
Committee Meeting

of

ASSEMBLY JUDICIARY COMMITTEE

Assembly Bill No. 4619

“Requires new voting machines purchased or leased for use in elections in this State to produce paper record of each vote cast”

LOCATION: Committee Room 11
State House Annex
Trenton, New Jersey

DATE: October 26, 2017
9:00 a.m.

MEMBERS OF COMMITTEE PRESENT:

Assemblyman John F. McKeon, Chair
Assemblyman Gordon M. Johnson, Vice Chair
Assemblyman Joseph A. Lagana
Assemblywoman Elizabeth Maher Muoio
Assemblyman Andrew Zwicker
Assemblyman John DiMaio



ALSO PRESENT:

Miriam Bavati
Rafaela Garcia
Office of Legislative Services
Committee Aides

Kate McDonnell
Assembly Majority
Committee Aide

Kevin Logan
Assembly Republican
Committee Aide

Meeting Recorded and Transcribed by
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Chair

GORDON M. JOHNSON
Vice-Chair

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**REVISED
COMMITTEE NOTICE**

TO: MEMBERS OF THE ASSEMBLY JUDICIARY COMMITTEE
FROM: ASSEMBLYMAN JOHN F. MCKEON, CHAIRMAN
SUBJECT: COMMITTEE MEETING - OCTOBER 26, 2017

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The Assembly Judiciary Committee will meet on Thursday, October 26, 2017 at 9:00 AM in Committee Room *11, 4th Floor, State House Annex, Trenton, NJ.

FOR DISCUSSION ONLY:

A-4619 Requires new voting machines purchased or leased for use in elections
Muio/Zwicker/Gusciora/ in this State to produce paper record of each vote cast.
Benson/Holley

Issued 10/20/17

* Revised 10/25/17 Please note: room changed to Committee Room 11.

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ASSEMBLY, No. 4619

STATE OF NEW JERSEY
217th LEGISLATURE

INTRODUCED FEBRUARY 27, 2017

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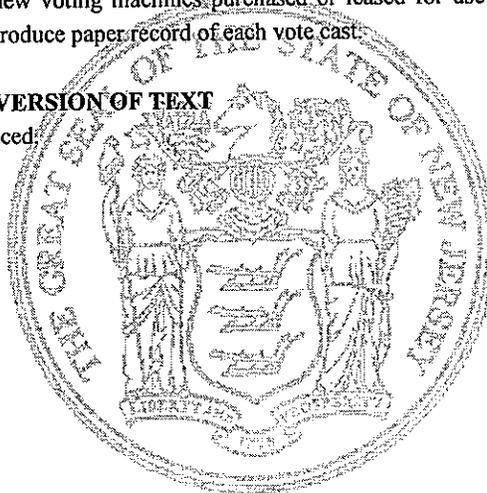
Assemblywoman Jimenez

SYNOPSIS

Requires new voting machines purchased or leased for use in elections in this State to produce paper record of each vote cast.

CURRENT VERSION OF TEXT

As introduced:



(Sponsorship Updated As Of: 6/16/2017)

1 AN ACT concerning the requirement for voting machines to produce
2 a paper record of each vote cast and amending R.S.19:48-1 and
3 P.L.1973, c.82.

4
5 **BE IT ENACTED** by the Senate and General Assembly of the State
6 of New Jersey:

- 7
8 1. R.S.19:48-1 is amended to read as follows:
9 19:48-1. a. Any thoroughly tested and reliable voting machines
10 may be adopted, rented, purchased or used, which shall be so
11 constructed as to fulfill the following requirements:
12 (a) It shall secure to the voter secrecy in the act of voting;
13 (b) It shall provide facilities for such number of office columns,
14 not less than 40 and not exceeding 60, as the purchasing authorities
15 may specify and of as many political parties or organizations, not
16 exceeding nine, as may make nominations, and for or against as
17 many questions, not exceeding 30, as submitted;
18 (c) It shall, except at primary elections, permit the voter to vote
19 for all the candidates of one party or in part for the candidates of
20 one party or one or more parties;
21 (d) It shall permit the voter to vote for as many persons for an
22 office as he is lawfully entitled to vote for, but no more;
23 (e) It shall prevent the voter from voting for the same person
24 more than once for the same office;
25 (f) It shall permit the voter to vote for or against any question
26 he may have the right to vote on, but no other;
27 (g) It shall for use in primary elections be so equipped that the
28 election officials can stop a voter from voting for all candidates
29 except those of the voter's party;
30 (h) It shall correctly register or record and accurately count all
31 votes cast for any and all persons, and for or against any and all
32 questions;
33 (i) It shall be provided with a "protective counter" or
34 "protective device" whereby any operation of the machine before or
35 after the election will be detected;
36 (j) It shall be so equipped with such protective devices as shall
37 prevent the operation of the machine after the polls are closed;
38 (k) It shall be provided with a counter which shall show at all
39 times during an election how many persons have voted;
40 (l) It shall be provided with a model, illustrating the manner of
41 voting on the machine, suitable for the instruction of voters;
42 (m) It must permit a voter to vote for any person for any office,
43 except delegates and alternates to national party conventions,
44 whether or not nominated as a candidate by any party or

EXPLANATION – Matter enclosed in bold-faced brackets [thus] in the above bill is not enacted and is intended to be omitted in the law.

Matter underlined thus is new matter.

1 organization by providing an opportunity to indicate such names or
2 name;

3 (n) It shall be equipped with a permanently affixed box or
4 container of sufficient strength, size and security to hold all
5 emergency ballots and pre-punched single-hole envelopes and with
6 a clipboard and a table-top privacy screen;

7 (o) It shall not use mechanical lever machines or punch cards to
8 record votes.

9 All voting machines used in any election shall be provided with a
10 screen, hood or curtain, which shall be so made and adjusted as to
11 conceal the voter and his action while voting.

12 It shall also be provided with one device for each party for
13 voting for all the presidential electors of that party by one
14 operation, and a ballot therefor containing only the words
15 "presidential electors for," preceded by the name of that party and
16 followed by the names of the candidates thereof for the offices of
17 President and Vice-President and a registering device therefor
18 which shall register the vote cast for such electors when thus voted
19 collectively.

20 b. (1) By January 1, 2009, each voting machine shall produce
21 an individual permanent paper record for each vote cast, which shall
22 be made available for inspection and verification by the voter at the
23 time the vote is cast, and preserved for later use in any manual
24 audit. In the event of a recount of the results of an election, the
25 voter-verified paper record shall be the official tally in that election.
26 [A waiver of the provisions of this paragraph shall be granted by
27 the Secretary of State if the technology to produce a permanent
28 voter-verified paper record for each vote cast is not commercially
29 available.]

30 (2) The provisions of paragraph (1) of this subsection shall be
31 suspended until: (i) the Secretary of State and the State Treasurer
32 certify in writing that sufficient funds have been provided by the
33 federal government and received by the State to offset the entire
34 cost of ensuring that each voting machine used in this State
35 produces an individual permanent paper record for each vote cast;
36 or (ii) the annual appropriation act contains an appropriation of
37 sufficient funds to ensure that each voting machine used in this
38 State produces an individual permanent paper record for each vote
39 cast and such appropriated funds have not been reserved by the
40 Governor under a spending reduction plan; or (iii) the Secretary of
41 State and the State Treasurer certify in writing that sufficient funds
42 have been provided by the federal government and received by the
43 State, and the annual appropriation act contains an appropriation of
44 sufficient unreserved funds, to ensure, when such funds are
45 combined, that each voting machine used in this State produces an
46 individual paper record for each vote cast.

47 c. Each voting machine newly-purchased or leased following
48 the effective date of P.L. , c. (pending before the Legislature as

1 this bill) shall produce an individual permanent paper record for
2 each vote cast, which shall be made available for inspection and
3 verification by the voter at the time the vote is cast, and preserved
4 for later use in any manual audit. In the event of a recount of the
5 results of an election, the voter-verified paper record of each
6 machine required under this subsection shall be used in the
7 calculation of the official tally in that election.

8 (cf: P.L.2009, c.17, s.1)

9

10 2. Section 3 of P.L.1973, c.82 (C.19:53A-3) is amended to read
11 as follows:

12 3. Every electronic voting system, consisting of a voting device
13 in combination with automatic tabulating equipment, acquired or
14 used in accordance with this act, shall:

15 a. Provide for voting in secrecy, except in the case of voters
16 who have received assistance as provided by law;

17 b. Permit each voter to vote at any election for all persons and
18 offices for whom and for which he is lawfully entitled to vote; to
19 vote for or against any question upon which he is entitled to vote;
20 and the automatic tabulating equipment shall reject choices
21 recorded on his ballot if the number of choices exceeds the number
22 which he is entitled to vote for the office or on the measure;

23 c. Permit each voter, at presidential elections, by one mark to
24 vote for the candidates of that party for president, vice president,
25 and their presidential electors;

26 d. Permit each voter, at other than primary elections, to vote for
27 the nominees of one or more parties and for independent candidates;
28 and personal choice or write-in candidates;

29 e. Permit each voter in primary elections to vote for candidates
30 in the party primary in which he is qualified to vote, and the
31 automatic tabulating equipment shall reject any votes cast for
32 candidates of another party;

33 f. Prevent the voter from voting for the same person more than
34 once for the same office;

35 g. Be suitably designed for the purpose used, of durable
36 construction, and may be used safely, efficiently, and accurately in
37 the conduct of elections and counting ballots;

38 h. When properly operated, record correctly and count
39 accurately every vote cast, including all overvotes or undervotes
40 and all affirmative votes or negative votes on all public questions or
41 referenda;

42 i. (1) By January 1, 2009, each voting machine shall produce
43 an individual permanent paper record for each vote cast, which shall
44 be made available for inspection and verification by the voter at the
45 time the vote is cast, and preserved for later use in any manual
46 audit. In the event of a recount of the results of an election, the
47 voter-verified paper record shall be the official tally in that election.

48 [A waiver of the provisions of this subsection shall be granted by

1 the Secretary of State if the technology to produce a permanent
2 voter-verified paper record for each vote cast is not commercially
3 available.】

4 (2) The provisions of paragraph (1) of this subsection shall be
5 suspended until: (i) the Secretary of State and the State Treasurer
6 certify in writing that sufficient funds have been provided by the
7 federal government and received by the State to offset the entire
8 cost of ensuring that each voting machine used in this State
9 produces an individual permanent paper record for each vote cast;
10 or (ii) the annual appropriation act contains an appropriation of
11 sufficient funds to ensure that each voting machine used in this
12 State produces an individual permanent paper record for each vote
13 cast and such appropriated funds have not been reserved by the
14 Governor under a spending reduction plan; or (iii) the Secretary of
15 State and the State Treasurer certify in writing that sufficient funds
16 have been provided by the federal government and received by the
17 State, and the annual appropriation act contains an appropriation of
18 sufficient unreserved funds, to ensure, when such funds are
19 combined, that each voting machine used in this State produces an
20 individual paper record for each vote cast.

21 j. Each voting machine newly-purchased or leased following
22 the effective date of P.L. , c. (pending before the Legislature as
23 this bill) shall produce an individual permanent paper record for
24 each vote cast, which shall be made available for inspection and
25 verification by the voter at the time the vote is cast, and preserved
26 for later use in any manual audit. In the event of a recount of the
27 results of an election, the voter-verified paper record of each
28 machine required under this subsection shall be used in the
29 calculation of the official tally in that election.

30 (cf: P.L.2009, c.17, s.2)

31

32 3. This act shall take effect on January 1 next following
33 enactment.

34

35

36

STATEMENT

37

38 Under current law, the requirement for the purchase of new
39 voting machines or retrofitting of existing voting machines to
40 produce a paper record of the votes cast has been suspended until
41 funding is made available from State or federal sources. This bill
42 would require that new voting machines purchased or leased
43 following the bill's effective date must produce a paper record of
44 each vote cast.

45 Specifically, the bill provides that each voting machine that is
46 purchased or leased following the bill's effective date would be
47 required to produce an individual permanent paper record for each
48 vote cast, which must be made available for inspection and

1 verification by the voter at the time the vote is cast, and preserved
2 for later use in any manual audit. In the event of a recount of the
3 results of an election, the voter-verified paper record of each
4 machine so purchased or leased would be used in the calculation of
5 the official tally in that election.

6 The bill also deletes a provision in current law that allows the
7 Secretary of State to grant a waiver from the requirement to
8 purchase new voting machines or retrofit all existing voting
9 machines if the technology to produce a permanent voter-verified
10 paper record for each vote cast is not commercially available. This
11 change is intended to reflect that the technology is now
12 commercially available.

13 This bill is prospective in application, and would apply to voting
14 machines purchased or leased following its effective date. The bill
15 would take effect on January 1 next following enactment.

TABLE OF CONTENTS

	<u>Page</u>
Andrew W. Appel, Ph.D. Eugene Higgins Professor Department of Computer Science Princeton University	5
Reverend Robert Moore Executive Director Coalition for Peace Action	35
Stephanie Harris Chair Task Force on Voting Integrity Coalition for Peace Action	37
Ann Rea Electoral Reform Group Co-Leader Blue Wave New Jersey	40
Cynthia Zirkle Representing Coalition for Peace Action	42
Michelle Mulder Consultant Verified Voting Foundation	43
Michael H. Harper President New Jersey Association of Election Officials, and Clerk Hudson County Board of Elections	53
Gary Olsen Election Data Coordinator Office of the Superintendent of Elections Passaic County	53
Shona Mack-Pollock, Esq. Deputy Superintendent of Elections Passaic County, and Second Vice President New Jersey Association of Election Officials	61

TABLE OF CONTENTS (continued)

	<u>Page</u>
Maureen G. Bugdon Superintendent of Elections, and Commissioner of Registration Atlantic County, and Executive Vice President New Jersey Association of Election Officials	68
Mary H. Melfi Clerk Hunterdon County	86
Paula Sollami Covello, Esq. Clerk Mercer County	87
Barbara A. Netchert Clerk Hudson County	89
APPENDIX:	
PowerPoint Presentation submitted by Andrew W. Appel, Ph.D.	1x
<i>Star-Ledger</i> Opinion Piece <i>Let's avoid a Russian hack, protect NJ's vote</i> By Senator Linda R. Greenstein and Robert Moore submitted by Reverend Robert Moore	35x
Testimony submitted by Stephanie Harris	37x
Testimony submitted by Ann Rea	38x

TABLE OF CONTENTS (continued)

APPENDIX (continued)

	<u>Page</u>
Testimony submitted by Michelle Mulder	41x
Proposed Bill Amendments submitted by Coalition for Peace Action and Verified Voting Foundation	49x
E-mail, addressed to Assembly Judiciary Committee from Julie Lips Private Citizen	54x
Letter, addressed to Hon. John F. McKeon from Robert F. Giles Director Division of Elections Department of State State of New Jersey	55x
Testimony submitted by Charles P. Lamb Private Citizen	57x
pnf:1-95	

ASSEMBLYMAN JOHN F. McKEON (Chair): Welcome, everyone.

And I apologize for getting here a little late. Nine o'clock is an early start for us in Trenton, especially coming from North Jersey.

And our colleague, the Vice Chairman, is coming from upper Bergen County -- you're in lower Bergen County, right? -- and he'll be here shortly. But in deference, we're going to get going; I think, particularly with the Professor's schedule.

So welcome, again; it's a very, very important issue. I'm actually going to have our colleague, Assemblywoman Muoio, say a few words at the beginning of the hearing.

But let's please start with a roll call.

MS. BAVATI: Assemblyman DiMaio.

ASSEMBLYMAN DiMAIO: Here.

MS. BAVATI: Assemblyman Zwicker.

ASSEMBLYMAN ZWICKER: Here.

MS. BAVATI: Assemblywoman Muoio.

ASSEMBLYWOMAN MUOIO: Here.

MS. BAVATI: Assemblyman Lagana.

ASSEMBLYMAN LAGANA: Here.

MS. BAVATI: Chairman McKeon.

ASSEMBLYMAN McKEON: Present.

Assemblywoman.

ASSEMBLYWOMAN MUOIO: Thank you.

First, I want to thank the Chairman for having this meeting, sort of out of sync. We've talked about this a lot this year -- this topic; and

we wanted to make sure that once the session started up again, that we could hit the ground running and have sort of an airing of the different perspectives on this critical issue.

It's been, obviously, in the news, getting a great deal of attention over the past year. And rightfully so, as we are confronted, almost daily, with stories about attempts to hack into the U.S. voting infrastructure and into our systems in an attempt to influence the outcome of the U.S. elections.

And while New Jersey is a leader in many areas amongst other states, in this area we are woefully behind -- being one of only five states without a verified paper record produced in our elections from our machines.

Like many other states, New Jersey-- Or like all the 49 other states, New Jersey replaced and overhauled our system back in the early 2000s when the Federal government made Help America Vote Act funds available to allow us to purchase new machines and implement new systems -- voter registration systems, etc. And like almost every other state, we purchase DRE machines. But unlike most other states, over the years we have not ensured that there is an auditable paper trail from our machines.

And it's not just about-- The issue we've heard a lot about lately is, essentially, the *hackability* of machines in use in the United States; but it is really a two-pronged argument. It's about the integrity of the machines, and it's about the integrity and the ability to audit our election results. And that's what we're going to discuss today -- not just the machines, but also the importance of being able to audit our results after an election. Right now, how do we even prove the machine had a problem in

an election? Right now, we are left with nothing but a printout from the back of our DREs.

So it's a two-pronged approach today; *a*) to look at the need for -- or potential need for new technology here in the state; and the second prong will be what type of technology we should focus on.

So I want to thank everybody who's worked with us over the year. We've brought in advocates from all sides of this issue to meet with and discuss. Many of you are here today, and I want to thank you; and again thank everybody on the Committee for coming in today and talking about this now.

Thanks.

ASSEMBLYMAN McKEON: Thank you for your leadership.

Assemblyman Zwicker, you're the Co-Sponsor of the legislation. Would you have any statement to begin?

ASSEMBLYMAN ZWICKER: Thank you, Chairman.

And I want to thank Assemblywoman Muoio for her leadership on this, and thank you for posting this.

It is, as the Assemblyman talked about, really something that we are lagging behind other states, and are quite fortunate that we have extremely knowledgeable experts here today to talk about this from a variety of different perspectives

It's beholden upon us to get this right, because this will set the stage for how the counties in New Jersey start to replace their machines. And so by looking into the details of this, it will allow this Committee to really advance a piece of legislation that will put New Jersey into the forefront of this. And it is really critical.

So I just want to say thank you for putting this Committee hearing together, Mr. Chairman.

ASSEMBLYMAN McKEON: It's a pleasure; and thank you for your leadership as well.

Assemblyman Lagana.

ASSEMBLYMAN LAGANA: Nothing.

ASSEMBLYMAN McKEON: We're good?

I was teasing John; we serve on a number of Committees together.

Welcome to Assemblyman DiMaio, who is substituting in, and came a long distance to be here on this very important issue.

John, do you have any comment?

ASSEMBLYMAN DiMAIO: Thank you, Chairman.

Just a couple.

I'm a former Freeholder, as some of you -- or most of you may know. And at the time we purchased the machines, I was a sitting Freeholder. We actually bought machines with a paper readout because we were very nervous about the possibility of hacking. I was happy to come down here today and participate in this discussion because none of us want to see an election taken from anyone. Whether we win or lose, it should be a fair process.

So I'm happy to be here; I'm happy to say that my home County of Warren already has a paper readout. You see it before it's cast, and it goes into a box. And I think this discussion is well warranted.

ASSEMBLYMAN McKEON: Okay, thanks much.

I was going to make a wise guy comment about Putin and tell him to stay away (laughter), but this is a serious topic, and we have two very serious people to lead us off.

Dr. Appel from Princeton University; you've done incredible study and work on this issue, and we're all looking forward to your thoughtful testimony. And you are joined by Reverend Moore, with the Coalition of Peace Action, who has been an important leader and an advocate, relative to this issue.

Gentlemen, welcome to you.

Professor.

A N D R E W W. A P P E L, Ph.D. Thank you for giving me the opportunity to testify on this issue.

(refers to PowerPoint while speaking) As you know, almost all of New Jersey's counties use paperless DREs -- that is, *Direct Recording Electronic* voting machines. Because these voting computers have no paper trail that could detect and correct computer hacking, New Jersey should switch to a more trustworthy voting method used by most states -- precinct count optical scan voting, in which the voter marks a piece of paper that can be counted by machine. So you have your election results as soon as the polls close, but in case the machines are cheating, you can recount those papers by hand without any computer interpreting to you what it says on them.

Precinct count optical scan was introduced in the United States, and was used as early as the 1970s and 1980s. In precinct count optical scan the voter blackens the ovals next to the names of the candidates of their choice on the ballot. And right there in the precinct

they feed it to an opscan vote counter. And if that opscan vote counter is malfunctioning or hacked, you have the safeguard that that ballot, marked by the voter, drops into a sealed ballot box under the machine and it can be audited or recounted by hand. Most states now use this technology.

New York state recently switched to optical scan voting directly from the lever machines; they skipped over any intermediate technology. And you see that New York state has its opscan ballot arranged in rows and columns. But those silly New Yorkers put the offices across the top and the parties down the rows, and everybody knows it should be the other way around. (laughter)

In the 1990s and early 2000s, Direct Recording Electronic machines were produced and adopted by some states. At top-center you can see the kind that's used in almost all of New Jersey's counties. And in these machines you touch a screen; a computer inside the machine decides what you meant by that, and decides what it will record in its memory; and at the close of the polls, it will print out behind, on a cash register tape, the vote totals, and it will write those totals to a cartridge.

Now, for any kind of voting machine -- whether opscan or Direct Recording Electronic -- the voting machine needs to know who's on the ballot and in what position onscreen, or on the opscan ballot. And for that, you need a *ballot definition file*. That's a computer file that's prepared on an election management computer, typically at county central. This is just an ordinary laptop or desktop computer in which election administrators prepare the ballot layout; they write it to a ballot definition cartridge, which is a removable media. In New Jersey, on most of our voting machines, that cartridge is about the size of a VCR tape. And then

that cartridge is installed into a slot in the voting machine before the election, so that the voting machine knows what ballot to display -- if it's a touchscreen -- or where the candidates are laid out on the ballot, if it's a paper overlay or if it's an optical scan machine.

Now, here's the fundamental flaw of voting computers. Whoever programs the computer decides what election results are reported by the computer program inside the voting machine. And if a legitimate election vote-counting program is installed in the machine -- the one that the manufacturer designed and that was certified by the Election Assistance Commission, and so on -- then the machine will be very accurate. If a fraudulent program that decides to count up the votes a different way happens to be installed on Election Day, then it will cheat; you'll get completely different results.

So here's how you commit election fraud using a paperless DRE voting computer. You write a computer program that, on nonelection days, accurately counts the votes. You do that because somebody will test that machine not on Election Day. But on Election Day, between 8:00 in the morning and 5:00 in the evening, it will cheat. It will add votes to the wrong column.

The voter won't see anything wrong because the little *X* that's going to light up on the screen is going to be the one by the button the voter pushed.

ASSEMBLYMAN McKEON: Professor, can I just stop you for a minute?

DR. APPEL: Yes.

ASSEMBLYMAN McKEON: Gentlemen, are we okay?
(referring to media representatives) It looked like it was going to be a fist
fight.

UNIDENTIFIED MEMBER OF AUDIENCE: (off mike) We
all lost audio.

ASSEMBLYMAN McKEON: All right; so we're good. I just
want to make certain that the Professor's very important remarks are in a
position to be recorded. We're good?

UNIDENTIFIED MEMBER OF AUDIENCE: Yes.

ASSEMBLYMAN McKEON: All right; excellent.

Sorry about that, Professor.

DR. APPEL: All right.

If the computer inside the voting machine is cheating, it will
make sure to light up the little green *X* next to the button the voter pushed;
but what it records in its memory may be different.

The pre-election logic and accuracy testing won't see anything
wrong because, first of all, the voting computer can know whether it's in
LAT mode -- *logic and accuracy testing* mode, and it knows what the date is.
So it won't cheat, except on Election Day. It won't cheat in testing mode
before the election.

You have to take this cheating computer program and load it
into the voting machines. You can do this at the factory, you can do it in
the warehouse where the machines are kept all year between elections, you
can do it in the field. These voting machines are delivered to polling places
on, typically, the Thursday or Friday before a Tuesday election. They sit
there in the lobby of my academic building, in the gymnasium of my kids'

elementary school, over the weekend, where people can access them. It's a felony to tamper with a voting machine, but that's what criminals do; they commit felonies.

ASSEMBLYWOMAN MUOIO: Professor--

DR. APPEL: There's a question.

ASSEMBLYMAN McKEON: Please; Liz.

ASSEMBLYWOMAN MUOIO: Just one thing I want to point out.

This does not involve the use of Internet Wi-Fi connectivity or anything. I just want to-- Because I know that's a concern that some people raised -- that our machines are not vulnerable to an Internet-type hack because we mandate that they not be connected to the Internet. But this does not -- this is completely--

DR. APPEL: This kind of hacking has to do with physical access to the voting machines.

So here's how you install a vote-stealing program into one of New Jersey's AVC Advantage voting machines. You have to put it onto a computer chip exactly like this. This chip has not the ballot definition, but the control program that decides how to add up the votes. And you can see in this picture there are four chips on that motherboard with white labels on them. And it's the -- it's one of those chips with the white labels that has the program that decides what the voter meant when they pressed the button, and adds votes to one column or the other.

So to install this chip in the voting machine you need to pick the lock on the outside. I don't know much about lock picking, but I can do that in about 15 seconds. You need to unscrew 10 screws, you need to

remove and replace any tamper-evident seals on it without evidence of tampering -- which I have demonstrated how to do for every different kind of tamper-evident seal that the Director of Elections proposed -- and pry out the chip, push in the new chip, replace the screws, replace the seals, close the lock.

I studied the computer program inside the AVC Advantage. If you have a copy of the source code it takes a week of, sort of, studying it to figure out how you're going to make it cheat; and then writing the program that cheats took only a couple of days. It was adding 122 lines of extra source code to the program. And what my program did was, at the close of the polls, it would just shift 20 percent of the votes from one party to another. There was no use being greedy (laughter), because then people might get suspicious. And 20 percent of the vote is a big margin, as you know.

If you don't have the source code, it takes more time to sort of reverse engineer the binary code and turn it back into source code to analyze it. But this is well within the capabilities of anybody with a bachelor's degree in computer science. There are hundreds of thousands of those people in the United States, and more in Russia.

Okay, so the firmware that cheats, that I demonstrated, doesn't cheat in pre-LAT mode. It cheats only when at least 100 votes have been cast on that machine. The AVC Advantage has a so-called *audit trail* in its electronic memory that sort of records each vote individually, so my program modifies the audit trail too. The AVC Advantage keeps two copies of the vote totals -- one on the removable cartridge, and one on the motherboard -- so I make them cheat consistently; and so on, and so forth.

So on many voting machines, you replace-- Well, on a computer you replace the software by, sort of, installing a removable media -- a CD ROM, or the USB cartridge, or you download it from the Internet. And the way you replace the software in some voting machines is through the PCMCIA -- the same ballot definition cartridge.

On the AVC Advantage, there are such removable cartridges that have software on them, especially connected with the audio kit used by disabled voters. And so they can be vulnerable to Internet hacking in that way. But by and large, the main attack vector on the AVC Advantage machine is by somebody who has physical access to it and replaces the chip. Now, this replacement could have been done 10 years ago; it could be done next Friday before a Tuesday election. Once you install a cheating computer program in the machine, it will cheat in election, after election, after election. You don't need to be touching the machine on Election Day, or the week before Election Day. You could hack the machine as it's sitting in the elementary school after the election, and that will make it cheat in the next election, and the one after that, for 10 or 20 years.

So it's not about access on Election Day, and it's not about shenanigans in the polling place.

Voting machines can also be hackable indirectly from the Internet, even if they're not directly connected to the Internet. It's been demonstrated -- an attack vector, where the attacker hacks into election administration computers from the Internet; and that infects the ballot definition cartridges, that are then loaded from those computers into the election machines. This may seem farfetched, but it's been demonstrated.

New Jersey's election administration computers are not supposed to be connected directly to the Internet, but still files are transferred back-and-forth to load ballot definition cartridges into the local election computers and to transfer results out so that they can be posted by the county clerk -- the precinct-by-precinct totals. So there are dangers there.

Now, here's what the AVC Advantage voting machine looks like without the paper overlay that has all the candidates' names on it. This is one of my own, personal AVC Advantage machines that I bought surplus from North Carolina when they, very wisely, moved away from Direct Recording Electronic voting machines. So there's a paper poster-sized ballot overlay that's put on top of all those buttons. And if the position of the candidates on the ballot -- on the paper doesn't match the positions of the candidates in the electronic ballot definition file, then when you press this button you think you're voting for this person, but it's recorded in the ballot definition file for a different candidate. Could this happen? Well, it did happen. There was an election in Cumberland County, New Jersey, in 2011, where the ballot positions were swapped in the ballot definition cartridge relative to what was on the screen. We don't know if this swap-- And therefore, the voting machine indicated that the wrong candidate won. How do we know this? Well, we'll have testimony about this later today, but it was such a small election -- for one position on the Democratic County Committee -- that it was all on one voting machine, and they could get affidavits from every single voter. Most of your elections -- if some of the voting machines are cheating or swapped, you can't really get affidavits

from all the voters; it's impractical. So this was the unusual case where the machine cheated, and it could be detected.

Now, we can't tell if the swap was on purpose or by accident. The judge in that case wrote, "I do not know, and may never know, exactly why this election was defective. I have suspicions that something happened here that was improper, and I even question whether something happened here that may have been criminal."

So if we had had voter-marked paper ballots -- right? -- and if the opscan computers had been hacked or made a mistake, and if you weren't sure how the election should have turned out, you wouldn't need affidavits from all the voters. You could recount those paper ballots by hand and see what the voters marked on them. And that's, sort of, the failsafe that you have with voter-marked paper ballots.

Okay, so computers connected to the Internet, even directly (sic), can be vulnerable to hacking. Computers where a possible criminal has physical access to them, whether in the warehouse, or in the polling place, or where they're manufactured -- they're vulnerable to hacking. No computers are invulnerable to hacking and, therefore, we should run our elections in a way that can detect and correct for computer hacking without having to put all our trust in computers. And particularly, you can't use paperless touchscreen voting computers and trust them not to be hacked. That's the fatal flaw of that technology; and pretty much everyone knows this now. Only a few states still use them. Not all states ever did use them; many states stayed with optical scan, even through the, sort of, HAVA process. But since 2004, many states have switched away from DRE voting

computers to optical scan. And no states have switched to DREs since 2004 and it's because of this fatal flaw of DREs.

So here are the states where all voters, or almost all voters, use paperless DREs. You know, it's Louisiana, Georgia, New Jersey, Pennsylvania, Delaware-- Except Delaware is now moving to optical scan, so we'll move Delaware into the *optical scan* category.

Maybe we shouldn't use computers at all; maybe we should have voters mark the ballots and count them by hand. And in many countries, that works very well. I don't think it will work well in the U.S.; and the reason is, that in the countries where that works there is only one race on the ballot. It's a parliamentary system; you're just voting for one party, and that covers everything. And so there is only one contest to count, and it's easy to count by sorting the ballots into piles and adding them up.

But in the U.S., we vote for many things at once. We vote for President, and Senator, and Congressman, and Governor, and State Assemblyman, and State Senator, and Mayor, and Judge retention -- in some states -- and ballot questions. And there are so many different races to count that it's impractical--

ASSEMBLYMAN McKEON: You could have started with State Assembly. I'm just saying (laughter); just from a personal opinion.

DR. APPEL: Yes; so, it's impractical to count accurately by hand, especially at the end of the Election Day when everyone's tired. So we can count more accurately by this method.

The voter marks the optical scan ballot, feeds the ballot to the scanner. And now the hacker's thinking, "Well, I'll just hack the scanner.

If I installed a vote-counting software in the opscanner, I could make it cheat, and I'll win the election." But the safeguard is that the paper ballot drops into the ballot box, and it can be recounted by hand without any computer interpreting to you what it says. And you might-- And that's the principle of the voter-verified paper ballot. The voter sees -- or, better yet, the voter marks, on the ballot of record that will be used for recounts, the choices without any computer in the way.

Now, you might think if you have to recount the ballots by hand, what do you save by having the opscanner? And here we have the principal of random audits. If there have been enough opscanners hacked to influence the result of a big election, then by randomly sampling a few percent of the ballot boxes and recounting them, and making sure that those ballot boxes come out exactly the way the opscanner claimed, then if there were a bunch of opscanners here and they were cheating, you would catch it; because the random sample would overlap statistically with the cheating opscanners.

And then if you detect that some of the opscanners were cheating or malfunctioning, then you could do a wider paper recount, ordered by a judge, in accordance with New Jersey State statute.

So that's the notion of random audits. Some states do random audits; the states in dark green do very good random audits. The states in light green, here, have random audit procedures, but they can be improved to get better statistical validity.

There's one state on this map that's in the unusual position of having a good random audit statute, but not having any paper ballots to audit -- and that's New Jersey. And that's because the legislature was very

forward-looking, 10 years ago, in passing a Random Audit statute and requiring voter-verified paper ballots. And it was sort of stalled in the Executive Branch. So we have a good random audit law; now we just need the paper ballots to be able to audit.

So we should run our elections in a way that can detect and correct for computer hacking, without having to put all our trust in computers with no way to check on what the computers did.

Now let me talk about voter-verified paper ballot printers. I applaud Warren County, New Jersey, for being forward-looking 10 years ago in saying, “Yes, we’re going to have a voter-verified paper ballot.” So you can see at the upper right that the record of the voters’ choices prints out behind a screen after they’ve touched things on the touchscreen. And that’s better than a Direct Recording Electronic machine without a voter-verified paper ballot.

But the consensus among the experts is that this is not actually the best technology. The voters generally don’t know what that’s for up there; they’re not very good at checking whether the candidates listed are the ones they actually chose, especially in the races that are not so high profile. So there’s the danger that the computer could be printing the wrong candidates on the down-ballot races on that sheet and manipulating the totals in the computer, and the voters might not notice.

And then there’s the question of, what if the voter does notice, right? The voter has the option to say, “No, this is not what I chose; let me try and vote again.” So the voter votes again, and what if the machine is still cheating? The voter doesn’t have that ballot in his or her hand to sort of have control over whether they deposit it.

So this was a good technology for its time, and I think Warren County is ahead of the rest of New Jersey in this. And I wouldn't necessarily make Warren County replace their election equipment. But if the rest of the counties are switching, I would strongly recommend they switch to voter-marked paper ballots with optical scanners.

So this works well in 37 other states; the voters can do this. New York switched from lever machines to this technology between 2012 and 2014, and that switch went fairly smoothly.

You can do this now in New Jersey. There is at least one optical -- precinct count optical scan voting machine certified by the Secretary of State's Committee for use in New Jersey -- the ES&S Model DS200. Within each polling place, by Federal law, you'll need an accessible ballot-marking device for use by disabled voters, so here's a couple of models of ballot-marking devices.

And some of them -- you use the audio machinery for blind voters, or the touchscreen for sighted voters who still have difficulty manipulating the paper. And it will print out just an opscan ballot that you can feed into the precinct opscan machine.

Now, the equipment for ballot-marking devices, and precinct count opscanners, and central count opscanners is available from five different manufacturers. This is the current status of what equipment is certified by the Election Assistance Commission for purchase by states and counties. Many of these machines -- I think all of these machines but one are in use in many other states. So New Jersey does not have to be limited to single-source bidding; there are lots of choices on the market.

The cost? Well, the voting machine manufacturers won't quote list prices, right? They negotiate, and they try to get you to pay what you are willing to pay. But our estimate is that it's about \$5,000 per ballot-marking device, or per opscan machine.

Now, unlike the DREs, you don't need several of them in each precinct. In fact, where I go to vote there are two different precincts that vote in the same elementary school gym; so in the same polling place. And all you need is one opscanner in the polling place; you can even have two or three different precincts using the same opscanner. And the reason for that is, when we vote on the touchscreen machine, the voter occupies that touchscreen machine for the whole time they're making their selections. But when you vote with precinct-count opscan, you sign in at the poll book, and the poll worker hands you a paper ballot; and you take that over to a cardboard privacy booth on a table to mark it with a pen. And several voters can be doing that simultaneously, not occupying the opscan machine.

And then when you've marked your ballot, you bring it to the opscan machine and you just feed it through.

Now, the other reason we have multiple DREs per polling place and per precinct is in case one of them breaks. What happens if an opscan machine breaks during Election Day? The voters can still mark their ballots and put them into a ballot box, where they can be counted at county central by a high-speed scanner. So it's a very resilient technology. And even if the equipment malfunctions, the pencils and pens still work. And that's why you don't need so many copies of the equipment, and it becomes more cost-effective.

And that concludes my testimony.

ASSEMBLYMAN McKEON: Professor, thank you very much.

I appreciate what you're saying about the random audits as a failsafe. But just listening to your testimony-- And again, when I say *easy* -- easy for someone who has, like many people now do, computer science backgrounds. But since it would be so easy to do, how is it that anyone in any election shouldn't ask for a recount of the paper ballots, ever? You know, why wouldn't they? Does that happen in other states? It just--

DR. APPEL: It depends on the state. Some states have a culture of more recounts; and where the cost of a recount is set at a price. A typical state will say, "If the margin is only *this* much, then there is an automatic recount. And if the margin is *that* much, then the candidate can request it, and pay this much per precinct." You know, it depends on state law.

The question of whether there should be a recount is according to state statute. And New Jersey has a statute by which a candidate can request a recount; and it's, I believe, up to a judge whether to authorize it.

If there are no random audits, then the candidate is requesting a recount, maybe, on the basis of no evidence that would convince a judge. So I think that's why a random audit law is a good idea -- that you do the audit, you don't detect any hacking -- which is the typical case -- and then people can be confident that the result is what it is. And this evidence can be brought to the judge, in accordance with state statute, in terms of recount requests.

ASSEMBLYMAN McKEON: You know, I'm going to open it up to other questions.

But you know, it's interesting, Professor, going back in our history, the Princeton -- apropos to that -- the way that one would vote would be to get the name of Woodrow Wilson, and you'd put it in the ballot box. And that's where the term *stuffing the ballot box* came from, as there were ways to cheat in that sense as well.

So I guess my question to you is, do we know of other instances where there's been electronic hacking as a practical matter? Has this happened? Or is it just so -- you can never tell. Who knows?

DR. APPEL: Well, there haven't been many documented cases of electronic hacking. There has been a documented case in New Jersey of the wrong result; and we can't tell whether it was because of deliberate switching or not. There's not much forensic investigation of voting machines that occurs in the U.S. after elections that could possibly detect this hacking.

You're right that paper is not perfect, and it's possible to manipulate paper. The kind of ballot box stuffing that used to occur before, let's say, 1890 or so, was-- In 1890, the kind of reform was instituted where you show up at the polling place and they hand you a blank ballot to fill out -- just one -- so you don't have a whole bunch of official ballots to stuff in. The ballot box stuffing mostly dated from before 1890, where the voters brought their own paper ballots with them; and if you could bring one with you, why not bring 20 on thin tissue paper, right?

So when you feed paper ballots through the opscan machine into the ballot box, and the, sort of, automatic electronic rollers are pulling the paper through, it's very difficult to get several pieces of paper through at once in that process.

ASSEMBLYMAN McKEON: Interesting. And I only mentioned Wilson -- God knows not to say that he was involved, or that election was involved in any of that -- as much as, as a collector, I have -- it looked like fortune cookie paper that has his name printed on it. I bought some, at some point in time, which were ballots from back in that day. Interesting.

Andrew; Liz?

ASSEMBLYMAN ZWICKER: Yes, I have--

Can you go back to-- Before we started hearing your testimony, Assemblyman DiMaio and I were talking about the way the machines are sealed; for instance, in his county, and overall. So you said, relatively quickly in the course of your presentation, that you can pick a lock, take out 10 screws, insert your chip -- which costs a few bucks, once you've done it, right? -- you've broken the seal--

DR. APPEL: Three-and-a-half dollars.

ASSEMBLYMAN ZWICKER: Three-and-a-half dollars, right? (laughter) So I know you practiced; how good did you get? How quickly could you walk up to a machine, break the seal, replace the chip, reseal it; so that it was, as far as you can tell, undetectable?

DR. APPEL: Right. So it depends which seals you put on the machine and how many. And one thing we heard, in the course of the investigation in 2008-2009, is we heard from an expert on seals, Dr. Roger Johnston of the Argonne National Laboratory. And he explained a couple of things; one is that every seal -- the attacker is not going to, sort of, walk up to a blind. They'll buy a hundred copies of that seal from the same vendor that sells it to the State and, sort of, practice on it. The typical

paper-based security seal that's supposed to -- when you peel it off and put it back on it's supposed to say *VOID* on it, right? But if you're careful with a razor blade you can just get it off without disturbing that adhesive.

And so each one of the different seals that the State Director of Elections proposed for use, I was able to get a bunch of copies of them and figure out what their weaknesses are. And so if you have three or four seals on there, it will take me 10 minutes to get them off. It does add to the time.

But Dr. Johnston also testified about the AVC Advantage voting machine as a whole. He said, "This machine is not possible to secure because it has so many different ways to get into it," that he made a cheat -- not by hacking a computer chip behind those seals; he just took off some of those button panels on the front and swapped the wires around. And that wasn't protected by any seals at all.

And I don't know if you've ever been in a polling place after the polls close and everybody has packed up. And you see all these security seals on the floor that the poll workers in the polling place had no idea what they were for and what to do with. So seals are not really going to be *the* answer to securing our vote.

ASSEMBLYMAN McKEON: Liz.

ASSEMBLYWOMAN MUOIO: Just one quick question; I know you have to leave.

But we had a memo from the Office of Homeland Security which talked about the lack of any evidence, historically, about the DREs that we currently use being vulnerable to hacking. But without a paper

trail, how can you tell, currently, if a machine has been hacked or somehow compromised?

DR. APPEL: Well, one way to tell is to get affidavits from every single voter, right?

ASSEMBLYWOMAN MUOIO: Okay, other than that, then.
(laughter)

DR. APPEL: Well, that's the best way we had in New Jersey.

ASSEMBLYWOMAN MUOIO: Okay.

DR. APPEL: You know, you could do a forensic examination of the machine and pull out the chip and see if it still has the legitimate computer program in it, and hope that that chip hadn't been put back since the election.

But I, as a computer scientist -- if I walk up to a voting machine to vote on Election Day, how can I tell what program is installed in that machine? I'm on the outside. All my expertise doesn't help me there. And the same for the poll workers and the election administrators. These machines have to be opened up all the way, every year or two, to replace the double-A batteries on the motherboard that keep the clock going. So every time -- every year or two, when those machines are opened up, there's room for mischief.

ASSEMBLYWOMAN MUOIO: Thank you.

Welcome, Vice Chair Johnson.

ASSEMBLYMAN GORDON M. JOHNSON (Vice Chair):
Thank you; thank you, Chair.

And thank you for your testimony.

I have a few questions about the security, though.

You say that seals are not a good line of defense against someone hacking or getting into a machine. And then you said there are different types of seals. So couldn't there be a type of seal that would be more secure than another?

DR. APPEL: You might think so.

ASSEMBLYMAN JOHNSON: And, in addition to that, couldn't we train or educate those individuals who work these polling places or have the responsibility of these machines -- couldn't they be taught or trained to systematically secure these machines before and after their use?

DR. APPEL: So what you're describing is a seal-use protocol.

ASSEMBLYMAN JOHNSON: That's what I was trying to say, sir; yes. (laughter)

DR. APPEL: Right, so in the lawsuit in 2008-2009--

ASSEMBLYMAN JOHNSON: When?

DR. APPEL: In 2009.

ASSEMBLYMAN JOHNSON: In 2009; okay.

DR. APPEL: Right; Dr. Johnston and I testified that the State of New Jersey didn't appear to have any seal-use protocol at all; that the seals don't help you if nobody is recording what serial numbers are on them. And also, the seals don't help if nobody is trained in how to examine the seals and remove them. And so the seals were completely useless at that point.

And so we asked the Court to require that New Jersey use a seal-use protocol; and the Court did require that. And it's my understanding that the Division of Elections is supposedly using a seal-use protocol. I have not seen their protocol, and I have not seen whether it's

actually applied in use; how well the many different election administrators and people who have to handle the voting machine are trained in its use.

And then you asked about -- couldn't one seal be better than another. So in 2008, I wrote an expert report for the court in August. I said, "There are no seals on these voting machines." So the Director of the Division of Elections said, "Okay, we'll use these seals," and he provided me with samples. In October, I wrote a report saying, "Here's how to remove and replace these seals without evidence of tampering." So then in December, they said, "Okay, we'll use these seals instead; these are tamper-proof." And so in January, I wrote a report saying, "Here's how to remove and replace these seals without evidence of tampering." And then they proposed a different set of seals; and, in April, Dr. Johnston testified, "Here's how to remove these seals and replace them without evidence of tampering."

Some seals are better than others; but they're all just little physical devices that essentially can be picked or lifted.

I'm not saying they're all useless; I'm saying you can get around all of them. And also there are enough people who legitimately open up the entire voting machine, as I said, to replace the batteries. And now we have to trust every single one of those people with counting up the votes in our elections. That seems to be unacceptable.

ASSEMBLYMAN JOHNSON: Okay.

I'm done.

ASSEMBLYMAN McKEON: You're good?

ASSEMBLYMAN JOHNSON: Okay.

ASSEMBLYMAN McKEON: Joe.

ASSEMBLYMAN LAGANA: Thank You, Mr. Chairman.

Thank you, again, for your testimony.

Now, and I believe you stated earlier about the level of expertise you need to actually accomplish something like this. Now, you're clearly an expert; now, is it your opinion that anybody -- I think you said anybody with a bachelor's degree in computer science can do something like this.

DR. APPEL: Yes, because--

ASSEMBLYMAN LAGANA: Is it really that easy?

DR. APPEL: Yes, here's basically why it's really that easy.

At heart, the computer program in a voting machine just records votes and counts them up. So it's not a very complicated program. And now to add functionality to that -- functionality to that program that will shift votes from one column to another, is also not very complicated.

So there are two kinds of action here. One is to prepare the vote program -- the vote-stealing program, which is not a very complicated kind of software engineering, well within the capability of 100,000 people in this country, and many others in Russia and North Korea. And the other is installing it in the voting machine itself, which needs no computer science expertise at all because it's just, essentially, the use of a screwdriver and a razor blade.

ASSEMBLYMAN LAGANA: So the voting machines that they use in Warren County, what could you do to those as a--

DR. APPEL: You could hack them to make them cheat.

ASSEMBLYMAN LAGANA: You could-- I'm sorry; you--

DR. APPEL: You could hack them to make them cheat. But the safeguard is that the voter touches the selections on the screen. That's going to be recorded directly in the computer memory -- or not, if it's cheating. But the voter's selections are printed out on the paper that displays behind glass on the upper-right-hand corner there. So the voter is supposed to check that what's on that paper is what they selected on the screen.

Then that paper -- the voter doesn't get to take it home. It drops automatically into a ballot box, and that can be recounted or audited.

ASSEMBLYMAN LAGANA: So if there was any type of hacking of one of those machines, you would be able to compare what was recorded into--

DR. APPEL: You would see that the recount of the paper ballots didn't match what the machine said. And since you'd know, supposedly, that the voter actually saw that paper, that that's the voter's selections, there would be evidence of hacking. And not just that you detect the fraud -- which is good -- but you'd be able to correct the fraud and get the accurate result without a do-over election. And as you know, do-over elections are very messy, and complicated, and not necessarily -- and certainly not what you want.

ASSEMBLYMAN LAGANA: Is there any way that this type of machine can be tampered with, besides messing with the computer system? I mean, I know it's a paper ballot and people can get pretty--

DR. APPEL: Well, okay, so those paper ballots drop into a ballot box; it's a sealed ballot box. And now you have to worry about chain of custody of that. The election results are brought back from a polling

place to the place where they're aggregated. I believe the procedure is to have that done by two people who are registered in different parties, right? So the chain of custody issues that follow the vote totals that come in the cartridges -- you would also want to apply that to these ballot boxes.

ASSEMBLYMAN LAGANA: Do you know what is the cost between this type of machine and the other ones that are used?

DR. APPEL: I don't know what Warren County paid for these machines; but in general--

ASSEMBLYMAN LAGANA: I mean, it was 15 years ago, so I'm sure it's much more expensive now.

ASSEMBLYMAN DiMAIO: It was 15 years ago. I can remember last year's budget numbers better than that.

ASSEMBLYMAN LAGANA: Yes; okay.

DR. APPEL: Generally, the-- No, I can't speculate about the exact cost.

ASSEMBLYMAN LAGANA: Okay.

DR. APPEL: I just will remark that you don't need as many of the opscan machines per precinct as you do of the touchscreen machines, for the reasons that I described. And that the opscan machines per each don't necessarily cost any more than the touchscreen machines per each.

ASSEMBLYMAN LAGANA: Thank you.

ASSEMBLYMAN McKEON: Anyone else?

John; and then if you have a follow-up, Andrew, please.

ASSEMBLYMAN DiMAIO: Thank you, Chairman.

Well, I beg to differ with you on the point that people wouldn't check that. I think that the voters in our County are just as sophisticated as many other places in the United States of America.

And I have yet to hear of anyone complaining that their actual votes that are recorded on the paper portion of the ballot are different from the votes on the screen. It would take one person in 15 years to make a complaint like that, and we would have heard about it.

DR. APPEL: Right. So I don't--

ASSEMBLYMAN DiMAIO: Because I have my finger pretty much on the pulse of what's going on in my County. I've lived there my whole life.

DR. APPEL: I would expect that those machines have never cheated; and therefore, that the result on the paper has always matched what it's on the screen.

Now, partly that's because we don't know whether any machines have yet been hacked in New Jersey, and we're worried about the future. And the second is that that paper is a strong deterrent against hacking those machines. So I think you're right -- that the voters have not seen any discrepancy, and that this has worked well in Warren County.

ASSEMBLYMAN DiMAIO: And the second question I have -- since you are more aware of the statute on audits -- has Warren County ever been audited with regard to checking the paper against the screen? I just sent a message to one of the election board members to see if--

DR. APPEL: Right.

ASSEMBLYMAN DiMAIO: --they do that.

DR. APPEL: I don't know, actually.

ASSEMBLYMAN DiMAIO: Okay.

DR. APPEL: And I wouldn't think about, "Has Warren County ever been audited?" Has Warren County ever *done an audit* itself?
(laughter)

ASSEMBLYMAN DiMAIO: Well, I'm asking--

DR. APPEL: Don't think of the--

ASSEMBLYMAN DiMAIO: I've asked one of the election board members; hopefully, he's--

DR. APPEL: Right.

ASSEMBLYMAN DiMAIO: --able to see it. But I will find that out. But I can tell you that it's very clear -- those things are printed very clearly. And I do look, and I'm sure other people do, because this is a very important thing.

DR. APPEL: Right. Well, certainly Warren County is ahead of every other county in New Jersey on this issue.

ASSEMBLYMAN DiMAIO: I could follow up on that
(laughter) in a positive way; but I won't do that today.

But the point is, I felt strongly about it at the time, and I still believe this works.

Now, we did have the optical scan machines previous to these machines, where you filled out -- you colored in an arrow, I believe it was, next to everybody you wanted to vote for, and you ran it through a machine. But because of the issue with the voter fraud and all of that, we've moved forward with these. They work, in my opinion at least.

Thank you.

ASSEMBLYMAN McKEON: Thank you, John.

Andrew, did you say you had a follow-up?

ASSEMBLYMAN ZWICKER: Yes.

So while we have you here, I actually want to ask you your opinion of the future.

You know, the integrity of elections in this country is, obviously, in the headlines almost daily. And it is so obviously critical to the confidence and to the public as a whole. And you're, I believe, arguing that we should go backwards, to 2004, at some level; though we would use machines made today -- but again, we're using Warren County as an example -- but go backwards, away from the 1987 machines and to these machines that you've described.

I'd just like to get your opinion on something else, which is, we also know -- especially as elected officials -- we know that turnout in elections continues to drop, for a variety of different reasons. And one of the things that has been pointed out is that among younger people turnout is not particularly high. And people have proposed that we should go to Internet voting. So it's the exact opposite of what you've just testified to, right?

So my question for you is, could you imagine a possibility of secure Internet voting?

DR. APPEL: One can imagine anything. (laughter)

Internet voting, as we could possibly do it now, would be a complete disaster. It would be so easy to hack not only into the server that you connect to that's counting up the votes, but think about this. You're doing your vote on your phone or on your own computer, and it's showing you a ballot, and you're filling it out. And then it's promising to transmit

those votes to the server. But if your computer is hacked, because some virus has gone around and taken over your machine, then it could interfere with the app that's allowing you to vote. And you think you're voting for these candidates, but it's transmitting completely different votes to the server.

So the hackability of Internet voting, both at the server -- who got to install that vote software? -- and at the client -- your own computer is so insecure that it could never be trusted.

Now, even if the people running the server are completely honest, are they so amazingly competent that their server is secure against every possible attack? Are they more secure than what we thought was a well-run company, like Equifax, or Target, or-- One company after another hires expensive people to run the security of their servers, and occasionally they still get hacked.

Now, there's interesting computer science research in cryptographic probabilistic Internet voting protocols that could allow a kind of end-to-end checking. And it's possible that, 5 or 10 years in the future, that research will pan out in such a way that maybe we could have a kind of trustworthy Internet voting. But there is certainly nothing available now, or in the near future, that would permit any kind of Internet voting that we could trust.

ASSEMBLYMAN ZWICKER: Thank you.

ASSEMBLYWOMAN MUOIO: Can I ask one, John?

ASSEMBLYMAN McKEON: Of course, Liz.

ASSEMBLYWOMAN MUOIO: Just one last question.

Just to clarify -- you don't-- Based on what you were telling us, that the laptop or computer that designs the ballot that gets put into the machine -- you don't need to be able to break into one of these machines to actually hack it, correct? Because it can be essentially hacked through the computer system that designs the ballot, that then is inserted on the chip into the machine--

DR. APPEL: You can-- Right.

ASSEMBLYWOMAN MUOIO: --by an election official, who may not realize that it's happening.

DR. APPEL: So on these machines we have in 19 counties in New Jersey, the most sophisticated kind of hacks, that are the most undetectable, I don't know how to do from the Internet. I know how to do them by replacing a chip, okay? From the Internet, indirectly, I can see how to manipulate the ballot definition file and how to manipulate the audio kit programming on those of the AVC Advantages that are equipped with an audio kit for blind voters. And there is at least one of those in every single precinct.

But the, sort, of, most undetectable kind of hack -- I don't know how to do from the Internet; only from replacing the chip in person.

ASSEMBLYWOMAN MUOIO: Now, that's what I mean. You don't have to go to a local venue, where the machine is sitting, unscrew the box, and hack into the machine directly. You had mentioned that every -- in every election office they have to design, sort of, a ballot that then is put into -- used for the machine to program the machine. And that's put in a chip and put in the machine by an election official.

DR. APPEL: Right.

ASSEMBLYWOMAN MUOIO: And then it's possible that you could--

DR. APPEL: You can certainly interfere that way with ballot definition files. Now, in principle, that kind of interference can be detected by the pre-election Logic and Accuracy testing--

ASSEMBLYWOMAN MUOIO: Okay, good.

DR. APPEL: --except when it wasn't detected -- for example, in Cumberland County in 2011.

ASSEMBLYWOMAN MUOIO: Okay, thank you.

ASSEMBLYMAN McKEON: Thank you.

Are we good?

Professor, I don't know if you need to absent yourself now, before the Reverend's--

DR. APPEL: Yes, actually.

ASSEMBLYMAN McKEON: You know, you could give your students the day. It's a nice fall day, you know. (laughter)

DR. APPEL: Right.

ASSEMBLYMAN McKEON: We'll leave it to you, understanding--

DR. APPEL: Yes, I do have to dash in about three or four minutes. I think the Reverend Moore wants to testify for just a couple of minutes.

ASSEMBLYMAN McKEON: Oh, no, I was going to turn to him; I wasn't--

DR. APPEL: And I'm getting a ride back with him (laughter), so I'll wait.

REVEREND ROBERT MOORE: We're a package.

ASSEMBLYMAN McKEON: I was giving you the chance to leave, if you didn't want to leave in the middle of his testimony.

Reverend.

REVEREND MOORE: Thank you.

My testimony is basically just to quickly summarize and highlight the OpEd that I was privileged to author, with Senator Linda Greenstein, in the early summer.

And, you know, the security of our voting system is very much in question, and yet it's one of the most sacrosanct rights that we have in this country. I mean, Democracy -- this is the pillar that Democracy stands on -- is can we know that our vote is going to be counted accurately. And right now, unfortunately, New Jersey is tied for last in terms of answering that question.

We don't know for sure; we don't have evidence that they have been, but we aren't sure. So we need that kind of certainty and, as it turns out, as we point out in the OpEd, the best way to do that is with a voter-marked paper ballot -- to go back to the basics.

And I think this is really essential. It was passed into law, actually, in 2005, as our OpEd says. And so it's frustrating that here we are, 12 years later, and it still hasn't happened. And so I think it's time for our elected officials to really make it happen.

I was very pleased to hear the bipartisan support for the principle here, because this is not a partisan issue at all. This is about the integrity of our Democracy. And so I'm very pleased to see that there is the kind of interest that your Committee has shown; I'm very pleased that some

of the Assembly people, who represent my area, are here also helping to lead this effort. And I urge you to move forward as rapidly as possible. Obviously, when we wrote this OpEd, we were hoping it might be in place in time for the election we're about to have in a few weeks, and that hasn't happened. But certainly I don't want to see us get into the year 2018, a very critical election, and not have the security of our voting system in place.

So the voter-marked paper ballot is the cornerstone; and I appreciate very much all of the expertise Professor Appel shared. The optical scan machines do sound like a great way to count those ballots rapidly, but we need the random audit as well, which was another law that has been passed and yet not yet implemented; because we don't have paper ballots to recount, as Assemblywoman Muoio already pointed out.

So we need to get this in place, and to move forward as rapidly as possible on a bipartisan basis.

Thank you very much.

ASSEMBLYMAN McKEON: Thank you very much, Reverend.

Any questions, directly, for the Reverend? (no response)

What a great combination of the science and the moral oomph that stands behind it. (laughter) I appreciate both of your professionalism and your great work, Professor. And hopefully, in New Jersey, it will come to fruition through the efforts of my colleagues, who have immersed themselves in this issue.

REVEREND MOORE: I hope so, too; and thank you again for allowing me the opportunity to testify.

ASSEMBLYMAN McKEON: Thank you.

Okay; the next group we're going to pull up together. Ann Rea of Blue Wave New Jersey; Cindy Zirkle, out of Cumberland County; Stephanie Harris, who is also a member of the Coalition for Peace, as was Reverend Moore; Michelle Mulder, Verified Voting is the name of her group. I know there are no prepared remarks that Michelle has, but she's available to answer questions.

STEPHANIE HARRIS: Good morning.

Thank you so much, Assemblyman, for having this hearing.

ASSEMBLYMAN McKEON: Just for the record, could you just repeat your name.

MS. HARRIS: Yes. My name is Stephanie Harris, from the Coalition for Peace Action. I'm the Chair of the Voting Integrity Task Force.

And I also want to thank Assemblywoman Muoio and Assemblyman Zwicker for their courageous leadership on this issue, which is very much appreciated by our group.

I wanted to, first, introduce my story to the Committee, and then introduce the rest of our people up here -- our witnesses up here.

This is the second time that I have been disenfranchised by our voting system. I came before you in 2004 to tell you how when I went to vote in the primary in 2004, I pressed the *cast vote* button on the machine, and the poll worker told me it did not register. I was advised to redo that; I redid it three times, and the poll worker shrugged and said, "Well, I think it cast that time." But he really was not sure.

And so, after that, I decided that I would always vote on paper. And the way that New Jersey allows me to do that is with the mail-in vote.

So I have been voting on paper ever since, and this summer I received a letter I guess it was about two months after the June primary, which told me that my vote was not counted because it was found, a month late, in a stack of mail in the Hamilton, New Jersey Post Office, and it was too late to be counted for the election.

At that point, I realized that the only way that we can have a paper ballot is if it is mandated throughout the entire state.

In 2005, the Legislature understood that the paper ballot is the most secure way of voting; and we have a law that requires a paper ballot. However, the implementation was postponed until the funds became available. And unfortunately, the funds have never become available.

So what we have now is a system that is insecure and that disenfranchises people like me.

So what the Coalition for Peace Action is advocating for is a system that would mandate a voter-marked paper ballot, which is read by an optical scan machine; and that there be one ballot-marking device that will produce a paper ballot, which is also read by an optical scan machine. The ballot-marking device, as Professor Appel has said, is required for people with disabilities who can either not handle or not see a paper ballot themselves.

And we have discussed this with ES&S, which has a certified machine in New Jersey, the DS200. And the information which they gave us was that it would be \$5,000 for each machine. And we calculated the number of precincts that are in -- the voting places that are in New Jersey, and we came out with an estimate of about \$26 million, which is what it would cost to replace all of the machines in New Jersey.

I have to emphasize that the machines that we are currently using are ancient machines; they are old. If you had a computer that was more than 10 years old, I don't think that you would want to continue to use it. Furthermore, these machines are no longer made, so that if they break, if they need parts, it is very difficult to repair them.

So we are going to be faced with a situation of replacing these machines. Whether or not we agree that they are secure or insecure, they are going to have to be replaced because they are getting old.

And Assemblywoman's Muoio's Bill is saying if these machines are to be replaced, they should be replaced with a system that allows a paper ballot. The original wording of Assemblywoman Muoio's Bill is for a *Voter-Verified Paper Audit Trail*, which refers to the 2005 law. We have seen that the AVANTE company has made a machine like that for Warren County. When Sequoia tried to create a prototype with a Voter-Verified Paper Audit Trail, they did not succeed in having a machine that was acceptable to either the election officials or to the public.

So therefore, after everything that Professor Appel has explained, I would like to emphasize that we are in favor of changing the wording, with an amendment, which the Committee will have to state that we would like to see a paper ballot -- a hand marked paper ballot, which is then tabulated by an optical scan machine -- instituted in the State of New Jersey.

Optimally, we would like to see that in a bill that gives a date-certain, and that would mandate this within an appropriation. But the Bill that we have currently has it as a suggestion as to when machines are to be replaced, this is what they should be replaced with.

With that, I would like to say that the amendments were written by Michelle Mulder of Verified Voting, who is here to answer any questions that you might have about the wording in those amendments which she has created. But before that, I would like to turn it over to Ann Rea, from Blue Wave, who would like to talk about voting in general.

ASSEMBLYMAN McKEON: Hi, Ann; welcome.

A N N R E A: Hi.

Thank you, Stephanie.

Last year, Donald Trump predicted that the election was likely to be rigged. That was a wild and unhelpful exaggeration. A majority of American polling places use transparent, commonsense measures that make our elections trustworthy; features like paper ballots. The way to make our system better is not to panic about conspiracy theories, but rather to double down on the things we already know work well, and adopt trusted voting procedures for every precinct in New Jersey.

States that keep the *faith-based* DRE machines risk the consequence of contested elections. This example is from an August 24, 2017 *USA Today* article, regarding the June 2017 special election to fill Tom Price's House seat in Georgia:

"...there is a.... special election suit that, if successful, it would be what election experts believe is only the second time an election was overturned due to computer issues. The first such case came in 2011, in Fairfield Township, New Jersey, where a computer programming error gave votes for one set of candidates to their opponents. In that case, a Superior Court judge ordered a new election."

It's not complicated. New Jersey's DRE voting machines do not instill confidence and cannot be checked. These machines have, and will, trigger costly law suits and do-over elections.

Right now, in Washington D.C., there is a bipartisan push to secure America's voting equipment. In fact, there is reason to hope that the Federal government may step up to the challenge and provide some much-needed funding for voting technology upgrades. Senators Lindsey Graham, a Republican of North Carolina, and Amy Klobuchar, a Democrat from Minnesota, co-sponsored an amendment to the National Defense Authorization Act that would provide grants to help states purchase new equipment. In the House, Representatives Mark Meadows, Republican from North Carolina, and Jim Langevin, a Democrat from Rhode Island, co-sponsored a companion bill to the Graham-Klobuchar amendment called the *Paper Act*. Such bipartisan support for elections funding is a recognition of not only the scale of the problem, but the potentially detrimental consequences of inaction.

When this Bill, the National Defense Authorization Act, was voted on this September in the Senate, \$37 billion more was added for military spending; more than what President Trump requested. Funds for upgrading the voting machines in New Jersey are vital to our national security, and the funds are there. Not only do our citizens crave secure elections, but the strength of our military depends on the protection of our vote. U.S. elections must be safe and secure so that in the event that the military is deployed, the citizens of New Jersey and the United States will have the utmost confidence that our leaders who take this most serious act have been properly, provably, and fairly elected.

Thank you.

ASSEMBLYMAN McKEON: Thank you very much for your passionate testimony.

Ms. Zirkle.

CYNTHIA ZIRKLE: Thank you for holding this hearing.

I am Cindy Zirkle; otherwise known as the *2011 Cumberland Reversal*. (laughter)

Our votes were reversed in that election, but it was the second time that it happened to me. In 1982, I ran for school board and lost by 100 votes. A local physician, who had managed my campaign, said it couldn't possibly happen; they impounded the machines; the back of the machine had a paper trail, and it was obvious that our names had been reversed on the ballot.

And rather than a new election, they simply reversed the findings. I won, and I went on to serve for 32 years at a local regional high school board.

In 2011, when we ran for the Democrat Committee, we lost 33-10. Because of my first experience, I said to myself, "I don't think that happened," and challenged it yet again. That was a small election that we had to get the interrogatories from each of the 30 people. We had to go to court twice; it cost us over \$5,000 in legal fees, which shouldn't have to be.

So I sit before you, as somebody who has twice challenged the system, and twice won.

If you have any questions, I don't want to belabor your time. But it has happened, and it really needs to stop.

ASSEMBLYMAN McKEON: Thank you. That's important testimony for us to hear.

I know Ms. Mulder didn't have any statements to make, but was available to answer any questions. And I would imagine the panel would be poised to do so as well.

Gentlemen or ladies?

Liz.

ASSEMBLYWOMAN MUOIO: One question -- and Stephanie you spoke about amendments you'd like to see made to the Bill. Do you want to just describe for the Committee-- I know we've talked about it previous; but just for the Committee's edification, why you feel a hand-marked paper ballot is preferable to a machine-marked -- or a hand-marked on the machine, but similar to what the Warren County system is -- why you would prefer a hand-marked paper ballot.

MS. HARRIS: Right. Could I ask Michelle Mulder to answer that question since she wrote the amendment?

ASSEMBLYWOMAN MUOIO: Sure.

MS. HARRIS: You have to turn on your mike, Michelle. Push the button, so it--

MICHELLE MULDER: (off mike) For a variety reasons -- and I think the-- First of all, when the voter marks the ballot themselves, they own the ballot. In some cases, the voter will require an assisted device to do that; however, for the most part they won't. Most voters will not. So then they own it themselves; they verify it because they're making it.

Another reason is that the-- And you have a printed statement listing all of these reasons.

Another reason is that when ballots are recounted, if you get to recount a ballot that's like this (indicates), you know, it's pretty easy. If you're counting a ballot that's like this (indicates), printed in 8-point font, it's not easy. I don't know why the election officials really want to do that; I would think they wouldn't.

There are many reasons -- and I could reiterate the whole statement; we've submitted it multiple times.

ASSEMBLYWOMAN MUOIO: The bottom line is that you don't feel that people will check--

MS. MULDER: They don't--

ASSEMBLYWOMAN MUOIO: I mean, other than the size of the paper--

MS. MULDER: Yes.

ASSEMBLYWOMAN MUOIO: --your concern is that people won't actually look to make sure that their vote is accurately reflected on the piece of paper that the machine is generating? Is that the concern?

MS. MULDER: Much of the time they won't. If they have -- if they can just go in and tap-tap-tap and then leave, they're going to do that.

ASSEMBLYWOMAN MUOIO: Do you have any--

MS. MULDER: And therefore--

ASSEMBLYWOMAN MUOIO: Okay; do you have any data-- I mean, have there been any--

MS. MULDER: Someone -- there is--

ASSEMBLYWOMAN MUOIO: --surveys of people, checking whether they've looked at the ballot? I'm just curious.

MS. MULDER: Yes, I believe Andrew has that study. We will try to get that to you. I think people really don't look at it, and it becomes, then, not a valuable audit record.

If all of the voters marked the ballot themselves, they have verified it while making it. They have created it; they own it.

ASSEMBLYWOMAN MUOIO: Okay; thank you.

MS. HARRIS: We want to make the voting process as simple as possible. And the most simple way of doing that is to have the voter mark a ballot, which goes into a machine, which tabulates it. And we feel that the simplicity of that overrides anything -- where you put an intermediary of a machine that could or could not be compromised into the process.

ASSEMBLYWOMAN MUOIO: Okay.

And one other thing, before I give up the mike. I want to thank Stephanie and everybody for the nice remarks they've made about the work Andrew and I have done on this Bill. But I just want to give a shout-out to everybody else who has worked on this Bill, including one of our-- We have other sponsors on the Bill, including my Assembly mate in the 15th, Reed Gusciora, who has been a leader in this fight for years. So I just wanted to make sure people realize it definitely takes a village to get something like this done.

So, thanks.

MS. HARRIS: Thank you.

ASSEMBLYMAN McKEON: No need to be so gracious; come on. (laughter)

ASSEMBLYWOMAN MUOIO: He'll find out if I'm not.
(laughter)

ASSEMBLYMAN ZWICKER: *The Village of Trenton.* (laughter)

ASSEMBLYMAN McKEON: Any other questions?

John.

ASSEMBLYMAN DiMAIO: Who's the most familiar with the Warren County machines?

MS. HARRIS: Well, we have talked to the AVANTE company, so we know about what their machine can do. We know that it is in use in Warren County, but we have never had the opportunity to see it being used.

ASSEMBLYMAN DiMAIO: Well, are you aware that it prompts you to check the paper ballot before it's cast?

MS. HARRIS: I'm sorry; I can't hear you.

ASSEMBLYMAN DiMAIO: Are you aware that it prompts you to check the paper ballot before it's cast?

MS. HARRIS: Yes.

ASSEMBLYMAN DiMAIO: You are?

MS. HARRIS: Yes.

ASSEMBLYMAN DiMAIO: So why would people not check it, if it's prompting you to do so?

MS. HARRIS: If it is a very small paper ballot in a window--

ASSEMBLYMAN DiMAIO: We don't have that any more.

MS. HARRIS: Yes.

ASSEMBLYMAN DiMAIO: But it's not that small. The font is bigger-- Did you say *8-point, 8-pitch*?

MS. MULDER: Yes.

ASSEMBLYMAN DiMAIO: No, it's not 8-pitch. It's bigger than that; I've seen it, and I have to wear reading glasses to see things. It's bigger than that.

MS. HARRIS: Ah-ha.

ASSEMBLYMAN DiMAIO: It's very visible, and it asks you to check it before you cast it.

MS. HARRIS: Right, right.

ASSEMBLYMAN DiMAIO: So not many people who are taking the initiative to go vote, in my world, are not checking that.

MS. HARRIS: Yes.

ASSEMBLYMAN DiMAIO: Because I think anyone wants to make sure it's correct.

Part of the reason we wouldn't go with just a computer screen voting is we wanted to have something verifiable and traceable.

MS. HARRIS: Of course.

ASSEMBLYMAN DiMAIO: And when that ballot gets deposited into the machine, it stays sealed in the machine for a period of time in the event there would be a recount call. And then, at some point in time, after the time period runs out for recalls, it's taken and put into a vault for the statutory required amount of time. It's stored and then it goes to whatever destroying place it goes.

But the reality is, you are prompted to check your ballot. Wouldn't you, if the machine told you to? Wouldn't you check it?

MS. HARRIS: Well, you know, if there is a huge line of voters waiting to enter my machine, I would feel pressure to vote as quickly as I

possibly could to accommodate more voters and speed up the process. So I might look at it; I'm not sure I would study it. Because there are a lot of candidates that will be voted on in each election, so it would take some time to go through all of them. So I might look at it; I'm not sure how much I would study it in detail.

ASSEMBLYMAN DiMAIO: Before you would cast the paper ballot and put it in the machine, would you study it?

MS. HARRIS: Oh, you mean--

ASSEMBLYMAN DiMAIO: You would take the time to study--

MS. HARRIS: --I hand-marked--

ASSEMBLYMAN DiMAIO: If you hand-marked the ballot, would you take time to study it?

MS. HARRIS: --a hand-marked-- Absolutely, because-- Yes, absolutely; because I would be in a privacy booth and there might be 10 people voting at the same time, all in privacy booths. So the pressure of having people waiting for my spot would not be as great. So I would take the time to actually check that I had marked all of those little ovals correctly.

ASSEMBLYMAN DiMAIO: One more bit of information. Our machines are in a privacy booth in Warren County.

MS. HARRIS: Right, right. Yes, I know all voting machines should be in a privacy booth. But when you are marking paper ballots, you can set up as many stations to mark ballots as you have the space, and each one has a little privacy booth. Therefore, instead of having one line of voters waiting to enter one DRE to make their vote, you can have 10 voters,

20 voters, as much space as you have for 20 privacy booths to be set up, so that it makes the line move much faster. And then taking that ballot, you go to the opscan and you insert it, which is just a matter of seconds, or minutes, to feed it through the machine. The opscan is then able to tell you whether your ballot has been marked correctly. And you can have the opscan set so that it tells you if there's an *undervote* or an *overvote*, and you have the option of going back to redo your ballot and correct it before it is put through the machine. So there are a lot of checks and balances in that system.

We did speak with the AVANTE company -- it must have been over 13 years ago -- that they were developing this system, and it was then purchased by Warren County. So I am assuming that your machines are now over 12 years old, and I would also assume that they are aging.

ASSEMBLYMAN DiMAIO: As we all are--

MS. HARRIS: As we all are; exactly.

ASSEMBLYMAN DiMAIO: --as long as this testimony goes on. (laughter)

But the reality is, when we had the optical scan readers, previous to these machines, there were not more than the same amount of booths we have now with the touchscreens. We only had two per district. And the interesting thing is, we can vote on either of the four-- If we have more than one district in one polling place, you can use any of those machines and it puts it where it belongs.

We didn't have 10 different booths to vote in, ever, that I can remember. Because the districts are broken up small enough that you wouldn't have huge lines that often.

MS. HARRIS: Right.

ASSEMBLYMAN DiMAIO: I think that our machines work quite well.

MS. HARRIS: Right.

ASSEMBLYMAN DiMAIO: I'm very pleased with the outcome. We absolutely have the paper trail that's necessary, and it's very clear -- it's right here (indicates). The only time someone could have problems is if someone -- in the event if they were blind, they would have assistance to fill out the hand card anyway. They would have to rely on the honesty of that individual assisting them to make sure it's filled out correctly.

So other than that, it's right there in front of you; very easy to read.

MS. HARRIS: Thank you.

ASSEMBLYMAN DiMAIO: I know it; I use it.

ASSEMBLYMAN McKEON: Any other questions or comments?

ASSEMBLYMAN ZWICKER: I have a question.

ASSEMBLYMAN McKEON: Andrew.

ASSEMBLYMAN ZWICKER: So we want to get this just right, which is why I'm so grateful that everyone is here today.

So in my mind, getting this just right has two pieces: one is the technology that we are going to decide upon hand-marked, optical scan, etc. But the other piece that you've talked about is, as the Bill as it's currently written allows for a natural transition as the counties are updating their machines -- and we're going to hear from many of the clerks about what it's

like in each of their counties. And of course, you're advocating that, instead, we put a fixed date, and then that we appropriate the correct amount of money.

So you did say in your testimony that you did an estimate that said that, for the machines, it was \$26 million.

MS. HARRIS: It was \$30--

ASSEMBLYMAN ZWICKER: It was \$36 (*sic*) million; okay.

MS. HARRIS: Yes.

ASSEMBLYMAN ZWICKER: So could you talk a little bit about where that comes from? And the reason why I'm asking that -- that number -- is we have a letter in front of us from Robert Giles, the Director of the Division of Election who says in his letter, that there are approximately 11,000 voting machines in New Jersey as a whole, right? So 11,000 times, let's say, \$5,000 -- right? -- that's more like twice as much as what you have.

MS. HARRIS: Right.

ASSEMBLYMAN ZWICKER: So where does the \$26 million come from?

MS. HARRIS: Okay. So we are not advocating that you replace a DRE one-for-one with an optical scan machine, because it's not necessary. You only need one optical scan machine in each polling place, and that can handle all of the ballots that are being hand-marked and put into this optical scan machine.

So I believe Mr. Giles probably said we are going to replace the machines one-for-one.

ASSEMBLYMAN ZWICKER: Yes, that's correct.

MS. HARRIS: We did not do that.

ASSEMBLYMAN ZWICKER: So do you know the number of machines you would say-- If we were going to replace all of them in New Jersey with this technology--

MS. HARRIS: Right.

ASSEMBLYMAN ZWICKER: --do you know, based upon precincts, how many we're talking about?

MS. HARRIS: Well, we were discussing polling places. And there is some difference of language, where you say *precinct*, you say *polling place*, you say *district*. We are talking about the polling place that might have more than one district voting in it. And we calculated -- and I could get you those numbers -- how many of those districts there are; and then multiply that by \$10,000.

ASSEMBLYMAN ZWICKER: By--

MS. HARRIS: By \$10,000.

ASSEMBLYMAN ZWICKER: You did \$10,000 per--

MS. HARRIS: Yes, because it's \$5,000 for the optical scan, and \$5,000 for the ballot-marking device, which is used by disability voters.

ASSEMBLYMAN ZWICKER: Got it; okay.

Thank you.

Thank you, Chair.

ASSEMBLYMAN McKEON: Everyone else, we're good? (no response)

Ladies, any additional comment? (no response) All good?

Thank you all. I know you're doing such out of a sense of doing public good; and we appreciate that, in and of itself, let alone the issue.

MS. HARRIS: Thank you so much.

MS. REA: Thank you.

ASSEMBLYMAN McKEON: Thank you.

The next group will include Mike Harper, the President of New Jersey Association of Election Officials and currently the Clerk of the Hudson Board of Elections. I should have said that the opposite way: the Hudson County Board of Elections and currently the President of the Association of Election Officials. And Shona Mack-Pollock, the Deputy Superintendent of Elections of Passaic; and finally Maureen Bugdon, the Vice President of New Jersey Association of Election Officials.

So we have Mr. President, Madam Vice President, and Superintendent.

M I C H A E L H. H A R P E R: We also have Gary Olsen, who is an Election Data Specialist from Passaic County.

ASSEMBLYMAN McKEON: Okay; Gary, welcome. I'm sorry, I didn't have you on my list.

G A R Y O L S E N: Thank you, thank you.

ASSEMBLYMAN McKEON: If you would like to--

MR. HARPER: Chairman, good morning; members of the Committee, thank you so much for having us here today.

My name is Michael Harper, I'm the Clerk--

ASSEMBLYMAN McKEON: Thanks for being here.

MR. HARPER: Thank you so much.

I'm the Clerk at the Hudson County Board of Elections and the President of the New Jersey Association of Election Officials. I am proud to be here today on behalf of the election officials of the 21 counties of New Jersey.

I'd just like to start by saying it is my personal belief -- my strongly held belief there is not a group, an advocacy group, a body, or any other group in the state that cares as much about the sanctity of the individual's cast ballot, being cast secretly and accurately, as the election officials of this state.

ASSEMBLYMAN McKEON: We appreciate it; it's all of your sworn duty--

MR. HARPER: Right.

ASSEMBLYMAN McKEON: --and we all have that sentiment.

MR. HARPER: Agreed.

ASSEMBLYMAN McKEON: But we know that this is what you've dedicated your professional careers to, and we respect that.

MR. HARPER: Thank you, thank you so much.

I'd like to start by saying-- You know, election officials have been prepared, from the Gusciora Bill of 12 years ago, for a Voter-Verified Paper Trail. It's something we've thought about and prepared for, for a long time now. I don't believe many of us have any problem with that, and understand when the technology is there and the machines are available to us, we are all prepared to do that. The issue that held it up 12 years ago was the issue that will continue to hold it up, I believe, in the present -- is money. My county doesn't have the money to buy new machines at this

time, so we are going to hold on to the DRE machines that we are currently using for as long as possible, until that money is made available.

There are questions, and there are certainly areas open to debate within this Bill -- certainly within the amendment I just heard about the difference between *voter-marked* and *voter-verified*. That's a conversation that needs to be had because it's easy to say that one is better than the other. As someone responsible, who oversees an office that counts vote-by-mails -- I will say, count one election where there's vote-by-mails, and then we could talk about voter intent, and voter circling the circle. And just, sort of, downplay the voter -- the intelligence and the intent of a voter using a Warren County machine -- as the former Freeholder uses that machine and likes it. I've used that machine myself; I've seen it, I like it very much. The Voter-Verified Paper Trail appeals to election officials in many ways because of that voter intent issue. It's sometimes hard to read a paper ballot marked by the voter. They make -- they vote for every candidate, they circle the circle, they make marks and erase them. And then it comes to a human, again, to say, "How did this voter intend for this mark to be made?"

We are very much in favor of a Commission to look into these issues; and to work together with you, and every advocacy group, and every voter in this state to make sure our voting system is safe, secure, and accurate, moving forward.

Shona.

ASSEMBLYMAN McKEON: Can I just ask a quick question on that?

MR. HARPER: Surely, sir.

ASSEMBLYMAN McKEON: I wonder all the time -- because we do vote absentee using that little pencil that everybody used to send -- or, at least, in Essex County they did, along with that kind of ballot. Isn't it the same issue? I mean, is it really that hard to discern, like, what's circled? I'm asking you; I'm not--

MR. HARPER: And I'm telling you--

ASSEMBLYMAN McKEON: --I guess, maybe, I'm very careful about it, but--

MR. HARPER: I was surprised myself. Sometimes-- Yes, yes. I mean, voter intent issues on a paper ballot come into play in every election.

ASSEMBLYMAN McKEON: If there were a thousand of them -- on how many?

MR. HARPER: Oh, that's real hard to say. I mean, any voter intent issue, out of a thousand, maybe 7 percent.

ASSEMBLYMAN McKEON: Seven percent? Okay.

MR. HARPER: And that's-- Please, don't hold me to that.

ASSEMBLYMAN McKEON: No, I-- Listen, that was -- 7 percent; that was pretty precise. (laughter)

MR. HARPER: I went between 5 and 10.

ASSEMBLYMAN McKEON: Okay; all right. All good.

Liz.

ASSEMBLYWOMAN MUOIO: Just, also, a follow-up.

It's my understanding that there are opscan machines in the polling place. When you bring your paper ballot, you can put it through and it will, essentially, spit it back out if it cannot determine the voter

intent. And it will send it back up to three times until it's actually counted as a vote?

MR. HARPER: That I-- There are things-- There are settings on all-- The machines that I now use to count my vote-by-mails on Election Day -- we have control over those settings. You said how much -- what is the percentage of the circle that has to be filled in, in order to accept a vote. Because, of course, you want someone to fully fill in a circle; some people check it, some people *X* it; some people-- But the issue of someone who circles the circle -- and that's why I always use that example. It happens; people circle the name next to the name that they want to vote for. People circle the circle that they're supposed to fill in. It's hard to-- Unless you set your machines to spit out every undervote -- which is a real difficult thing to do, because then you are also interfering with my right *not* to vote for a given race. A lot of people come in and vote the top of the ticket; and there is probably a matrix, that the Professor could give us, of how those votes fall off as you go down from the President to a Committee race, you know?

ASSEMBLYWOMAN MUOIO: Okay.

Yes, my point was that-- And I've been -- I've seen what you've had to do on Election Day. I was a County Chair for six years, so I've seen the VBM counts. But if the opscan machine is set to send it back out if the intent is not discernable. At the polling place, it takes it -- you don't have to sit there, as the Board of Elections, and determine what the intent is on Election Day when you're going through all the ballots, because it will have been figured out at the polling place, correct? Because it will have spit back out and said, "Is this -- what did you--" "You voted for two people; you can't," or whatever the issue is.

MR. HARPER: Right.

But an overvote is the easier of the two spit-outs. My issue is the undervote-- Are you going to keep kicking out every time someone doesn't vote for every available contest on a ballot?

ASSEMBLYWOMAN MUOIO: Right. Well, that's up to the district.

MR. HARPER: Of course.

ASSEMBLYWOMAN MUOIO: I'm just saying that the issue that you usually have in a Board of Elections on Election Day, where you have bags of VBMs that you're feeding through the machine, and it jams, or you can't tell what it says -- you will-- Any issue of voter intent will have been sorted out at the polling place because that's where the opscan will have counted that ballot. It won't be a question of--

What I thought you were saying was, "If you could see what we have to deal with, with VBMs on Election Day, you would understand how difficult it could be if we had to deal with a bunch of paper ballots from everybody on Election Day." And my thought was -- my questions was, won't those ballots -- not VBMs; separate issue -- but won't those ballots, that are hand-marked at the polling place, if that's what New Jersey decides to go with, that determination will be made at the polling place with the voter standing there.

MR. HARPER: Respectfully, Assemblywoman, no, not always. My contention was this: It wasn't how hard it will be because of the additional paper, those intent issues are often not, even in counting vote-by mails-- You know, a lot of times you don't catch those until a recount, an audit, or looking at that election again. Because it will go through the

system -- an undervote. When someone votes for someone -- again, I'll use the same example -- by circling the circle, that's going to feed through the system. Then when I look at that ballot, physically, later on, I'm going to notice that intent. And as you understand, knowing the system -- then I'm going to put it in front of my board members, and those four Board of Election members are going to make a call on what they see that intent was.

But many things can't be or aren't caught. I mean, I guess, I can't say *can't* be. But certainly in the system that we currently use, the optical scan reading our vote-by-mails, are not caught. Intent issues are often left until after -- have to be -- come up after the election when you find them.

ASSEMBLYWOMAN MUOIO: Okay; thank you.

ASSEMBLYMAN McKEON: Thank you, Liz.

Andrew.

ASSEMBLYMAN ZWICKER: Do you happen to know, off the top of your head, how many polling places are in Hudson County?

MR. HARPER: Physical polling places?

ASSEMBLYMAN ZWICKER: Yes.

MR. HARPER: I don't. Upwards of--

ASSEMBLYMAN ZWICKER: All right. And my follow-up was going to be about the number of physical voting machines you have in the County.

MR. HARPER: Physical polling places? (addresses colleagues, off mike, in audience)

UNIDENTIFIED MEMBER OF AUDIENCE: (off mike)
(Indiscernible).

MR. HARPER: There are 575 districts; I would say about 300-and-change physical polling places.

ASSEMBLYMAN ZWICKER: Okay. Any idea how many voting machines you have?

MR. HARPER: Six hundred.

ASSEMBLYMAN ZWICKER: So, two -- roughly two for every poll; roughly, right?

And what is your opinion of the condition of these machines? So as we were talking about before -- if there was no funded mandate to replace your machines, how long, approximately -- one year, five years, ten years, twenty years, a hundred years?

MR. HARPER: Five years.

ASSEMBLYMAN ZWICKER: Five years, right? Roughly, just very rough, ballpark.

MR. HARPER: Yes.

ASSEMBLYMAN ZWICKER: You are thinking that in about five years it would be time to replace the machines because they've aged, they are too expensive to repair--

MR. HARPER: Absolutely.

ASSEMBLYMAN ZWICKER: --things like that. Okay.

And since you know about what's going on statewide, in your opinion is that what would be the case for most counties? Maybe not Warren, which has updated more recently, but the ones that have the Sequoia machines?

MR. HARPER: Yes, yes.

ASSEMBLYMAN ZWICKER: Rough, right; you know what I mean. Plus or minus something.

MR. HARPER: Yes.

ASSEMBLYMAN ZWICKER: Okay; all right.

MR. HARPER: I also have an issue, just before I hand it over to Shona, too.

I understand the thought -- you do need less opscans in a district than you do DREs. When I say the 300 districts, which house the 575 precincts in Hudson County -- some of those are two; some of them I have -- West New York Middle School has 11 districts. I would never feel comfortable putting one opscan there.

ASSEMBLYMAN ZWICKER: Right.

MR. HARPER: I'd want three, or four, or five.

ASSEMBLYMAN ZWICKER: And I'm just looking for rough--

MR. HARPER: Right.

ASSEMBLYMAN ZWICKER: Right; rough numbers here.

MR. HARPER: I'm speaking rough numbers here, yes.

S H O N A M A C K - P O L L O C K, Esq.: Excuse me; some counties have language issue. Like Bergen and Middlesex have language issues. Middlesex is -- I believe they're up to five languages on their ballot already, and I believe Bergen is already maxed out as far as languages on their ballot. The Bergen County Superintendent and Deputy are here as well. They have maxed out on their physical ballot, as far as languages are concerned. So when you're looking at paper ballots and the length of the paper ballot, that's a concern that you have to take into consideration as well.

ASSEMBLYMAN ZWICKER: Would it -- and I am just making this up off the top of my head -- that it wouldn't be an issue because you could physically hand someone a ballot that was in English, or Spanish, or whatever?

MS. MACK-POLLOCK: But then you have to print those ballots as well.

ASSEMBLYMAN ZWICKER: Sure.

MS. MACK-POLLOCK: So you have to look at your costs of the ballot; you have to look at the cost of the paper ballots that you're printing.

ASSEMBLYMAN ZWICKER: Right, sure; absolutely.

MS. MACK-POLLOCK: Yes, good morning. Thank you so much for having us. I'm sorry for interrupting.

As an organization -- and thank you so much for having us -- we really do appreciate this opportunity to be here -- the New Jersey Association of Election Officials. We are very committed to partnering with our legislators.

My name is Shona Mack-Pollock; I am the Second Vice President of this organization. We are very excited about this opportunity to implement this legislation. This expands and it enhances our voter registration and it actually makes it more -- it provides and gives our eligible voters more access in participation in the electoral process -- the Bill, as it is written, we understand that now, and we want to thank the sponsors of the Bill -- while maintaining the integrity of the voting process.

Additionally, we strongly disagree with any theory, argument, or belief that falsely alleges that the voting machines currently in use are

hackable and unsecure, and undermines the credibility and faith that the public has in the electoral process.

To be clear: we are very supportive of the theories and many of the provisions of this legislation. We know that implementation to some extent is imminent. As our voting machines are nearing the end of their lifespans, but before the passage of this and many other legislations can happen because of financial concerns -- as you are aware -- there needs to be a thorough cost analysis. We believe that a steering committee including legislators, election officials, and administrators from the Division of Elections is suggested so that we can develop an ongoing working relationship in the implementation of this most significant legislation to achieve our mutual goals and ensure that the electoral process is fair, effective, secure, and reliable for every eligible voter.

As the Bill is currently written, we do support it but we do suggest some modifications in language. We do not support the amendments that were currently suggested by Professor Appel.

We do make some recommendations with regard to some members who have requested that you identify-- There have been some omissions with regard to the ADA requirements. There has been no mention of the American with Disabilities Act in the Bill as currently written.

There has been no mention, as well, with regard to the retention period schedule for paper ballots. We do believe that has to be addressed as well. There has to be a discussion with regard to how long we keep the paper ballots. The period has to be discussed currently with regard

to how long and whether or not we keep the Bill -- the papers post-election period and, if so, for how long.

Thank you for this opportunity.

With me, I have Gary Olsen, who is our Election Data Specialist. And Gary can answer all of our technology questions, including questions that were posed to Professor Appel.

Thank you.

ASSEMBLYMAN McKEON: Thank you.

Gary.

Gary, are you responding to questions, or do you have comments?

MR. OLSEN: I would actually just like to say a couple of quick things.

Previous to my tenure at Passaic County, I was an employee at Election Systems and Software. And, as a project manager, I was responsible for implementing some of these DRE systems throughout the United States. My co-workers have also conducted elections in other countries -- the Philippines and Venezuela come to mind.

I would like to say that this is a complicated issue, and I thank you guys for taking the-- And I don't envy you for taking the time to truly understand everything that's involved. There are many ways to have this process of voting, and essentially there are certain factors that we have to weigh. There's an old adage in racing: If speed is money, how fast can you afford to go? And indeed, the total cost of ownership is something that I would like to mention. Shona had previously mentioned that the cost of the prepare ballots is not insignificant. It is an addition to the cost of the

voting machines themselves on the total cost of ownership is something that I would ask you to review. I've looked at some of the quotes from manufacturers previously with ES&S I've been intimately involved in them. And there are things like the election management system that Professor Appel alluded to as being a possible attack vector. There are things like licensing fees and the cost of administering the entire election.

So one of the benefits of our current system is that it is less expensive in the sense that the DRE doesn't have as high a cost as the paper ballot system.

I have, in fact, voted on the precinct-based system. I used to be a citizen of Honolulu County -- Oahu County. I voted on the M100. And one of the things that comes to mind, anecdotally, is standing in line to place my hand-marked ballot into that precinct counter. People sitting behind me were looking over my shoulder and I could look over the shoulder of the person in front of me so the privacy issue is theoretically addressed by something called a privacy folder. And the idea is that you have this little, kind of, folder that you could keep your ballot in until it's your turn at the machine; at which point you have to take the ballot out of that privacy folder and feed it into the machine.

As Michael had mentioned, there are, at that point, the machine indicates an overvote and an undervote; or any deficiencies with it. The undervote could be accepted by forcing the machine to accept your ballot. But in the sense that there are less machines required than a DRE because the paper ballot is being marked in a privacy booth and then you're standing in line to have the precinct counter count your ballot -- there is

still a line, and sometimes these lines can be quite long. And the issue of privacy does come to mind, at least in my personal experience.

The other way is the central ballot system. I had the privilege of conducting Stanislaus County, California for the Governor -- *Governator*, if you will -- race. We counted 55,000 ballots centrally in Modesto at the Election Board.

And the reason I mention that is that we had quite a few ballots that were marked in different color ink that were mutilated to a degree that made it difficult for them to count. Instead of filling in the oval, the candidates' name was circled, or underlined, or *X'd* out, or only a portion of the oval was filled in so the intent of the voter did not always match to a high degree what the machine counted.

I'm kind of hopping around a little bit. Professor Appel made mention of the fact that the paper ballot is easily recounted. And not in this country, but I could tell of an anecdote from Venezuela when the ballots that were printed, the oval -- for in this case, I believe it was Hugo Chavez -- the oval in certain districts where he wasn't particularly the favorite, the oval was slightly thicker than the other ovals; not discernable to the human eye, but to a computer sensor that was reading that oval. It detected it as a vote; and it also detected the candidates indicated vote with the filled-in oval, and the machine saw that as an overvote. And then that contest was not counted.

The newer technology does address some of these things. I just mention -- it that all technologies have some degree of attack vector. And again, speed is money: How far do we go, can we afford to go? If we were just printing the money, I found myself agreeing with several of the

previous people who testified and nodding in my head a lot of times. And then sometimes just shaking my head, "No, absolutely not."

And just to be brief, the one that comes to mind is, our Election Management System isn't violent; it is not connected to any network of any kind. But furthermore, even if it somehow could or would be, the system is hardened. And I do have a security systems certified professional certification, so I'm not a Ph.D., but I do have a background in computer security.

And what hardening means, briefly, is just that we don't have installed, on the computer, the programs that are necessary to run the Internet, to do TCP/IP protocol, to communicate with other computers, to operate Blue Tooth or the network interface card. These things are just not installed. So if a hacker wanted to use one of the vectors that professor Appel suggested, those vectors don't exist.

So in terms of attacking through the Election Management System -- it's not an option. In terms of attacking the voting machine itself, via the chip, that is an option only because the chip is in a socket that can be removed from the socket and replaced. If that chip had been soldered in, or is epoxied in place, the vector would no longer exist.

So yes, our machines are old, and they're not going to last much longer. And we do need to consider -- you guys need to consider (laughter) costs, and what direction we're going to go, and what is the best method of counting -- of having our people count, our citizens count; having confidence in the system which, ultimately, encourages turnout; being able to report, at the end of the night, so that the media has the results in a timely manner.

And finally, and perhaps most importantly, is, I agree with Professor Appel. The statistical audit needs to be facilitated in a way -- but by the system -- in a way that it isn't overly burdensome. So if conducting the audit is such a burden and is so difficult, it's unlikely that it will be done often or properly, as opposed to it -- the systems by design, created to facilitate an easy audit. And that contributes to this overall total cost of ownership.

Finally, I'd like to make one last comment, which is something that is nationwide. Whenever we get together with our counterparts, we hear that it is so difficult to recruit experienced poll workers, poll workers who care, poll workers who are able to diligently perform the tasks they need to do. So the World War II generation, my grandfather's generation -- those guys and ladies, they donated blood and had their gallon pins, and they were very civically minded. I had, as a Boy Scout, the Civic Skill Award. But the point is, is that it is difficult to recruit good poll workers. And I would caution you that any system that we do transition to should not overly burden the board worker, as opposed to the fulltime people who are trained and experienced in performing these tasks.

That concludes my remarks.

ASSEMBLYMAN McKEON: Thank you; thank you very much.

Ms.--

MR. HARPER: Bugdon.

ASSEMBLYMAN McKEON: Yes, I was about to--

MAUREEN G. BUGDON: It's a tough one.

ASSEMBLYMAN McKEON: But thanks for your help. Do you want to switch? (laughter)

MS. BUGDON: It's a tough name to pronounce. I married and divorced into it, so-- (laughter) Unfortunately, I want to keep my children's name.

Good afternoon. Thank you for having us, and for hearing from us.

Just a few comments that might--

ASSEMBLYMAN McKEON: I have a few questions now; I'm sorry. (laughter)

MS. BUGDON: Yes, that's okay. Just a few comments to reinforce what some of my colleagues have said and, perhaps, to just lend consideration to you all.

And that is, on the lines of the poll workers -- one of the things that struck me in considering the paper ballot system is that it is required, currently, by law -- when assistance is given to a voter with a paper ballot, that that assistance be established and signed off on by the voter. So when you talk about multiple districts in one polling site having or sharing a scanner, or even just one scanner with folks out, throughout the room, with a paper ballot, I would think that would be a difficult thing if there weren't some ground rules established and things in place to ensure that there wasn't any intimidation of the voter. And that any voter getting assistance from a friend, or a political person, whoever else may be in that room, that there is a way to ensure that that assistance is not only revealed-- As is now, it is required that a form be completed when a voter gets assistance in

the polls; but that there not be a means to intimidate or to have a whole other situation going on in polling places because ballots are distributed.

The second thing that was evident to me is -- coming from not only my role as Superintendent, but a former eight-year role as a member of the Board of Elections -- we do see duplicate ballots, because voters make mistakes. So if you have paper ballots in the field, and there is a mistake made, you've now gotten more ballots out there being distributed in the polling place, as well as poll workers trying to keep an eye on all this activity. (cell phone buzzes)

And as luck would have it, that's the gentleman who used to -- where I got my name, calling me. (laughter)

So I would suggest that -- you can't get rid of some of them (laughter) -- I would suggest that you keep that in mind.

ASSEMBLYMAN McKEON: He was watching the live stream, so he's not happy right now. (laughter)

MS. BUGDON: Isn't it great; I'm hoping he's voting.

And finally, I would suggest to you that for those of us who have been doing this, who try so very hard to continually improve the processes, the efficiencies, the security -- because we're so concerned about the integrity of each and every election -- please allow that seat at the table; please consider a steering committee. We realize that this is likely inevitable. There is such a wealth of information throughout all of the professional election officials throughout the state, that you would really be missing something without that input. And I know you've welcomed that input up until now; we really want to see it continue. Because in our polling sites and, most importantly, within our warehouses where these

voting machines are stored, there's a clearance level; there is testing upon testing; there is, in most cases, surveillance cameras, alarm systems. Is it still possible for anybody who wants to have some bad behavior to get in and hack an election? I mean, almost anything is possible, so I'm not suggesting it isn't. But, boy, you would have to go through a lot of hoops, and you would have to be purchasing one of these machines and sitting home and figuring that out, just as the Professor has done.

So it may be aging and it may be in need of replacement very soon, but it is, indeed, the best we've got. And we have tried to nail down every inefficiency along the way to perfect this process as best as we can with what we've got.

So, thank you.

ASSEMBLYMAN McKEON: Thank you very much for your thoughtful testimony.

Anybody have any questions?

Vice Chair.

ASSEMBLYMAN JOHNSON: Thank you, Chair.

I'd like to ask Gary a couple of questions.

Gary, what's your last name?

MR. OLSEN: Olsen.

ASSEMBLYMAN JOHNSON: Olsen.

You've been to the Philippines; you said you worked there?

MR. OLSEN: I have, yes.

ASSEMBLYMAN JOHNSON: And where else -- what other country was that?

MR. OLSEN: I have not personally been to Venezuela, but my coworkers from Election Systems and Software, yes.

ASSEMBLYMAN JOHNSON: Okay.

Our election system -- the stand-alone system is not tied to the Web, correct?

MR. OLSEN: Indeed.

ASSEMBLYMAN JOHNSON: All right. With today's technology -- and I asked you about the Philippines because, it seems to me airlines -- going off-topic here a bit -- throughout the world, when you buy an airline ticket, no matter where you are in the world, they know, the government knows who you are, where you're flying from, what seat you're in, and where you're going. Why can't we get that straight for our machines here, which seems to be a simpler system?

Does that question make sense?

MR. OLSEN: Not entirely. (laughter)

ASSEMBLYMAN JOHNSON: Okay, good.

MR. OLSEN: Because we have a bit of anonymity; there's a disconnect with identity -- right? -- so we that we have an anonymous vote in our country.

ASSEMBLYMAN JOHNSON: Right.

MR. OLSEN: The airlines do use a 3-D barcode system. There have been several cases, just this past year, of airline systems being hacked, most recently in Great Britain. And there have been instances of the barcode reader misidentifying a person, and that had caused some delays at the gate.

But specifically, what would be the intention, with regard to voting?

ASSEMBLYMAN JOHNSON: Yes, I'm trying to get a comparison. This seems to be a very complex system that's secure; and our system in New Jersey, I guess, would be a bit simpler to secure. I mean, as I heard earlier, if we had some training on seal-use protocol, and we had some way to secure these machines prior to the election to ensure they're accurate before the election, seal them, and then check the seal after the election -- which I believe is in effect now -- I'm trying to figure out-- And as we go forward with the new series of machines-- I guess we're looking to buy new machines, of course, because they're reaching their lifespan. And of course, you want a seat at the table when we discuss this, as I've heard, which makes sense to me. It seems to me to be that it's a simpler system; I just don't see where it's so complicated--

MR. OLSEN: So indeed, we do have--

ASSEMBLYMAN JOHNSON: --with the hacking.

MR. OLSEN: --a variety of seals that were designed after this current machine was built and engineered. It is an older technology. There are a variety of seals in different access points. Unfortunately, those seals that are tamper-evident after a machine has been tampered with. It's not, in terms of a deterrent -- if someone was going to enter the machine, they are going to know that, yes, it's probably going to be detected, albeit after the fact.

I have personally attended the seal protocol training. It was conducted by someone from Homeland Security, ICE, Immigration, Customs Enforcement. I was blown away; I would love to share some of

those things with you, however, I actually signed a nondisclosure agreement. It was an all-day class; and I was really educated, I was schooled. And everyone who is authorized to work on our voting machines in all of our counties must attend this seal training. And we have developed-- Through Bob Giles and Ocean County we have developed a system, with barcode scanners and a database, that we use to know, both on the way out that all of the seals are in place, and then, on the way back in, that all of those seals are intact.

And we have been-- Part of the training I can share with you is that we were passed around some seals that were used, actually, on shipping containers; and that drug smugglers had tampered with the seal in a way that made it not obvious that the container had been opened.

Likewise, the seals we use on our voting machines -- they were passed around. And these high -- highly, well-implemented work-arounds, where someone had used an X-Acto knife, perhaps, and then a piece of clear tape over the top to make it look-- And we were trained and challenged to see if we could detect which seals had been tampered with and which ones had not been tampered with.

And then, likewise, when we have to replace the batteries on a machine, of course we do have to remove these seals and then replace them with new seals, which are entered into our database, etc.

I have tried, with a heat gun and with a razor blade, to try to get the seal off without indicating that you would know, in any way, that it had been tampered with. It is extremely difficult.

So I would just say this is kind of an arm's race, just like in hacking with computers. There is -- you know, they come up with

something, and the good guys come up with something, and the bad guys come up with something; and I go back to, how much money can we spend?

But we have really implemented a robust system of detecting any tampering with these machines.

ASSEMBLYMAN JOHNSON: These seals are numbered?

MR. OLSEN: Indeed.

ASSEMBLYMAN JOHNSON: And assigned to a machine?

MR. OLSEN: Yes, they are.

ASSEMBLYMAN JOHNSON: And if they're changed, the new seal is recorded and put into a database so you know it's been changed.

MR. OLSEN: And I guess I can say that it's both a human readable and a barcode version. There are also other--

ASSEMBLYMAN JOHNSON: Security features.

MR. OLSEN: Features; thank you -- that are in place that make it clear to us whether this is a fraudulent seal, a replica, the original, the original that's been tampered with. And again, the Department of Homeland Security -- the ICE people who provided this training to us, in cooperation with the State -- it was-- I was really schooled, I was really impressed. And we've adopted every one of the recommendations that Homeland Security gave us.

ASSEMBLYMAN JOHNSON: Okay, thank you.

ASSEMBLYMAN McKEON: Andrew.

ASSEMBLYMAN ZWICKER: I found myself nodding my head, and then shaking my head the other way, as each of you were testifying.

Let me start by just saying, very clearly for the record, that there is no implication of anything but the highest integrity for the Board of Elections, for the clerks of the various counties, for the poll workers -- you know, across the board. That is in no way the intent of what we're discussing today.

MR. HARPER: Thank you.

ASSEMBLYMAN ZWICKER: Yes; I mean, just a thousand percent clear.

And we also heard -- there is only one documented case that's ever come up; and even in that case, it's not quite clear what happened there.

Having said that, I do want to go back to a couple of things that you each testified to. So perhaps it's unfortunate Dr. Appel had to go teach a class, since he's not here at this point. (laughter) And I will say, also for the record, I know him; I'm a Princeton University employee as well, though I don't work in the Computer Science division.

So, I mean, he was here giving very compelling testimony -- that in nominally 10 minutes he can take off a seal, put in his chip, etc., etc., etc. If you soldered, it might take him 15 minutes, right? If you epoxied--

But these machines, of course, are not soldered, they are not epoxied. These are strawman-types of arguments.

So you seem to be testifying that he's wrong, right? I think you said, "That's just theoretical;" that he can't do this and, therefore, these machines are not really hackable. I mean, I heard a lot of that, which is different than saying, you know, you do everything at the highest level --

integrity, and seals are checked, and security cameras. So I'm not -- again, I'm not questioning every effort that you've put in here. But I thought what I heard you say is that these machines are not hackable; that he's wrong.

MR. OLSEN: No, I wouldn't characterize it that way. I would characterize it as the level of difficulty that he has expressed is perhaps not entirely true.

It is true that the machine could be opened, and that the chip could be removed from its socket, and a new chip could be put in its place; no doubt. In terms of the path of least resistance or low-hanging fruit, I think there are other ways that elections can be influenced, and this is probably not the lowest-hanging fruit.

ASSEMBLYMAN ZWICKER: That's true, but that's not the question at hand here. I mean, he also quickly said, aside, you could take the front off, rewire, and there are other ways to do this.

So it is trying to get a sense of -- if these machines are 30 years old, right? -- we can debate, like I said before, which type of machine-- Eventually you're going to buy new machines. I mean, that's a given, right?

MR. OLSEN: That's exactly right.

ASSEMBLYMAN ZWICKER: And we could debate which one of these machines, you know, you might debate. But it seems-- I guess I'm still getting to the -- you are arguing, "Well, you might want to try to do it a different way." Or, "He can't really do it, because seal technology at the Division of Homeland Security is such--" da-da-da-da-da, right? Yet he's, I mean -- he said, "Give me 10 minutes," -- you know? -- "15 minutes," and

he's undetectable. And he's-- Other places said he could teach students to do this, right? So, you know, it seems like there's a disconnect here.

MR. OLSEN: So there are a couple of parts of this process. The first is being able to develop some code, and to burn it to a run-through compiler, and burn it to a chip. And that can actually be done in advance.

ASSEMBLYMAN ZWICKER: Yes; he said it would take him, you know, a day.

MR. OLSEN: Right. And I agree, that is not difficult. I've actually burned chips in an EPROM burner myself. I happen to be an electronics guy; I have a frequency counter at home, and my first PC was from 1979. So I don't disagree with that portion of it.

And likewise, I don't believe the State did either, which was why they were looking forward to implementing a seal protocol that required the training -- the level of training that it does.

So again, in order to conduct this type of hack, it's a single machine at a time. And the amount of energy and effort that would go into that would influence a very small amount. And I would daresay that if this was done a 100 times, 99 percent of those times -- if not more -- it would be detected when the machine returned to the warehouse. Which, again, is closing the barn door after the horse has left. But it would certainly put that machine into question; and certainly a recount, if not further scrutiny. Because I do not agree with Professor Appel to the degree that it is easy to remove a seal without it being detected. And again, I did sign a nondisclosure agreement, but there are robust features that we are very diligent about, in terms of inspecting these tamper-proof seals.

ASSEMBLYMAN ZWICKER: Okay. So that's--

MR. OLSEN: But just quickly -- your point is that these machines are not going to be with us forever. And your group has the difficult task of deciding what requirements, what criteria should be used for the next generation for us, moving forward. And that is where I believe that your focus is, and that is why having a clear understanding of all of these nuances really will help you to make the right decision for all of us.

MS. MACK-POLLOCK: And as the Deputy Superintendent of Elections for Passaic County, one of my responsibilities is to make sure that the machines -- the voting machines are securely stored when they're not in the polling sites. And we do keep them safe during the off-season, and we make sure that they are secure; we make sure that we are keeping them safe. And when they are in the polling sites, we make sure that the schools are adhering to all of the other responsibilities.

Professor Appel-- I saw a news clip a couple of weeks ago; he said that he had two weeks to hack a machine in the safety of his bedroom in his home. He took it apart; he had access to a machine, and was able to-- And he's a Ph.D. at Princeton, you know? -- a Computer Science person, who had all the tools, and equipment, and skills, to get that done -- for two weeks. So yes, if he was able to that, then--

ASSEMBLYMAN ZWICKER: But his point is, of course, that once he's done it once, he could do it for all of the similar machines.

MS. MACK-POLLOCK: For 600 machines.

ASSEMBLYMAN ZWICKER: Right. So -- but I think we're-- I do think we're--

MS. MACK-POLLOCK: That would take him, you know-- To hack an entire election, it would take him a substantial amount of time.

ASSEMBLYMAN ZWICKER: Right. But I think we're a little off-track, because there are just two issues, I think. One is, *which* type of machine, as we replace; and number two is, *when*, right?

MS. MACK-POLLOCK: Yes.

ASSEMBLYMAN ZWICKER: Do we appropriate -- do we mandate an appropriation, you know? Or do we allow-- That was what my question was before.

But you also-- There is a lot of testimony about difficulties of this. There was -- the cost of the paper ballots is not insignificant. But of course we're cutting the number of machines down by an enormous factor. And I agree that how those numbers would have to be worked out.

But then it seemed like there's a lot of testimony that it would just be too much of a burden to do, right? There's concern over the poll workers; we'd be putting a burden on the poll workers -- at least, that's what I was hearing, right?

MS. BUGDON: If I could just answer for--

I don't think any of us are here to suggest that this is not inevitable; that it's not a question of *if*, but *when*. But in getting to that ever-important *when*, we just want to be sure that all of the intangibles, if you will, are on the table, and that you are well aware -- not just from those looking from the outside trying to hack or trying to suggest these are the current difficulties -- what are the difficulties that this particular group, who deals with it, day in and day out, are aware of. Let us help you--

ASSEMBLYMAN ZWICKER: Absolutely.

MS. BUGDON: --to get there together, so that at the end of the day you don't end up with a system that Professor Appel is then looking

to get in front of you, in several more years, and go, “Look, I just hacked your scanner; how’s that?”

So I think all of those people need to be at the table; so what we end up with, at the end of the day, is far better than what we have and perhaps lasts, especially due to the expense to the taxpayers in being able to buy all of these.

ASSEMBLYMAN ZWICKER: I mean, the goal is to get this right, get the technology right, save money, keep the integrity, etc. etc. Aren’t we all at the table right now? I mean, do we need another Commission?

MS. MACK-POLLOCK: Well, A-4619, as currently written, is for a Voter-Verified Paper Audit Trail machine.

ASSEMBLYMAN ZWICKER: Yes.

MS. MACK-POLLOCK: So we’re not looking to change it to a paper ballot voter (indiscernible). So you’re not cutting down the number of machines.

ASSEMBLYMAN ZWICKER: I’m sorry, you lost me. Say that again.

MS. MACK-POLLOCK: The Bill, as currently written, is for a Voter-Verified Paper Audit Trail machine. Isn’t that correct? That’s the Bill that’s currently written.

ASSEMBLYMAN ZWICKER: Right; and we’re discussing amendments that are -- that lots of people are proposing.

MS. MACK-POLLOCK: Okay, because any other amendments we would object to, other than the ones that we were proposing.

ASSEMBLYMAN ZWICKER: And, why?

MS. MACK-POLLOCK: Because the other amendments that were proposed change the entire Bill. That was a totally different Bill. And previously, when we had a meeting earlier this summer, Assemblyman Zwicker -- that actually was a totally different Bill that was being proposed.

That Bill suggested -- that had substantial financial concerns to the voter, that had substantial financial concerns to the poll worker, to the public, to the administrators of the -- the election officials, specifically, who had to implement the provisions of the Bill. It also -- as far as the poll workers were concerned, educating the public, the cost of the paper as we mentioned previously. We talked about changing this to a ballot-marking device when we had disabled voters; this was a totally separate Bill. You were taking us back, as we mentioned before -- the wording in the Bill that you mentioned over the summer was a paper ballot voting system, which was -- paper ballot versus the automatic ballot tabulator had-- And it was an accessible ballot marking device, versus the accessible -- the ballot-marking device, versus the ballot-marking tabulator.

You also discussed, in that meeting-- And I'm sorry, because I'm talking about a meeting that other people weren't present for. Gary talked about the voter confidentiality, which we were discussing previously.

We also had concerns where we mentioned the delays at the polls. Currently, we have a system where the people don't wait at the polls. They go in, they get the voting authority slip, they go in, they are very familiar with the machines. And not that we have any objections to this, because we know that change is coming. But we want to have, like we do now, an opportunity to have our seat at the table and make sure that this is

going to go forward with the ease, transition, and we want to make sure that people are familiar with this.

If there's a change, that the voters are going to be familiar with this; the poll workers as well, who are going to be having to implement this and work this. The tabulator that Gary was talking about would be -- and I know you were talking about ejecting the ballots -- the tabulator may eject the ballot back to the voter if they have overvoted in races. It also would notify the voter if they undervoted. It would display the undervoted contest on a display. The voter would then press and accept or reject the vote -- the button. Most states would allow the voter to spoil up to three ballots at that time. And in addition to that, the poll workers would be required to set up the privacy booths where the voters will mark the paper ballots.

There was a chain of custody issue at that time, where, at the end of the night, we were going to have to determine who was going to be responsible for bringing these ballots back into -- where?

So these are some of the issues that we brought up previously.

So if we were going to be changing the entire Bill, it was no longer going to be the Bill that we are talking about today. That was our concern.

ASSEMBLYMAN ZWICKER: Got it.

ASSEMBLYMAN McKEON: I am-- You know, I don't know how many more questions there are. There are a bunch of members who needed to wrap this up by noon.

ASSEMBLYMAN ZWICKER: I have 50 more questions.
(laughter)

ASSEMBLYMAN McKEON: There's another panel that's been very good, and gracious in waiting. So I just wanted to--

ASSEMBLYMAN ZWICKER: I'm good; thank you.

ASSEMBLYMAN McKEON: So I don't want to keep anybody from asking anything.

MR. OLSEN: If I could make one very quick final comment, just regarding the concept of change.

ASSEMBLYMAN McKEON: Just -- if you could just wrap it up really quick, sir.

MR. OLSEN: Just two sentences.

In my experience with doing voter outreach, poll worker training, and training of board of elections throughout the country, it comes down to money, and it needs to be properly funded to be successful. And in places where I've seen that there weren't enough hours or enough funds dedicated to that task, that's where we've seen the failures.

ASSEMBLYMAN ZWICKER: No doubt.

ASSEMBLYMAN McKEON: All right, thank you very much.

MR. HARPER: Chairman, members, staff, thank you very much.

ASSEMBLYMAN McKEON: Members -- thank you, Mike; I'm always happy to see your face around here.

MR. HARPER: It's a pleasure to be back, Assemblyman.

ASSEMBLYMAN McKEON: We miss you here, day-to-day.
(laughter)

MR. HARPER: I don't miss the drive, but I miss being here.

ASSEMBLYMAN McKEON: Liz, do you have one follow-up?

ASSEMBLYWOMAN MUOIO: Just one quick follow-up.

You guys -- you don't even have to stay, but I think it was Shona who mentioned about the Bill, as we discussed earlier in the summer.

And I think the understanding-- When we were sitting at the table, with everybody in the room, talking about how the Bill could be changed or improved on all sides, the understanding, I think, was that this Bill essentially would allow counties to choose to go to the hand-marked paper ballot route if they wanted. Or they could -- it didn't stipulate, as the amendments that are being proposed by the earlier group here -- they are stipulating hand-marked paper ballots. The Bill, as drafted currently, without any changes, would allow a county to do either-or. The important part about that Bill is that the end result is a paper trail, a Voter-Verified Paper Trail for each election.

So the Bill-- I don't agree that this Bill was one thing earlier this year, and it's now being turned into something completely different. I think what's being proposed has more specificity in terms of how you would actually vote under this Bill.

ASSEMBLYMAN McKEON: I appreciate your comments, Liz.

I'm going to call to the panel -- final panel, Barbara Netchert, Hudson County Clerk; Mary Melfi, Hunterdon County Clerk; and Paula Sollami Covello, the Mercer County Clerk.

It's nice to see the three of you again. We had a chance to meet earlier, and thank you for coming up.

As you're taking your place, I'd just like to note the presence of Kathleen Cherry, Coalition for Peace Action, who is in favor of the Bill, with amendments, with no need to testify; I think Ms. Zirkle -- it may be

someone different; Ernest -- Ernie Zirkle, okay; it was your spouse who testified, in favor, from the Coalition for Peace, with amendments. And Dianna -- and I'm going to mess your name up -- Houenou, of the ACLU, in favor.

Thanks to the three of you; and your presence is noted.

And I appreciate the three of you.

MARY H. MELFI: Thank you.

Good morning. I'm Mary Melfi, Hunterdon County Clerk, and Legislature Liaison. And I would just like to thank you all for including us in this panel. The Constitutional Officers Association of New Jersey did recognize Assemblywoman Muoio this year for her ability to reach out and talk to us on issues affecting constitutional officers.

So that being said, my role was to talk about the cost; but I think the Board of Elections officials pretty much brought it to your attention.

My concern is, with the counties and the 2 percent cap, counties are struggling as well to do public safety, to do the communications, to do roads. If this were to turn into a county -- where the county got the cost, in Hunterdon -- whether you have one machine, which is-- Polling places in Hunterdon -- there are 44 polling places. So if you put one machine in a polling place, at \$10,000 a machine, without the cost of paper and all the other extraneous costs, it could be a tremendous burden. I don't think our Board of Elections, as you heard, would want one machine per district.

So the thing about it is, is whatever we do, we have to be -- we have to have a plan on how we're going to pay for it. So that would be-- Our position as Clerks, you know -- just be cognizant of how we pay for it.

Thank you.

ASSEMBLYMAN McKEON: Thank you very much.

PAULA SOLLAMI COVELLO, Esq.: Hi, everybody.

We're trying to keep it brief today.

Thank you so much. And I want to congratulate Assemblyman Zwicker and Assemblywoman Muoio on bringing us all together today, and for this Bill. I think that it is great that it's come back and been amended, since 2009 -- that you're keeping it alive, and that we're moving forward. Because in my County, in Mercer County, our Freeholders -- and your counties as well -- our Freeholders are really anxious to move forward and purchase new machines.

So I think it's very important that we have a paper trail. And I think it's very important that we have some hard and fast requirements from the Legislature for this Bill, because they're planning to move forward. They see the age of the machines, and they see the fact that we're, like, getting parts and we're having to refurbish the parts -- for example, our cartridges. And the cartridges are VHS cartridges, and they were, like, 20 years old. That's what we use to recount the votes.

And so we are looking forward to buying new machines. And I think our County actually might buy new machines even without a State grant. So I'm trying to tell them to hold back a little bit, because we don't know how the funding is going to go yet.

So we are very happy to see some requirements; and a paper trail, I think, is important, because we do need to be able to audit the results.

And one of the reasons that I was supposed to talk about auditing is that, as County Clerks, NJSA 19:52-6.1 says that the County Clerk has to provide the election night results. And the County Clerk has to certify the count at the end of the night -- at the end of the election. So even though the Board of Elections has a role, and the Superintendents of Elections have a role in verifying registered voters, we have to certify that count. So we want to make sure it's accurate. So we have to have a way to audit those votes, we definitely think that's important.

And New Jersey should be a leader, and not one of the last to-- We have people who are educated in technology, and we have the Route 1 corridor. And we should have an educated population -- we have an educated population. We should be able to lead, in terms of being able to audit our votes and have a fair election.

So we are excited about it. And I know that we shouldn't mandate technology, or how-- And I know some people like the push-button feature and not making people mark them. And to that extent, I can say we have had a lot of problem in terms of discerning what a voter is trying to say when they hand-mark a ballot. So I do think that's very real. So we have to look at that, and balance that, and I guess our Freeholders would decide which way to go on that.

But there are issues where -- that we have thought about duplicating ballot software, things like that, just to try to figure out what a voter intends with the vote-by-mails. So I can imagine that this could also

be a difficult thing with the -- if people were hand-marking the votes if we had that technology. So I'm just putting that out there.

But we want to thank you for having us, and we do feel it's important to have a paper trail.

And thank you so much.

ASSEMBLYMAN McKEON: Thank you very much for your thoughtful testimony.

MS. SOLLAMI COVELLO: Thank you.

B A R B A R A A. N E T C H E R T: And last, but not least--
(laughter)

ASSEMBLYMAN McKEON: Definitely not least.

MS. NETCHERT: I'm Barbara Netchert, Hudson County Clerk.

And while I concur with everything that my sister clerks have said, I further-- I'm here-- My position, today, was to support the Joint Resolutions that we have. The Senate had passed one back in -- I guess in February of 2016. It was SJR-11, and that was of the creation of a 13-member New Jersey Elections Technology Task Force. And I believe Assemblywoman Muoio, you might have co-sponsored the Assembly one, which is AJR-13. That came out of this Committee, back in February of last year -- in March of last year.

Reading through the Joint Resolution, I think this would be a wonderful committee to set up. It has representation completely across the state; it includes clerks, election officials, the Legislature, various other agencies that are all very well aware of what the election process involves. And I think that if we could move that forward and get that committee in

place -- even if the Bill were to proceed, the committee is still a good thing to have because there are -- there are so many other areas, such as we were discussing: cost, or how many machines, or different -- the effect of what the Bill would have with hand-marked, machine-marked -- you know, that type of thing. I think that if you read the Joint Resolution, I think it would be a wonderful thing if we could move that one forward and get that going as quickly as possible.

And it does have a timeframe; so it's limited. It's not like a committee that's just going to be formed and it can be out there forever. It has a one-year turnaround time. Too bad; if we had gotten it through last year, we might have been at this point, saying, "Here's the report," and we could all look at it now.

But thank you.

ASSEMBLYMAN McKEON: Thank you.

MS. MELFI: The other thing I just wanted to add was in reference to the woman who had the problem with the post office.

That was an issue that all clerks faced last year, with the vote-by-mail ballot. And I would have suggested that she go to her Clerk's Office and vote in person. All of us are doing that; we're all going to be open Saturday and Sunday the weekend before the election, to encourage folks who are not able to get to the polls.

And because of the post office issue -- which we can't control the Federal Post Office -- people are very comfortable voting in the office, on paper, and seeing their ballot being put in the box. There's a comfort level having an in-person voting in a Clerk's Office. If you put this out -- I try to put the vote-by-mail process out in the field because, in essence,

that's what the optical scan is. You have a paper ballot; people screw up the ballot; some people sit there. I mean, we have really, really different voters.

And if you look at the presidential election -- which is everybody's biggest election; which is, like 65 percent; I wish it could be 80, 90 percent. But 60 percent -- and you get all these people in a polling place with a piece of paper. I go back to Hurricane Sandy when we, in Hunterdon, put 2,700 voters walking through the Hunterdon County Clerk's Office Saturday, Sunday of Hurricane Sandy. And we had people with paper ballots all over the place. And it's just -- I just look at paper ballot in a voting machine with one optical scanner thinking, "Holy smokes," you know, you talk about being disenfranchised. People think they can just fill this out, and, "What do you mean, I have to wait while 16 people are going through the scanner?"

That's why I support -- personally support this commission, because I think there's technology out there. But New Jersey hasn't actually, like, looked for it.

ASSEMBLYMAN McKEON: Thank you again for your thoughtful testimony.

Any other members have questions at this point?

ASSEMBLYWOMAN MUOIO: Can I just do one?

ASSEMBLYMAN McKEON: Sure; of course you can. You can do as many as you want.

ASSEMBLYWOMAN MUOIO: Just one follow-up.

But we are one of only five states that has no paper trail right now. And most of these states -- am I wrong? -- do the opscan and have not-- Including Virginia, which has now decertified all of their DREs with --

what? -- I mean, three months' notice? They now have to switch to paper ballots in Virginia for the upcoming gubernatorial election.

So we're one of-- Other states have figured out a way to do it. I'm not saying they're all doing hand-marked paper ballots, but they've all had to make this adjustment. So--

MS. NETCHERT: Oh, no, I think we're all in agreement there. Paper ballots are definitely, probably, the way to go. But I think that limiting it to-- I agree with what you had said earlier--

ASSEMBLYWOMAN MUOIO: Paper *ballot*, or paper-- You mean a *record*? Like a--

MS. MELFI: Paper record.

MS. NETCHERT: Paper audit; paper audit.

ASSEMBLYWOMAN MUOIO: Okay.

MS. NETCHERT: When you had suggested earlier that not limiting the counties to a specific machine or a specific way, but making sure that there is that paper ballot audit trail.

ASSEMBLYWOMAN MUOIO: Right.

MS. NETCHERT: You know, because we've been working with various voting machine companies, and they've been coming to our conferences. And they're all scrambling to give us the best of the best, you know. And taking into consideration -- they've met with us, they've talked to us, they understand the concerns. They've even-- Like they said, they've been speaking to Professor Appel and others. So they're very well aware of the situation.

And I spoke with Mr. Giles down in the Division of Elections the other day, and he told me that they're anticipating a new machine that

would come in for approval in 2018, probably the spring, that might be able to even take the paper that, you know-- Right now, with the optical scanner, you would go to a machine; you could machine-mark it, have the ballot print, and then you'd have to go to a scanner and have it scanned in. With the machine they're looking at now, that ballot could come up behind a secrecy screen so that the voter has to review it before he actually casts a vote. Because if they get it out of a machine and they find out they made a mistake, then they have to go through another process to get another ballot, you know?

And the technology keeps advancing faster and faster; I mean, we all know that. I mean, we can talk to our computers now. So I'm sure that you know that we do know that the paper trail is something. But with the new technology coming out, we'd like to be right on top of the best that's available at the time.

MS. MELFI: And I also -- I don't want you to think that I'm against the paper trail; I'm not against paper. I'm just saying that if this Bill were to make it mandatory, the only thing the State has approved to use so far is that ES&S system. And that may not be the best technology out there, and that's what counties may be forced to purchase without any plan on how to purchase them. And it may not be the best thing to buy. That's basically what I'm saying.

ASSEMBLYMAN McKEON: Thank you again.

MS. SOLLAMI COVELLO: We do have confidence, at the current time, in our machines. We don't want anyone to think that we don't have confidence. We just would like this; we think this will make it better, and we think it will make it more auditable, going forward.

So, thank you.

ASSEMBLYMAN McKEON: Thank you, to the three of you.

Did we miss any members of the public who desired to testify on this very important issue? (no response)

I'm going to allow any of my colleagues who would like to sum up, to do so; and I'll bat clean-up.

ASSEMBLYWOMAN MUOIO: No, I'm fine.

I just want to thank everybody for coming today. I think we all learned a lot, and we'll take this and move forward.

Thank you.

ASSEMBLYMAN McKEON: Andrew, anything?

ASSEMBLYMAN ZWICKER: Ditto.

ASSEMBLYMAN JOHNSON: Ditto; exactly.

ASSEMBLYMAN McKEON: Ditto.

Sir?

ASSEMBLYMAN JOHNSON: I'm done.

ASSEMBLYMAN McKEON: Just many thanks, again, to partisan and nonpartisan staff; and to all of our members of the hardest-working Committee in this Legislature. And particularly -- that's truth -- and particularly Liz and Andrew; your leadership on this very important and complex issue is much appreciated by this Chair and by this entire Committee.

ASSEMBLYMAN JOHNSON: Correct.

ASSEMBLYMAN McKEON: And we look forward to getting into -- beyond this election, and maybe getting something done in the next month or two in a positive way.

And to all of our -- I won't say *stakeholders*; we're all stakeholders, as voters and citizens. But to all of those who are advocates, as well as those with very specific knowledge, we appreciate your testimony. And we'll try to have some wisdom in coming up with something that's affordable, and we'll do the best to minimize any type of prospect of voter fraud.

Thank you again.

(MEETING CONCLUDED)