of printing up the cards and the time required to transcribe the names the following day (no records were kept of that time, but we guess that it must have taken something in the order of two hours or so). The potential for proxy voting is somewhat higher than in the roll call vote above, but still the visual observation of a Member handing in two cards or a non-member handing in a card is possible either by fellow Members and/or the tellers and should be a reasonable deterrent to such mischievous action. One other potential disadvantage noted in the 2002 report was the possibility of a Member standing one way for observation by his/her colleagues and handing in a card to record a different vote. The 2002 Moderator's Committee recommended that this method be tried for all votes taken at the 2003 Annual Town Meeting but that recommendation was never implemented.

Electronic Voting: Electronic response polling is becoming more and more widely used in advertising, business, training seminars, conferences and some legislative bodies. The 2002 Moderator's Committee examined various electronic voting methods, including hard wired radio frequency (RF), wireless RF, infrared (IR) and passive RF Identification (RFID) tags. They also examined alternative acquisition methods for the wireless RF devices, including the purchase (\$68,600) and rental (\$6190 per day). As in all consumer electronics, these prices have reduced significantly over the last few years, and in particular, the purchase price, which has gone down by more than 70%.

If the Town was going to use electronic voting, the clear way to go today would be the purchase of roughly 300 wireless RF handheld devices, a base station to collect the handheld responses and a software license for the software used in the base station to functionally make the entire system work. The handheld devices themselves would contain 3 buttons – one for responding with a “yes,” one for a “no” and one for “present.” The typically work over a minimum linear

range of 100 meters or so, more than adequate to cover the high school auditorium. The responses from the entire body are collected automatically by the base unit and are identified and recorded in less than one second. The file the system produces is designed to interface with standard Microsoft Office products, enabling almost instant tallying in either a Word document or an Excel spread sheet. Either of these would allow pre-tailoring the format and display of the results of a vote to whatever appeared to be the most useful and appropriate method. Multiple methods could also be employed, such as one method for presentation of the results at Town Meeting and another format for permanent archiving. The flexibility is that that derives from Office and is independent of the device itself. Our committee contacted a few of the vendors that sell such devices today and four of our members participated in a web-based interactive demonstration provided by one of the vendors. The demonstration verified the various features that had been described in the brochures that we had received, including the timelines and the interfacing with Microsoft Office products. Acquisition cost for the entire system (not including a PC to host Office and a projector to display the results, both of which are available at the High School) would be competitively bid out, but should be under \$20,000.

Given the apparent functionality of the system, the availability from various vendors and the current pricing, the committee's attention focused on the issue of security and the for potential fraudulent voting. A significant amount of attention was devoted to the various methods and procedures that could be used to employ the system at Town Meeting. After much discussion, a "strawman" process was identified that addressed to the extent possible the security issues surrounding the use of electronic voting. A draft procedure is described below:

- When taking the oath of office, a Town Meeting Member pledges that the only votes that will be cast in that member's name will be those that are personally entered by the individual.
- After taking the oath, the member is given a hand held unit for the duration of that member's term of office. The device's ID number (there is a unique one for each device) is assigned to that member's name.
- When a recorded vote is to be taken at Town Meeting (the committee did not get into the issue of whether or not all votes would be recorded or how many Town Meeting Members it would take to request such a vote – we felt that that would be better left to the discretion of the Moderator):
 - A message would flash up on the screen in the front of the auditorium, reminding Members of the oath they pledged upon taking office
 - Those voting in favor would be asked to stand (as in a standing vote today) and would have ten seconds to press the "yes" button on their handheld. During those ten seconds, the vote could be cancelled if desired. At the end of the ten seconds the unit would freeze out.
 - The "yes" voters would sit down and the "no's" would stand and the same procedure would be used for the "no" votes.
 - Lastly, any "present" votes would be taken and recorded.
 - Upon the completion of the vote the names and responses are scrolled across the screen in groups of ten for approximately five seconds a group.
 - At the end of the scrolling, the totals are presented and the moderator asks if any member wishes to challenge the results. A challenge may result for two reasons:
 1. His/her vote is in error. In this case, it would be automatically changed.

2. The challenger does not believe that a particular Member was present, even though his/her vote was recorded. In that case, the challenged person rises to affirm his/her presence or the vote is nullified.
 3. After the challenge is resolved, if there are any changes, the new totals are presented on the screen.
- The entire process outlined above should about 3 minutes, exclusive of any challenges, which would likely be rare.
 - At the end of a Member's term the units would be returned to the Town. Any member who was not reelected or did not choose to run for office again and failed to return the unit within a reasonable amount of time would be charged for it. Damaged or first time lost units by a serving Member would be replaced free of charge.

The process outlined above is presented simply as an example of one that attempts to balance the complication of the process with reasonable safeguards against voting abuse. In the end, however, it would be the Moderator who would decide what process was to be used. Regardless of what procedure ends up being used, should Town Meeting decide it want to employ electronic voting (or the even the card system), the issue of fraudulent voting ultimately rests on two things:

1. The inherent honesty and integrity of elected Town Meeting Members
2. The probability (and corollary risk of embarrassment) that a person who has left the hall and gives his/her proxy vote to another person will be noticed by another Member.

As mentioned above, the one time cost for such a system is expected to be slightly under \$20,000. The recurring cost would be that of an IT clerk at each Town Meeting session and the occasional purchase of replacement units. If we assume the loss or damage of 5% of the units per year, this would require a restocking of about 50 or so units in five years for an estimated cost of about \$1500 or so. Overall lifetime of the entire system could be expected to be similar to that of most consumer electronics – somewhere between 10 and 15 years.

Summary

The three methods are summarized in the table below:

	Time	Security	Acquisition Cost	Recurring Cost
Roll Call	30 minutes	Very high	none	none
Card System	10 - 15 minutes	Slightly less	none	Two person hours per vote
Electronic	3 – 4 minutes	Slightly less	\$20,000	Four person hours per session

The questions that remain are ones that only Town Meeting can decide:

- To what extent does Town Meeting want, and should the public expect, for the votes of each member, particularly on highly contested issues, to be part of the public record?
- What are the tradeoffs between the time it takes for such a vote can be taken; the dampening of willingness to take such votes as a function of the time required to take

them and the slightly higher potential for “mischievous” proxy voting associated with the two non-roll call methods?

- Is the use of today's electronic technology for automated recorded voting worth the acquisition cost of \$20,000 and a few hundred dollars per year for replacement of devices?

We feel that each Town Meeting Member is in a position to answer these questions themselves, given the facts that we provide above, and therefore we submit our report for consideration.

Respectfully,

Gilbert Hoy
Stanley L. Spiegel
Alexandra “Sandy” Spingarn
Robert M Stein
Patrick J. Ward