STATE OF WISCONSIN CIRCUIT COURT DANE COUNTY

BRANCH 3

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In the Matter of the Recount of Votes for President of the United States: JILL STEIN, c/o Emery Celli Brinckerhoff & Abady LLP 600 Fifth Avenue, 10th Floor New York, NY 10020, Petitioner, vs. WISCONSIN ELECTIONS COMMISSION, 212 East Washington Avenue Third Floor Madison, WI 53707, and Members of the Wisconsin Elections Commission, each and only in his or her official capacity: MARK L. THOMSEN, ANN S. JACOBS, BEVERLY GILL, JULIE M. GLANCEY, STEVE KING, and DON M. MILLIS 212 East Washington Avenue Third Floor Madison, WI 53707, Respondents.	Case No. 16CV3060

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PROCEEDINGS: HEARING

DATE: November 29, 2016

BEFORE: The Honorable VALERIE BAILEY-RIHN,
Circuit Court Judge, Branch 3, Presiding

APPEARANCES: Attorney CHRISTOPHER M. MEULER,
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APPEARANCES: (Con't)

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Secretary Hillary Clinton.

REPORTER: Melanie Olsen
Official Reporter

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November 29, 2016

P R O C E E D I N G S

THE COURT: We'll call the case. Go ahead and call the case, and then I'll ask for the appearances.

THE CLERK: Calling the case of Jill Stein versus Wisconsin Elections Commission, et al., case number 16CV3060. Appearances, please.

MR. MEULER: Good afternoon, your Honor. Christopher Meuler from Freibert, Finerty & St. John appearing on behalf of the petitioner. With me at counsel table is Matthew Brinckerhoff and Debra Greenberger and also right behind us is David Lebowitz. All three, I believe, by your order this morning were admitted pro hac vice, and we thank you for the quick speed with which you handled that.

THE COURT: Thank you.

MR. MURPHY: Your Honor, for the respondents, I'm Mike Murphy from the Wisconsin Department of Justice. At counsel table with me is Colin Roth and Dave Meany. In the row behind me is Attorney Andy Cook,

Mike Haas, the administrator of the Wisconsin Election Commission, and Attorney Anthony Russamanno. And we thank you for finding time this afternoon to hear this matter.

THE COURT: Thank you.

MR. KAUL: Your Honor, on behalf of the Intervenor, Secretary Hillary Clinton, I'm Josh Kaul. I'm joined at counsel table by Chuck Curtis.

THE COURT: Okay. So, we have some outstanding motions. One is the motion to intervene. I am going to grant that, unless anybody needs to argue it.

MR. MURPHY: No.

THE COURT: Okay. So I will grant that.

I will also grant the motion of pro hac vice of Mark Elias, and I've signed that.

Is there any outstanding motions that I have not addressed? I did the pro hac, the other ones, earlier this morning.

Okay. Great. Thank you.

So, we're here today on an expedited basis. I have in fact read all the affidavits, I've read all the briefs, and I

have taken a look at the statutory authority for this proceeding. And obviously the court is required to hear this as expeditiously as possible. That's why we're having it for 4:30 tonight. I apologize for the lateness of the hour, but we need to get this resolved.

So, it is the petitioner's petition, so unless there is any more preliminary information that we need to address, let's get started.

We will need -- I'm assuming we're going to have an evidentiary hearing on this.

MR. BRINCKERHOFF: Yes. We are prepared to proceed. There is one slight complication. And we're happy to go right into the evidence if that is the Court's preference, but we were only able to get one witness here live. He's flown in from Ann Arbor. He landed about 20 minutes ago. We expect him to be here quite soon.

And I guess I have almost a housekeeping question, which is, we obviously want to do whatever we can to help the Court make a determination in this case, and if the

Court wants to hear argument or has questions or any of that sort, we're obviously here and happy to entertain any of those things. But if we had our druthers, we would prefer to start with our first witness live as we think he'll be here momentarily. But we can also -- the other ones, we had made a call earlier today to inquire about the possibility of telephonic testimony, and we have witnesses prepared or standing by to provide that testimony.

And one other thing that -- I was a little uncertain about whether or not the Court would be interested in entertaining evidence of this sort. I'm happy to hear that the Court is. But I think there might be some opportunities for some stipulations, for instance, qualifying people as experts, things of that sort that could speed this up, and I had not yet had a chance to confer with any of the counsel for their respective parties to this action.

So, I'm just trying to figure out the best way to proceed efficiently and expeditiously.

THE COURT: Thank you. I do believe that we will need live testimony. Obviously, I can't decide on affidavits. I need to hear the evidence. But maybe while we're waiting for your first live witness, we have granted approval to have witnesses appear by phone, so we could always take those. But before we get that far, maybe we should talk about the stipulations regarding the qualifications.

Does the Wisconsin Election Commission have any concerns about the qualifications of the proposed -- well, who are your witnesses? I guess that's the first question.

MR. BRINCKERHOFF: The first witness who's attempting to get here in person is J. Alex Halderman. He's a computer science professor at the University of Michigan. Obviously, we've submitted an affidavit on his behalf in two places but with the petition as well as with the -- I mean, sorry, the petition before the Wisconsin Election Commission and the petition before the Court.

The next witness after that that we would like to call is Professor Philip Stark

who would be appearing by telephone. He is basically a statistics professor.

All of our experts have specialized expertise in voting issues, irregularities, integrity, and the like. But Professor Halderman is a computer scientist, Professor Stark is a statistician, and then we can keep rolling beyond that, depending of course also on the time that we have with the Court and perhaps some other issues. But we want to at least start with those two.

THE COURT: Okay. And any response to that?

MR. MURPHY: Your Honor, I've reviewed the CVs all of these people. They certainly have some academic qualifications. I think we'd -- I think a blanket stipulation we can't do without knowing a little bit more about what they're testifying to and how that fits into their expertise.

THE COURT: Okay. You want to respond to that?

MR. BRINCKERHOFF: For the record, we are planning for the most part to keep their testimony essentially within the bounds of

the affidavits that have already been submitted. There might be a little bit of rebuttal to the papers that we received this afternoon at a little bit after 1 o'clock. But beyond that, it wouldn't go past that.

I'm happy to have -- these experts are incredibly well-credentialed and world renowned in their field, so I'm happy to have them explain all of that to the Court. I just thought for efficiency purposes, I didn't imagine -- and I'll be more specific -- that anyone would necessarily object to, for instance, qualifying Professor Halderman as an expert in computer science and electronic voting security.

MR. MURPHY: We can stipulate to the qualifications but not the relevance, your Honor. If we're going to have computer scientists testifying about Russia, that's another matter. But to their qualifications in their field, we have no objection.

THE COURT: That's fine. Then we'll take it as it comes.

At this point, is there any other housekeeping we need before -- and you're

still waiting for your first witness.

MR. BRINCKERHOFF: Yes. We could start with Professor Stark and try to set up the phone call. Or we could also try to contact him right now and just see how close he is to being here, only because it's conceivable we could set up the phone call and then he's here.

THE COURT: Okay. Why don't you have one of your colleagues call him and find out.

In the meanwhile, we do have as long as we need tonight to the point where we can stay awake, and then we have cleared the decks for tomorrow as well. I know that's not optimal for the Elections Commission, but that is a possibility if we need to continue over to tomorrow. So, we'll see where we go tonight.

MR. BRINCKERHOFF: Thank you very much, your Honor. We're committed to trying to keep this moving as quickly as possible, and we're certainly hopeful that we can finish it tonight, because obviously it will be a lot for you to consider in making your determination. And the good news is that

Mr. Halderman is here, he's in the building, and he should be here any minute.

THE COURT: Okay. Good.

MR. BRINCKERHOFF: So I'm prepared to call him as soon as he arrives.

THE CLERK: Right here is fine. That's fine. Raise your right hand.

J. ALEX HALDERMAN,

called as a witness, being first duly sworn, testified on oath as follows:

THE CLERK: Thank you. Go ahead and have a seat. The chair does not move; the microphone does.

MR. BRINCKERHOFF: May I proceed?

THE COURT: Yes, you may.

DIRECT EXAMINATION

By Mr. Brinckerhoff:

Q. Good afternoon, Professor Halderman.

MR. BRINCKERHOFF: (Unintelligible.)

THE CLERK: No, you ask his name. Ask him to spell it for the court reporter, please. And also, you'll want to make sure

that you use your microphone as it won't pick up if you're not speaking into the microphone.

MR. BRINCKERHOFF: Thank you very much.

THE COURT: You have a soft voice so you may want to get a little bit closer. The microphone does move closer to you so you might want to --

MR. BRINCKERHOFF: I'm actually not known for my soft voice, so I'm quite confident I can make up for that.

THE COURT: All right. Okay.

Q. Good afternoon, Professor Halderman. Could you please state your full name for the record.

A. My full name is John Alexander Halderman, J-O-H-N, A-L-E-X-A-N-D-E-R, H-A-L-D-E-R-M-A-N. Although, I abbreviate it J, period, Alex, A-L-E-X.

Q. Could you tell me what your current employment is.

A. I'm a professor of computer science and engineering at the University of Michigan and the director of Michigan Center for Computer Security and Society.

Q. And do you have any particular areas of expertise?

A. I am an expert in computer security, network security, and the security of electronic voting systems.

Q. And do you have any specific expertise as it relates -- I'm sorry, you said voting systems. Can you tell me what kind of expertise you have when it comes to security with voting systems?

A. I have extensively studied the kinds of electronic voting machines and voting systems that are used in the United States and other countries including ways in which they might be compromised by attackers as well as methods for improving their security.

MR. BRINCKERHOFF: And I believe we have a stipulation, but for the record, I would ask the Court to recognize Professor Halderman as an expert in the areas of computer science and specifically in voting security, election security.

THE COURT: Any objection?

MR. MURPHY: No objection.

THE COURT: So noted.

Q. Professor Halderman, do you have any experience or knowledge with voting machines that are typically called optical scanning or optical scanners or Opscan machines?

A. Yes, I do.

Q. And in the work -- have you ever done any work or testing on these kinds of machines?

A. I've been involved in studies sponsored by governments including the California Top-to-Bottom Review that did examine optical scan voting machine security.

Q. And are there any kinds of security problems just in general that you're aware of or have identified or become familiar with in the years that you've been working in this area?

A. Yes. Optical scan voting machines are computers. Just like other computers, they are subject to security problems. Somebody who attempted to hack into an optical scan voting machine could change the way that it functions to cause it to count votes incorrectly and produce any outcome that they wanted.

Q. And as I think you may know, have you had an opportunity to review any of the affidavits or materials that were submitted by the Wisconsin Elections Commission earlier today?

A. Yes. Very briefly.

Q. Understood. But based on that brief review, do you have any opinion about whether or not the safeguards that are in place in Wisconsin to prevent some kind of outside cyber interference with optical scanning machines specifically gives you any degree of comfort that they are secure?

A. My understanding is that those safeguards include

pre-election testing, they include tamper evidence seals, and those are not effective at preventing cyber attack against voting systems. We know from extensive research that seals and pre-election testing can be completely bypassed by attacks on the machines.

Q. Let's start with the seal. Can you describe for me what the sealing security measure is and why it can be bypassed in the way that you just described?

A. So a tampered evidence seal is supposed to show that a voting machine has not been physically tampered with. Unfortunately, in research that's been conducted over the past 10 years, security experts have demonstrated that the kinds of tamper evidence seals typically used on voting machines are easy to bypass by an attacker with simple and readily available tools. And by bypassing them, you can tamper with the voting machine without leaving evidence that's going to be detected when the seals are checked as part of normal election procedures.

Q. And insofar as you can, what kind of available tools are you referring to when you say specifically the kinds of tools that could be used to bypass the seal?

A. Well, depending on the kind of seal, it might be something as simple as a screwdriver or a hair dryer that can be used to loosen the seal or remove it in a

particular way without leaving evidence of tampering.

Q. And if there is no attempt to compromise the integrity of the voting machines by physical means that might be revealed in a seal but might not in the way that you described, are there other methods available to someone to try to change the potential outcome of the vote tally?

A. Yes. And unfortunately, physical access is not required to tamper with optical scan machines and other kinds of voting machines. Even though they may not be connected to the Internet directly, these machines receive software updates, they receive ballot programming from other equipment either at the offices of a county government or perhaps at a company that provides services to the county. Those other systems may be connected to the Internet or may be attacked in other ways. And once those systems used to program the voting machines are compromised by an attacker, the attack can spread on the removable media that's used to configure the voting machines into the machines themselves, and that requires no compromise of any seals.

Q. And are you familiar with whether or not the State of Wisconsin and specifically the Wisconsin Election Commission has any private company vendors that do

any of the operating of the voting equipment on election day?

A. Yes. Based on material that I've reviewed, there are examples of companies that service a thousand or more different polling locations in Wisconsin, and the worry would be in my mind that that company if compromised could be used to spread an attack to all of the poll sites that it services.

Q. Now, one of the other things in addition to the seal that you mentioned is that there's a certain amount of testing that is done of optical scan machines leading up to their use on election day, correct?

A. That's correct.

Q. And what kind of problems arise, if any, in the effectiveness of that particular technique?

A. The pre-election testing requirements in Wisconsin and other states are designed to demonstrate the logic and accuracy of the machine is functioning correctly. That is, the ballot has been set up properly and mechanical factors like that. It's not designed and does not function to detect cyber attack against the machines.

The logic and accuracy test can be defeated by malicious attacks in a number of different ways, including by having the attack only function if the machine has counted a large number of votes, larger

than the number that are tested in pre-election testing, or perhaps by setting the time at which the attack will function to be towards the close of polls rather than prior to the opening of polls when the logic and accuracy tests are performed.

Q. And, Professor Halderman, have you yourself ever attempted to, to use a colloquial term, hack into a voting Opscan machine to attempt to alter the way it would operate?

A. I myself have been involved in studies that have demonstrated the vulnerability of Opscan machines including the California Top-to-Bottom Review. I have in my own work constructed a tax against DRE voting machines that would function similarly in this the way of an -- similar to the way an attack on Opscan machines would function, by spreading in the form of a voting machine virus from one point of infection to many machines.

Q. And is there a difference between a virus and what sometimes is referred to as malware?

A. A virus is one form of malware. In this case, a virus is a form of malware that can spread to machines sometimes not connected to the Internet by colloquially hitching a ride on the memory cards that are used to program the voting machines on election day.

Q. Just so I understand specifically what you mean, when you say "hitching a ride," what is happening physically if there's malware or a virus that's infected a computer system at a manufacturer or at the primary computer base for an election system within a state. How does it exactly hitch its ride to these individual machines?

A. The malware -- the specifics would depend on the particular voting system involved, but in general, the malware would modify or add files to the memory card that would cause the voting machine to malfunction in a way that it miscounted votes. For certain kinds of voting machines we know that the malware on the memory card can modify the programming inside the voting machines in a persistent and potentially undetectable way.

Q. Professor Halderman, I think you are familiar with the fact that one of the issues presented today in this case is whether or not there's an important distinction between recounting ballots by hand and tabulating them by hand versus basically running the same ballots through the machines after they've been reprogrammed. Do you have an opinion as to whether or not that reprogramming will ensure that none of the kinds of things that you have testified about

thus far would reoccur?

MR. MURPHY: I'm going to object on foundation and relevance. Without knowing or having foundation on the way Wisconsin does that, I don't think he can competently answer that question.

Q. Professor Halderman, if you accept hypothetically that an Opscan machine is completely reprogrammed from the start for the same election, is there any way in your professional -- I'm sorry, expert opinion that that hacker or some kind of person bent on infecting that machine could accomplish that a second time?

A. Well, yes. The same vulnerabilities that were present on election day continue to exist in the voting machines because they are the same technology, the same model, and for that reason the machines are just as subject to hacking now as they would have been prior to the election.

Q. And is there any possibility that if you posit that someone had initially gotten malware or a virus to hitch a ride into one or more Opscan machines, that it could remain there in some way and affect further operation even if it is subject to some kind of reprogramming with new memory cards and the like?

A. Yes. Because some of the programming in a voting machine as a computer is persistent programming. It doesn't exist on the memory card. It's in the firmware inside the device. And as I have shown in my research on certain models of voting machines, we can persistently reprogram that firmware to cause the machine to continue to be dishonest to cause fraudulent results in future elections or recounts.

Q. And do you have an opinion based on your testimony thus far of what kind of a recount would be most reliable, a hand recount where the ballots are examined by human eyes and hand tabulated, or a rescan through the same machines with a new program?

A. I strongly am of the opinion that a hand recount is going to provide a more accurate result because it will not be affected by any kind of cyber security attack that might be compromising the scanning machines.

Q. And so, is it true then that you're confident that if -- that in any of the jurisdictions in Wisconsin where there is a hand recount and not rerun through the machines that those tallies should be accurate?

A. I believe that those tallies should be accurate. The optical scan ballots used in Wisconsin are --

MR. MURPHY: Object to foundation here.

THE COURT: Any --

Q. Professor --

MR. BRINCKERHOFF: May I -- I can try to --

THE COURT: Sure.

MR. BRINCKERHOFF: I think I understand the objection.

Q. Professor Halderman, are you familiar with the types of optical scanning machines that are used in Wisconsin?

A. Yes, I am.

Q. And based on that familiarity, can you tell me --

MR. BRINCKERHOFF: I'm sorry. Can I have the question read back that I had the objection to? Is that possible? Or is that too burdensome? If so, I'll just try to move forward.

(Question page 21, lines 14 through 17 read back.)

THE COURT: Thank you so much. I'm sorry to burden you with that.

Q. Professor Halderman, you testified already that you're confident that the hand re-tally will be accurate, correct?

A. Yes.

Q. And I believe that my next question was are you

confident that a rerun through the machines will be accurate?

A. Oh, that a rerun through the machines will be accurate. I am not confident that a rerun through the machines will be accurate.

Q. And that is based, as I understand your testimony thus far, on your familiarity with the kind of machines, optical scanning machines, that are used in Wisconsin?

A. Yes. Optical scan machines have been demonstrated in research to suffer from a wide variety of not only security problems but also problems with their accuracy.

Q. And, Professor Halderman, is there anything about this particular election cycle that leads you to have any specific concerns about cyber security when it comes to the integrity of the election systems within the United States at large?

A. Yes. I'm concerned because in this election cycle we've seen unprecedented cyber attacks that the federal authorities have linked to foreign government that appear to have been aimed at interfering with the course of the election.

Q. And what are the nature of those attempts and/or breaches, cyber security breaches, that you're

referring to leading up to the election specifically?

A. These include attacks on the e-mail system of the Democratic National Committee, the e-mail of John Podesta, the Hillary Clinton campaign manager, and include attacks aimed at the voter registration systems of two states, Illinois and Arizona, as well as attacks that reportedly were attempts to infiltrate election systems in I believe it was 20 other states that's been reported.

Q. And are you aware of any such attempted attacks and successful attacks on election-related machinery prior to the 2016 Predentinal election cycle?

A. Prior to -- can you clarify the question.

Q. At least within the United States, have there been other attacks that you're aware of or attempted attacks specifically targeted at election-related activities, whether it's a campaign or election official websites and the sorts of attacks that you just described?

A. These are, to my knowledge, a pattern of attacks and especially one linked to foreign government that does not have precedent in an American Presidential election.

Q. And do you have any familiarity of any attempted or successful types of cyber attacks into elections in

other countries in the world?

A. In the 2014 election in Ukraine, there was, according to published reports, an attack that targeted the election infrastructure --

MR. MURPHY: Objection to foundation, your Honor.

THE COURT: I'll sustain it.

Q. Professor Halderman, based on the nature of the attacks that you described within the United States, do you have any opinion about the sophistication or abilities of the person or persons who carried out one or more of those attacks?

A. My opinion is that the pattern of attacks that we've seen follows the mode of operations commonly associated with nation-state style attackers, foreign states, and their cyber military capabilities. These capabilities are among the most powerful threats known to computer security.

Q. And why is it that they are in that rarified category that you just described?

A. Nation-states in their cyber offensive capabilities often target very well-hardened and secured systems and yet have methods of breaching them, such as what we call jumping an air gap or targeting, which means targeting systems that are not directly connected to

the Internet.

Q. And can you tell me what an air gap is, please.

A. An air gap simply means that a computer or other device isn't directly networked to Internet connected devices or other systems that might be attacked. Instead, there's some kind of physical disconnection between the systems.

Q. And I'm sorry to jump a little bit around, but when we go back to the hand tabulating or hand counting of the vote, I know that you testified that you believe that that would be accurate and reliable. Do you have any opinion about any risk of human error in that kind of compilation?

A. Human error in the hand tabulation of the vote?

Q. Yes.

A. My opinion is that the risk of human error in hand tabulation is low.

Q. And why is that?

A. In hand tabulation of a single race, the procedures in Wisconsin call for ballots to be sorted by the chosen candidate and then the number of ballots for each candidate to be counted. These are simple and straightforward steps.

Q. And is there any opportunity in that kind of method of recount for someone to electronically through

malware or any of these kinds of activities influence the outcome or the tallies of the vote?

A. No. And that is the very point of having a paper record is this provides a very strong defense against attempts to manipulate the election outcome through cyber attack because the paper itself obviously is a physical record, cannot be changed by cyber attack after the votes have been cast.

Q. And thus, that paper record ends up being the most reliable indicator of the intent of all of the voters?

A. That is my opinion.

Q. Okay. And is there anything about the state of Wisconsin in this election cycle that you believe makes it more vulnerable or likely to be targeted by potential cyber attackers of the sort that were confirmed leading up to the election?

A. Wisconsin was among the states that were predicted to have very close races in the Presidential election. An attacker planning to commit an attack that would disrupt or change the outcome of the Presidential election would logically want to target the close states just because those are the place where an attack would likely have the most probability of effecting the overall outcome.

Q. But isn't it also true that as long as you change enough votes, you could change the outcome of a vote in a state that was not prognosticated to be as close as Wisconsin.

A. That's true, but the more votes you change, the more likely the attack would be to cause people to be suspicious. So thinking in the role of an attacker, the best strategy is to attack the states that are predicted to be as close -- to be the closest.

MR. BRINCKERHOFF: Just one moment please. I have no further questions.

THE COURT: Thank you. Cross?

MR. MURPHY: Yes, your Honor.

CROSS-EXAMINATION

By Mr. Murphy:

Q. In your testimony today and your affidavit, you've not identified any specific attack on a Wisconsin vote tabulation machine, right?

A. I have not.

Q. And you've not identified any instance of a Wisconsin vote tabulation machine being compromised, right?

A. That is true, though the evidence of that would come from the paper record and by comparing that to the digital record.

Q. And you're not aware of any malware currently on a Wisconsin election tabulation machine?
A. I don't know of any malware presently on the machines, but the evidence of the malware would come from inspecting the paper ballots.
Q. And you don't know what kind of seals are used in Wisconsin, right, on the machines?
A. I don't know the -- I know the types of seals that are typically used in election systems in the United States.
Q. So that's a no; you don't know what types are used in Wisconsin. Right? I'm sorry --
A. I do not know which types --
Q. Okay. Thank you. I'm sorry. I was kind of all there.

And you've not physically reviewed or investigated any of Wisconsin's machines or the security procedures used in this election; is that right?
A. Yes, I have investigated some of the electronic voting machines used in Wisconsin.
Q. In Wisconsin?
A. I haven't conducted the investigations within the borders of Wisconsin.
Q. So you haven't conducted any that have been tested by

the Wisconsin Election Commission.

A. I have tested some of the models of voting machines that have been -- that are used in Wisconsin.

Q. The question is not models; the question is machines.

A. Of the individual machines, no, I have not.

Q. Thank you. And you're not aware of any malware on election tabulation machines in Wisconsin that would affect a recount in the way that you described would be possible.

A. I'm not aware of such malware, although, such malware could certainly be constructed.

Q. I believe you testified that a hand comparison between the ballots fed into a machine and the output of the machine would establish whether the machine was counting correctly, right?

A. A hand comparison, excuse me, between the ballots that are fed in and the count that it --

Q. Uh-huh.

A. No. I testified that a hand recount would reveal whether the machines were functioning correctly.

Q. Okay. So a hand recount, meaning you look at the ballots that were fed through the machines -- I understand the distinction.

Would a comparison between the ballots that were fed through a machine and the output of the

machine based on those ballots tell you whether the counting had integrity?

A. No, necessarily. It depends on, for instance, the size of the count.

Q. Okay. So comparing the output from the actual ballots would not let you know if the machine was counting correctly. Is that your testimony?

A. Comparing counting the votes -- counting the ballots by hand --

Q. Uh-huh.

A. -- right? Counting the ballots by hand and comparing them at scale to the output of the machines on election day would tell you whether the machines had been counting correctly.

Q. Thank you. You've written articles about the integrity of the 2016 general election, right?

A. Yes.

Q. And you concluded and publicly stated that deviations between election poll results -- election -- excuse me.

And you've concluded and stated publically that deviations between elections and polls was probably not the result of a cyber attack, right?

A. Probably not.

Q. And you believe the more likely explanation is that

the polls were systematically wrong, right?

A. I think that's correct, although, I don't think the cyber attack is orders of magnitude less likely than the deviation from the polls.

Q. It's fair to say that your testimony here about the dangers and hazards are about possible problems with Wisconsin voting machines and not what has actually happened as far as you're aware, right?

A. I consider vulnerabilities of this magnitude to be an actual problem with the Wisconsin voting machines.

Q. But we went through a number of questions where you don't have any evidence of any of those problems occurring in Wisconsin, right?

A. If the problems occurred in Wisconsin, it is possible that the only evidence will be on the paper ballots and will only be detected if a hand count is performed.

MR. MURPHY: Nothing further. Thank you.

THE COURT: Thank you. Attorney Curtis or Attorney Kaul?

MR. KAUL: No questions, your Honor.

THE COURT: Any redirect?

MR. BRINCKERHOFF: Yes, please.

REDIRECT EXAMINATION

By Mr. Brinckerhoff:

Q. Professor Halderman, have you been provided any opportunity to inspect any of the machines that were used by Wisconsin in the 2016 Presidential election?

A. No, I have not.

Q. Would you be willing to conduct such an inspection?

A. Yes, I would.

Q. And if you inspected any -- I'm sorry, that the machinery of this election, would you be able to conclude definitively whether or not there was some kind of cyber attack that affected the outcome of the election here in Wisconsin?

A. I cannot say for sure without performing such an inspection, but such an inspection would have a significant likelihood of revealing the presence of such a cyber attack if one had been conducted.

Q. And so inspection would be one way to determine or rule out the potential of some kind of cyber interference that is not a hundred percent guaranteed to detect it. The method, as I understand your testimony, to be confident that such a thing is detected is hand counting every ballot?

A. Yes.

Q. Now, you were questioned about the types of seals.

Are there any kinds of seals, given the nature of what a seal does, that you're aware of that in any way prevents the kind of malware "hitching a ride" that you've testified to earlier?

A. No. I am not aware of any seal that could do such a thing, and seals are essentially irrelevant to that kind of malware.

Q. And a moment ago you were asked questions about comparing ballots to the count on a machine and your answer referenced the scale of that comparison, correct?

A. That's right.

Q. And can you tell me what you meant by scale?

A. It means how many ballots are being recounted. A recount that -- a hand count -- scanning a small number of ballots as in pre-election tests and comparing the machine's output to what's actually on the ballots could be defeated. That's not the same as performing a hand count of the election, which is the best method we have of determining whether a cyber attack influenced the outcome.

Q. And how could the smaller subset pre-election type of test be defeated as you've just said?

A. Malware might be programmed, for instance, not to cheat unless a large number of ballots were being counted as

the number found in a typical polling place.

MR. BRINCKERHOFF: I have no further questions.

THE COURT: Any recross?

MR. MURPHY: Very briefly.

RECROSS-EXAMINATION

By Mr. Murphy:

Q. I understand your testimony and opinion to be that the only way to know if the outcome of an election in a particular state reflects the balance is to do a hand recount; is that right? It's the only way to know?

A. Is to inspect the physical evidence --

Q. The physical ballot --

A. -- when possible, such as a hand recount, yes.

Q. So was it your opinion that a hand recount should be conducted in every state that was predicted to be close in the 2016 general election?

A. Yes. I believe that a hand recount is -- or other methods of determining to high statistical confidence that the physical record matches the digital record are necessary as a routine matter of election security.

MR. MURPHY: Nothing further. Thank you.

THE COURT: Counsel, I have a couple questions. Do you mind if I ask them? I won't if anybody objects.

MR. BRINCKERHOFF: No, your Honor. We very much welcome that. Obviously, you are the fact finder. We want to accommodate you in all respects.

THE COURT: Okay.

EXAMINATION

By the Court:

Q. Sir, there is some indication that after the election there are some audits performed by the Wisconsin Election Commission on some of the ballot machines to ensure that they -- they do hand counts against some of the ballot machines to make sure that there is not an issue. Do you have an opinion as to whether that is sufficient?

A. My opinion is that that is insufficient, because the kinds of audits that are conducted in Wisconsin, is my understanding, audit a fixed number of poll sites, which is not necessarily sufficient to establish with high statistical confidence the outcome -- that the outcome was correct if the outcome was close, as it was in this election.

Q. What is your opinion as to what sort of hand counting of the ballots -- what percentage of the Wisconsin polling places -- what would in your mind be sufficient to determine whether or not there were any concerns with the balloting process?

A. A larger, random sample of polling places could be sufficient, but how large would need to be calculated by statisticians, and I have not done the calculation.

THE COURT: Thank you. I have no further questions.

MR. BRINCKERHOFF: Just one followup --

THE COURT: Sure.

MR. BRINCKERHOFF: -- because I think it's pertinent to his answer to that question.

FURTHER REDIRECT EXAMINATION

By Mr. Brinckerhoff:

Q. Why is it that it would have to be a random sample?

A. The necessity of a random sample is that if it is not a random sample, say, some particular counties choose one method or the other, it's possible that an attack would be designed to target only counties that were likely to use a machine count. It's also possible that -- it's

also much harder to estimate the number of ballots that need to be counted in a nonrandom sample that would need to be counted by hand in order to gain high statistical confidence.

MR. BRINCKERHOFF: Thank you.

THE COURT: Thank you. Any further cross?

MR. MURPHY: Very briefly.

FURTHER RECROSS-EXAMINATION

By Mr. Murphy:

Q. Are you aware of how Wisconsin selects its samples for auditing?

A. I understand that Wisconsin selects a random sample of a hundred poll sites --

Q. Thank you.

A. -- which is too small for high statistical confidence.

MR. MURPHY: Nothing further.

THE COURT: Okay. Anything further?

MR. KAUL: No, your Honor.

THE COURT: All right. You may step down. Thank you.

THE WITNESS: Thank you.

MR. BRINCKERHOFF: Our next witness is Professor Philip Stark, who we will need to

contact by telephone.

THE COURT: Okay.

(Phone call is made.)

MR. STARK: Hello?

THE COURT: Professor Stark, this is Judge Bailey-Rihn. How are you?

MR. STARK: Fine, your Honor. How are you?

THE COURT: Good. You are going to be sworn in, and then I believe your counsel is going to ask you some questions followed by some cross examination. So, you want to raise your right hand.

MR. STARK: It's up.

THE COURT: Okay.

PHILIP B. STARK,

called as a witness, being first duly sworn, testified on oath as follows:

THE CLERK: Thank you.

THE COURT: Thank you. You may proceed.

DIRECT EXAMINATION

By Ms. Greenberger:

Q. Good afternoon, Professor Stark. Can you state your full name for the record.

A. Philip Bradford Stark.

Q. And can you spell your last name, please.

A. S-T-A-R-K.

THE COURT: Wait one second. You're pretty quiet. We're having trouble hearing you, and I need to have a legible record so my court reporter can get everything down.

THE WITNESS: Okay. Is this better?

THE COURT: Yes.

Is it better? Okay.

Yes.

Q. And what is your current employment, Professor Stark?

A. I'm a professor of statistics and associate dean of mathematical and physical sciences at the University of California - Berkeley.

Q. And what are your areas of research expertise?

A. Broadly, I work on uncertainty quantification that applies to a bunch of different applications ranging from astrophysics and cosmology on one hand to elections and nutrition and human hearing in another direction.

Q. And when you say that one of your areas is elections, can you explain specifically your expertise in elections?

A. Yes. I've been working in election integrity and specifically on methods to determine how accurately votes are counted and to audit election results to assure that the reported winners are the winners according to the underlying ballots, how people voted. I've been working in that area since 2007 when I served on then California Secretary of State Debra Bowen's Post-Election Audit Standards Working Group. That turned into an academic research area for me.

Then working shoulder-to-shoulder with local election officials in approximately 20 different jurisdictions in California and Colorado to develop methods that were contracted to audit elections based on laws and regulations to improve election integrity and improve election audits. Testified to both Houses of the California Legislature on auditing methods. My methods ended up being incorporated into laws in Colorado and California.

I've made presentations to professional organizations of elections officials including IACREOT, International Association of Clerks, Recorders, Election Officials, and Treasurers, and CACEO, the

California Association of Clerks and Election Officials. I currently serve on the Board of Advisors the of U.S. Election Assistance Commission. I was part of the (unintelligible) from the USEAC earlier (unintelligible) in California and Colorado.

THE COURT: Professor, this is Judge Bailey-Rihn. You are breaking up again. If you might want to talk a little slower and a little closer. I know our court reporter's having a hard time getting down your testimony.

THE WITNESS: I apologize.

MS. GREENBERGER: I ask the Court to recognize Professor Stark as an expert. I believe there's no objection.

MR. MURPHY: In what fields?

MS. GREENBERGER: In the fields as a statistical expert and in the fields of election integrity.

MR. MURPHY: I think election integrity is too broad. I think that statistics and maybe statistical analyses of elections would not be objectionable.

MS. GREENBERGER: Let me lay further foundation, if you will, your Honor.

THE COURT: That's fine.

Q. Professor Stark, can you speak more specifically about the background and experience that you have specifically as to issues of election integrity.

A. I've written a number of peer-refereed articles on election integrity including an article called Evidence-Based Elections, which was written jointly with Professor David Wagner, a computer scientist here. I've been an invited speaker or keynote speaker at a variety of conferences nationally and internationally relating to election integrity and verifiability of voting, transparency voting.

I'm working with a group in Travis County, Texas, where Austin is. The group is led by Dan Wallach, computer science professor for Rice University, developing a voting system that is designed to be auditable, transparent, and who are combining cryptographic end-to-end verifiability with paper based audits, an audit trail. Let's see. What else.

Q. And I believe that you also previously testified that you're on the Board of Advisors on the U.S. Election Assistance Commission?

A. Yes, ma'am.

Q. And other than the Texas group that you were working with, have you consulted for any other government

agencies on election integrity issues?

A. Yes. For the California Secretary of State's office and the Colorado Secretary of State's office. And then I've also worked with individual jurisdictions in California and Colorado as well as in Denmark on methods to ensure the integrity and accuracy of counts.

MS. GREENBERGER: I would ask the Court to recognize Professor Stark as an expert both in statistics and election integrity.

THE COURT: Any response?

MR. MURPHY: Your Honor, I'm not trying to be obstructionist. According to his CV, he's only been in the past been qualified as an expert in statistics. And he's certainly qualified in statistics in math and certainly in the field of elections, but I think that election integrity, particularly in things like conceivable foreign influence, is just outside the scope of what he's shown here.

MS. GREENBERGER: I don't believe he's going to be testifying about foreign influence, your Honor.

MR. MURPHY: That's fine then. Maybe

we can -- I can reserve my objections for relevance, your Honor.

THE COURT: That's fine.

THE WITNESS: May I interject a couple of more things? I --

THE COURT: Sir, you need to wait until your counsel asks some questions. But I will -- I found based on his background -- Professor -- I will allow him to testify as an expert in the two areas that you mentioned.

MS. GREENBERGER: Thank you, your Honor.

Q. Professor Stark, can you speak generally about any vulnerabilities that you know of about Opti-Scan computerized voting equipment?

A. Could you clarify what you mean by "vulnerabilities"?

Q. Sure. I mean -- let me go back. Are you familiar with Opti-Scan voting equipment?

A. Yes, ma'am.

Q. I'm sorry?

A. Yes, ma'am. There are several different strategies to optically scan voter-marked ballots. There are mark-sense style optical scan systems. There are imaging-style optical scan systems. There's a great

deal of variety among them. But broadly, yes.

Q. And do you know of any errors in the tabulation of optical scan voting system results --

A. Yes.

Q. -- that could occur?

A. Yes.

Q. And could you describe those.

A. Well, so I understand that Wisconsin is a state that considers voter intent in determining whether a ballot has been interpreted correctly by the voting system. Optical scan systems can fail to correctly ascertain voter intent for a number of different reasons ranging from problems with how they are configured, problems with how they are maintained, mechanical issues, failing to scan all of the ballots or scanning some batches of ballots more than once, mechanical problems such as mis-picks and mis-feeds or jams.

The inability of software to perfectly ascertain voter intent from various kinds of voter marks, there can be variability according to the kind of ink that the voter uses to mark the ballots, variability depending on whether the voter marked the ballot per instructions or makes a mark like circling something that should be filled in or putting an X where something should be filled in.

There can be variations in how the equipment reads ballots depending on the physical length of the ballot. I know of an instance where the printer had trimmed the ballots to an incorrect length resulting in the scanners not recording the ballots as having any votes. There are instances where the scanner has overflowed their buffers for counting and started to count backwards.

There are all kinds of things that can contribute to a difference between how a human adjudicator would tally the votes on paper ballots and how an optical scan system would tally the same votes.

Q. Are you aware of the margin in the Wisconsin Presidential race between the President-elect and the second place candidate?

A. Yes. I understand it to be approximately 22,500 votes.

Q. And given that margin, what does that mean about what percentage of error would need to be made by the optical scan machine for that error to effect the outcome of the Wisconsin vote?

A. Well, errors in the interpretation of less than 0.38 percent of the ballots could result in causing a tie or a win for Secretary Clinton appear to be a win for Mr. Trump.

Q. And when you say less than 0.38 percent, that means

less than 1 percent, right?

A. Yes, ma'am.

Q. As far --

A. It's less than four-tenths of a percent.

Q. And does that mean that even if the vote tabulation was more than 99 percent accurate, it still could be inaccurate enough to effect the outcome of the election statistically?

A. Yes, ma'am.

Q. Are you familiar with a recent study by Professor Walter Mebane about the Wisconsin vote?

MR. MURPHY: Your Honor, I object to this line. I'll elaborate if you'd like.

THE COURT: Sure.

MR. MURPHY: This came up in the declaration, and Professor Mebane apparently did a study. That study was reported on in the Washington Post and Dr. Stark's affidavit explains his interpretation of the Washington Post article. This is just too far removed. It's an attempt to get an expert testimony through the backdoor through a non-expert and it's just not competent evidence.

MS. GREENBERGER: Your Honor, first of all, that's incorrect. Professor Stark

reviewed the study itself, which is also attached to his affidavit as Exhibit B, not just the Washington Post article. They're both attached. And as an expert, he can review all competent evidence. And to the extent they want to cross him on the competency of the evidence, they're welcome to, but it's certainly well within his competency as a statistician to review other peers' studies and evaluate them.

THE COURT: I'll overrule the objection. You can ask him questions about it.

MS. GREENBERGER: Thank you, your Honor.

Q. Professor Stark, are you familiar with a recent study by Professor Walter Mebane concerning the voting data from Wisconsin?

A. Yes, ma'am.

Q. And can you explain to the Court what the study found?

A. Broadly, yes. So Professor Mebane, I know him personally --

Q. And if you can speak up, please.

A. Yes. Professor Mebane, I know him personally. He's a

professor of political science and statistics at the University of Michigan. He's an expert on election fraud and detecting election fraud statistically from reported election results.

This particular paper of his, a working paper, uses ward levels from Wisconsin from the current elections. I understand that the data were current as of approximately a week ago.

He applies a battery of standard tests for suspicious election results to this board level data from the Wisconsin election. The tests were developed -- the software that conducted the test I understand was developed by him and others under -- with funding from the USAID.

What we find is that according to several of those tests, the results from optical scan systems in smaller wards are suspicious in that under a standard statistical model for the digit frequency of terminal digits or the next to the last -- or the second digit, the numbers are different than expected by an amount that would be considered statistically significant.

Moreover, the frequency of zeros and fives, the count is surprisingly -- and the terminal digit of the count is surprisingly low. In the ward count, the terminal digit of zeros and fives in the rounded

percentage error of a candidate was surprising in some of those smaller wards.

There also appears to be multi-modality, meaning there's more than one most frequent digit in the distribution of those supporting some of the tests that he did.

Q. So, if I understand your testimony correctly -- and I know this is very sophisticated expert testimony, but I'm going to try to make it clear for everyone -- what you're saying is that there were suspicious results that he found in terms of the vote totals; is that correct?

A. Yes. None of this is conclusive. None of this demonstrates conclusively that the totals are erroneous or that anything malicious happened. The only way to determine that conclusively is to go back to the paper records by hand and examine them. But these statistical results would be surprising under standard models for what results ought to look like including things like the last digit of the results somebody expects to be equally likely to be 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

Q. So what you're calling suspicious and surprising is not the total number of votes that the President-elect won but instead the exact number in

terms of the last number of vote totals; is that fair to say?

A. According to one of the tests, yes. None of the test is comparing the reported percentages or number of votes to the share that a candidate was expected to get according to polling or anything else. Rather, these are just looking at the numbers themselves and saying in situations where we count things in large numbers, we would not expect any particular digit to occur more frequently than any other in the 1's place in the count. So if you see that in the 1's place in the count you tend to get numbers that are smaller than 5 more frequently, or you tend to get 0 or 5 less frequently than you would expect, that may be a mark that the numbers are -- that something has caused the numbers to differ from their true values.

Q. And did these suspicious, surprising results occur in Opti-Scan areas, or areas that have the other type of voting machine in Wisconsin, DRE areas?

A. The ones I was just mentioning are in Opti-Scan areas.

Q. You said that the only way, as I understand your testimony, to determine whether these suspicious results indicate that something malicious occurred is to do a hand recount; was that your testimony?

A. Yes, ma'am.

Q. And why is that?
A. Well, first of all, the amount of error that could have caused the electoral result to differ from -- the pre-electoral result to differ from the reported result is very small and could easily have occurred as a result of either innocence, you know, sort of normal errors, normal malfunction or limitations of optical scan equipment, or as a result of some kind of bugs or errors in the software or malicious hacking of the software or systems. To simply put the same ballots back through the optical system and tally them again that way --

I mean, an analogy for that would be someone goes to a doctor and gets a diagnoses and says I'd like a second opinion and the doctor says Okay, I still have that diagnoses as opposed to going to a second doctor for an independent diagnosis. To ask the system to check itself will detect some kinds of errors, but there are many kinds of errors that cannot be detected by simply re-scanning the same ballots and processing them with the same hardware and the same software that was used to create the original counts.

Q. And you said that the normal errors or malicious hacking might not be determined from an automatic recount. Is that because of the small margin between

the first and second place finisher that you talked about earlier, the .38 percent number?

MR. MURPHY: Object as leading.

THE COURT: Sustain that.

Q. When you speak about the normal errors that could affect the results, how is that related to the vote counts here, if at all?

A. Some of the normal errors would simply be repeated if you re-scan the same ballots, if not repeated exactly, then repeated approximately. For example, if a voter had mis-marked a ballot by circling the vote target instead of filling in the vote target, the machine would be likely to misread it the same way both times that ballot was scanned. If two ballots were stuck together in the scan and went through together the first time, it could be likely that those same two ballots would be stuck together the second time they go through the machine. If the software in the scanner had bugs or had been hacked, it would be expected to behave the same time [sic] both times the ballots were fed through the machine. There would be no way on the basis of a re-scan to determine whether the original results were wrong. At best, you would find out whether asking the same question of the same device produces the same answer.

Q. Thank you. Moving to a different area, did you review the submission from the State of Wisconsin that was received earlier this afternoon?
A. I reviewed part of it.
Q. And did you see that Wisconsin has stated that they rely on the U.S. Election Assistance Commission's program of certification of election equipment?
A. I read that in Mr. Haas' declaration, yes.
Q. And I believe you earlier testified that you're actually on the Board of Advisors of that same U.S. Election Assistance Commission; is that correct?
A. Yes, ma'am.
Q. And what is your view about Wisconsin's reliance on the Election Assistance Commission's certification of election equipment?
A. I think that all other things being equal, it's probably better to use certified equipment than not at this stage of the market. But that certification is not a guarantee of election accuracy.

To use an analogy, to rely on certification as insurance of the accuracy of the result would be like a brain surgeon saying I used a sterile scalpel, therefore, the patient is fine. All other things being equal, it's certainly better to use a sterile scalpel than one that isn't sterile. But if you want to know

whether the operation went well, you have to look at the patient. Similarly, probably better to use certified equipment than not. But if you want to know if the election went well, you have to look at the ballots.

Q. And you said certification is not a guarantee of accuracy. Tell me why that is.

A. Well, the part of certification test that relates to tabulation accuracy amounts to taking a brand new machine, running machine-marked ballots through that machine in a laboratory, and figuring out whether the equipment is capable of tallying votes to a pre-specified level of accuracy.

In a real election, you have equipment that has been in a warehouse. It's been transported. It's some years old. It's being set up by poll workers who have varying degrees of training. It's being fed ballots that had been marked by real voters rather than perfectly marked ballots. The accuracy with which that tabulation occurs is very different in principle from the accuracy with which a brand new machine processes machine-marked ballots.

Q. Does the certification ensure that this machine could not be vulnerable to a cyber attack?

A. No, it does not.

Q. In that same submission from Michael Haas, did you see that he spoke about Wisconsin's process of auditing election results?

A. Yes. I understand from his declaration that Wisconsin collects a hundred groups of ballots from different parts of the state and compares a machine count of those group of ballots to a hand count of those groups.

Q. And do you have a view on whether that audit ensures that the election results are accurate?

A. Yes. It is my opinion that it does not ensure that the election results are accurate for a number of reasons.

First of all, in the worst case, suppose that one selected a hundred batches of ballots at random from the state but that there were errors amounting to errors in 0.4 percent or .038 percent of the ballots, which is all that would be required to change the electoral outcome in Wisconsin. There could be as large as a 67 percent chance that none of those hundred batches would show any discrepancy whatsoever.

Secondly, I understand that as of the date of Mr. Haas' declaration, only six of those samples has been drawn and only four of them have been examined.

The probability that you could get six perfect counts and yet still have an error rate of .04 percent or higher among all ballots is on the order of

98 percent. That could be as large as 98 percent.

Moreover, in his research to the four batches that have been examined, he refers to them as not having any unexplained discrepancies. It doesn't really matter whether the discrepancies have an explanation or not. What matters is whether the count according to the Opti-Scan machines is equal to the count that a human doing his or her best job of inferring voter intent from the physical ballot will find.

Q. So if I understand your testimony correctly, even if there was an error in Wisconsin's voting equipment that was large enough to effect the outcome of the election, the fact that four audits found no unexplained discrepancy is not sufficient to indicate -- strike that. Let me ask that again.

The fact that --

Even if there was an error --

-- I understand your testimony to say that even if there was an error that was large enough to effect the outcome of the election, there is a 67 percent chance that after the audit is completed, that error would not be discovered. Is that correct?

A. The chance could be as large as about 67 percent that every batch -- every one of the hundred batches inspected would match perfectly and yet the answer is

incorrect, the electoral outcome is incorrect. Based on the batches that have been examined so far, the probability could be as high as about 98 percent.

Q. 98 percent of what?

A. There could be as large as 98 percent chance that those four batches would show no errors whatsoever, not just no unexplained discrepancies, and yet, the aggregate error in the election as a whole was large enough to change the apparent outcome.

Q. Thank you, Professor Stark.

MS. GREENBERGER: I have nothing further.

THE COURT: Cross?

MR. MURPHY: Thank you.

CROSS-EXAMINATION

By Mr. Murphy:

Q. Professor Stark, do you have your affidavit in front of you?

A. I will momentarily.

Q. Thank you.

A. Yes, sir, I do.

Q. I'll give you a moment if you want. The text of your affidavit, pages 1 through 8 through paragraph 39, doesn't identify Exhibit B to that anywhere, does it?

A. Doesn't identify what? I'm sorry?
Q. What Exhibit B is?
A. Oh. No, it does not.
Q. Thank you. So, turning to Exhibit B -- and just briefly, if you turn to the cover page of Exhibit B, it doesn't identify what it is, does it?
A. No. It just says Exhibit B.
Q. All right. Thank you. But this is the Mebane study that you discussed in the text of your affidavit?
A. Yes, sir. That's working paper downloaded from his website. The URL for it is in a footnote in the body of my affidavit.
Q. All right. Thank you. This is not your working paper, right?
A. No, sir, it's not.
Q. So you're relying on the analysis and procedures of Dr. Mebane?
A. I'm taking his work at face value.
Q. Thank you. On page 6 -- it's the last page of it -- I'm going to read you -- it's short -- the second full paragraph. It says *Why do Small wards with Opscan technology (and several other kinds of wards) have anomalies, and why do the anomalies mean that the reported vote counts do not* --
Excuse me. I misread that. I'm going to

start over because the text is important.

"Why do Small wards with Opscan technology (and several other kinds of wards) have anomalies, and do the anomalies mean the reported vote counts do not accurately reflect the intentions of the electors," question mark. "Given all the information we have, it is hard to say." Do you see that?

A. Yes, sir.

Q. And since you didn't do the research on this, you didn't have any basis to disagree with that, right?

A. That's correct.

Q. Thank you. Earlier in your testimony you identified a number of potential problems with Opscan reading of ballots. This is not meant to be an exhaustive list, but examples are how it's maintained, mis-trimming of the ballots, scanning ballots more than once. Right?

A. Yes, sir.

Q. Those are potential problems of any Opscan system, right, not just Wisconsin?

A. Yes, sir.

Q. All right. Thank you. And you don't know how the machines in Wisconsin are maintained, right?

A. I have no specific knowledge. I would imagine that it varies quite a bit from jurisdiction to jurisdiction.

Q. And you don't have any knowledge that ballots were

seconded more than once in Wisconsin, right?
A. No, sir. I understand that to be a fairly routine error, but I don't have any specific information about Wisconsin.
Q. And you're not aware of a printer mis-trimming the length of any ballots in Wisconsin?
A. No, sir.
Q. And you're not aware of any buffer overflows that would cause backward counting in Wisconsin?
A. No, sir.
Q. Of those types of systemic errors, there's no reason to think that they would all error in the direction of one candidate or another, is there?
A. For those particular errors, I can't think of a reason that they would favor one candidate rather than another. But some are -- they're haphazard in nature and it would be difficult to predict what their effect would be on the count.
Q. Okay. Thank you. You gave some opinions toward the end of your testimony about the audits that Wisconsin does as described in the Haas declaration and some opinions about the statistical significance and how much error there could be based on that audit. Is that fair?
A. Yes, sir.

Q. You don't know the number of ballots in each batch of audited ballots in Wisconsin, do you?
A. No, sir.
MR. MURPHY: Just one moment, your Honor.
THE COURT: That's fine.
MR. MURPHY: I have no further questions. Thank you.
THE COURT: Okay. Any further direct?
MS. GREENBERGER: No.
THE COURT: Any questions?
MR. KAUL: No questions, your Honor.
THE COURT: Professor, this is Judge Bailey-Rihn. I'm going to ask you a few questions if that's all right with counsel.
MS. GREENBERGER: It is, your Honor.
THE COURT: Thank you.

EXAMINATION

By the Court:
Q. The study that you relied on for part of your opinions, that was performed by your -- from -- excuse me --
MS. GREENBERGER: Professor Mebane, your Honor?

THE COURT: Yes.

Q. Professor Mebane, do you know how many -- he indicates in the study that he's looking at small wards. Do you know how many wards that he focused on?

A. My understanding is that he had data from all wards but he stratifies them based on their size. If I recall correctly, he considered a small ward to be one that had a hundred or fewer ballots cast.

Q. Okay. And do you know approximately how many wards that constituted?

A. I don't off the top of my head. I'm sorry.

Q. Okay. And so his conclusions were related to the small wards; is that correct?

A. Not entirely. But the anomalies that he found were primarily in the small wards. There's one column in his table one that applies to large wards, and I'm not quite sure what the number -- the label none means there, but I don't recall what that means in the caption of this paper. I'm sorry.

Q. Okay. And the small wards, do you think that they would have added up to over 22,000 votes?

A. I'm sorry. I don't know how many votes there were in all in them and so I'm not -- I just don't have the data -- the basis on which to answer.

Q. Okay. And the anomalies, if I understand looking at the distribution and digit test in table one were both in small -- anomalies were both in districts that went in favor of Mr. Trump and in favor of Ms. Clinton. Is that correct, or am I reading something wrong?

A. My understanding is that according to these tests there were anomalies in districts that went for both of those candidates.

Q. Okay. Thank you.

THE COURT: I have no further questions. Based on that, is there any redirect or recross?

MR. MURPHY: No.

REDIRECT EXAMINATION

By Ms. Greenberger:

Q. Does the fact that the anomaly occurred in a ward that favored Trump or Clinton indicate whether the anomaly caused the votes to swing in favor of Trump or Clinton?

A. No, ma'am. The anomaly is not itself proof that there's anything wrong with the counts at all. It just suggests -- it just suggests that it would be prudent to examine the underlying paper records to find out

what happened. The anomalies are not with respect to the share or the magnitude of the -- they're not with respect to margins in these wards. Rather, they're to do with the raw numbers and whether the digit frequencies appear suspicious.

MS. GREENBERGER: Thank you.

THE COURT: Any further recross?

MR. MURPHY: None.

THE COURT: All right. Any --

MR. KAUL: No.

THE COURT: -- questions? Okay. We will hang up on you now. Thank you very much, Professor.

THE WITNESS: Thank you, your Honor.

(End of call.)

THE COURT: Is this a good time to take a 10 minute break?

MS. GREENBERGER: Yes, your Honor.

THE COURT: Okay. What time is it? It's -- why don't we come back about 6:20 or so? Is that acceptable?

MR. BRINCKERHOFF: Thank you, your Honor.

(A short break is taken.)

THE BAILIFF: All rise for the Court.

THE COURT: Please be seated.

MR. BRINCKERHOFF: At this time we would like to call Professor Ronald Rivest.

THE COURT: Okay. Just for a matter of scheduling, how many additional witnesses do you have?

MR. BRINCKERHOFF: I believe, unless something very unexpected happens, that we will be closing this piece, meaning the evidentiary testimonial piece, after Professor Rivest.

THE COURT: Okay. Thank you.

(Phone call is made.)

MR. RIVEST: Hello?

THE COURT: Good evening. This is Judge Bailey-Rihn. How are you this evening?

MR. RIVEST: Fine. Thanks.

THE COURT: Your attorney will be asking you some questions followed by some cross-examination, so I'll let your attorney proceed.

THE CLERK: We have to swear --

THE COURT: Oh, yes. I'm sorry. Please raise your right hand.

MR. RIVEST: Yes.

THE COURT: My clerk will swear you in.

RONALD L. RIVEST,

called as a witness, being first duly sworn, testified on oath as follows:

THE WITNESS: I should say also (unintelligible).

THE COURT: Excuse me?

THE WITNESS: I just wanted to identify myself since I hadn't said anything about my identity since the phone call started.

THE COURT: Oh, okay. Well, your counsel will ask you the name for the record, and also if you could speak slowly and directly into your phone so that our court reporter can take down your testimony accurately. That would be very helpful.

THE WITNESS: Will do.

THE COURT: Okay. You may proceed.

MR. BRINCKERHOFF: Thank you.

DIRECT EXAMINATION

By Mr. Brinckerhoff:

Q. Professor Rivest, can you state your full name for the record and spell it, please.

A. My full name for the record is Ronald Linn Rivest, R-O-N-A-L-D, middle name L-I-N-N, last name Rivest, R-I-V-E-S-T.

Q. And, Professor Rivest, what is your current professional position?

A. I'm an institute professor at the Massachusetts Institute of Technology.

Q. And do you have any particular areas of expertise or interest as an institute professor at MIT?

A. I do research in security broadly, including cryptography and election security.

Q. And have you received any awards over the years for your work in computer science, cryptography, and/or election security?

A. I've received awards. They're listed on my website. The most notable award I've received is perhaps the ACM Turing Award.

Q. And can you tell me what the Turing Award is?

A. It's an award for contributions to computer science. In this particular case it relates to the invention of the public-key cryptosystem know as RSA.

Q. And in your election integrity work, have you had an opportunity from a computer science perspective to examine voting systems that are typically used within the United States?

A. So I've had some contacts with the particular voting systems and most of my work tends to be more mathematical and theoretical.

Q. And, Professor, when you mentioned the RSA cryptography, can you tell me what that is?

A. Sure. It's a public-key cryptosystem that's used in most web browsers these days for securing the browser connection. It involves the product of large prime numbers, and encryption is performed by performing modular exponentiation where the module is the product of prime numbers.

Q. And do you do any research into the potential vulnerabilities of computer systems from malicious kinds of intrusion?

A. More of my research relates to trying to detect compromises and design systems that are immune from compromises. Most of the work on detection of compromises has to do with auditing technology.

MR. BRINCKERHOFF: At this time I would ask the Court formally recognize Professor Rivest as an expert in computer

science and specifically in the area of cryptography and election integrity and security.

MR. MURPHY: No objection.

THE COURT: So noted.

Q. Professor Rivest, are you familiar with a term called "software independence"?

A. Yes. That's a term that I coined together with my coauthor Jonathan Wack.

Q. And can you tell me what it means?

A. We coined that term -- it's very similar to the notion of auditability. It means that a software, a voting system in particular, is software independent if an undetected change in the software can't cause an undetectable change in the election outcome.

Q. And so if a system exhibits this characteristic that you coined software independence, I take it that means that the system would be more secure versus less secure?

A. It means that it's more auditable. Yes. It means that you're -- if it's software independent, it means you're not in a software dependent state. In a software dependent state, you're basically in a situation where you have to trust the software.

Q. And in American elections in general using scanning

technology, is that an example of software independence or dependence?

A. That's an example of software independence because you have the opportunity to detect if the scanner was misbehaving by examining the paper ballots.

Q. Aside from examining the paper ballots, is there any other way that you're aware of based on your experience in the computer science field to detect whether or not there is a problem with the software that is used to drive the machinery of the election?

A. Well, there are other methods that might be used, but they tend to be very complicated, imperfect, and expensive and only partial. For example, one could try to examine a code that was running on the machine, however, most machines, voting machines, don't even have the ability to examine the code. It's loaded onto the machine. You don't know what machine is -- what software is actually controlling the machine.

Q. You're saying that when it comes to voting machine software -- and let's be specific here and talk about specifically the scanning kind of technology and software -- are you saying that there's no way to independently verify even what software is running on those machines?

A. That's correct. I mean, you're putting trust in the

vendor that when you load the software onto the machine that that software is what is actually running. It could be the case that the software on the machine is some other software that was installed some other way and the software that you think is loaded is in fact ignored.

Q. And do you have an opinion in general about how vulnerable Opti-Scan technology is as it's used currently in American elections?

A. Only when I read through other reports of other researchers. I have not directly investigated them. These machines are computers. They tend to be rather simple from a security viewpoint. They can be compromised. So their vulnerability is noticeable. Whether they're actually being compromised in the field, I don't have any evidence.

Q. I understand. So, I take it that your testimony just now is that they're vulnerable but what you don't know is whether or not they've been compromised; is that accurate?

A. That's correct. I don't know -- I don't have direct information about compromises of this machine.

Q. And I think consistent with the motion that you mentioned a few minutes ago, given the nature of the software, are there any other methods besides

recounting the hand paper ballots that you're aware of in a system like Wisconsin where you have Opti-Scan machines and paper ballots that could be used to detect whether or not the election systems were compromised by malicious software -- or, sorry, malicious intrusion?

A. No, I don't know of any. The idea, for example, of rerunning all of the ballots through the same machines certainly fails to detect whether those machines have been compromised.

Q. And why is that?

A. Because if they're faulty, if they're malicious, and they sort of preplanned errors or changes, the rerunning of the data through those machines, one would expect to get the same results out of those machines again, erroneous results.

Q. And, Professor Rivest, you're familiar, I believe, with the fact that at the moment some of the counties in Wisconsin will be rerunning these ballots through machines and others will not. Do you have an opinion as to which one of those methods is likely to be the most reliable and reflective of the actual votes cast on election day?

A. I would strongly favor the counties or the jurisdictions that are doing a hand count of the

ballots themselves because that reflects the will of the voters without the potential corruption of any errors in the programming of the machines that are doing the scanning.

Q. Okay. And I take it -- we've mentioned malicious intrusions and errors. Am I correct that both of those kinds of problems can result in vote tabulations and tallies being inaccurate?

A. That's correct. I mean, it need not be a malicious intrusion that would cause an error. It may just be a mis-programming that causes votes for A to be counted for B and vice versa.

Q. And, Professor Rivest, I understand that you are a supporter of voting systems that create a contemporaneous voter completed record of the vote; is that right?

A. Yes. A voter --

Q. And why is it that -- go ahead. Sorry.

A. A voter verified paper audit trail of some sort.

The question's why. I think that if the only official record of how the voters' choices are electronic bits somewhere in the guts of a machine, the voter has no real ability to tell whether those bits are being accurately set to record his choices.

Q. And do you have an opinion of how reliable you would

consider the vote to be in Wisconsin if all of the ballots were examined by hand?

A. I think the hand count is typically viewed as the gold standard for accuracy if it's done well. You have a number of people looking at each ballot and checking for voter intent and recording it multiple ways. So this would be the highest, not to say that it's perfect, but it's the best we know how to do.

MR. BRINCKERHOFF: Excuse me just one minute. Sorry, Professor Rivest.

THE WITNESS: Sure.

Q. Professor Rivest, are you familiar with a term called "script kiddie"?

A. Yes.

Q. Can you tell me what that is, please.

A. So, that's a term that relates more to the eighties and nineties perhaps when the hackers of the computer system were perhaps high school kids who didn't know really anything about security and attacked systems merely by copying a script from a website somewhere and applying it against another website that you wish to attack.

Q. And do you have any view or opinion about whether or not the Wisconsin election system is vulnerable to some kind of intrusion by script kiddie?

A. I wouldn't think they would be.
Q. Okay. And do you have any opinion or view about whether the Wisconsin election system is vulnerable to intrusion or attack by a more sophisticated state-sponsored, potentially, hackers?
A. I think we've learned over the last decade or so that almost any system can be compromised by an adversary who's skillful and persistent and determined. I think that -- and I've seen this with my own company, RSA Security, that's had various break-ins, whether they're by the Chinese. We've seen it with military establishments.

And I think when you talk about security for the Wisconsin voting system, you should keep in mind not only the servers and voting systems of the election system themselves but also those of the vendors and distributors that are supplying the software. And one should think not only of what happens on election day but what happens in the months and years beforehand. If a foreign power were to gain the passwords of all of the election officials of the state, how secure would the system be then? That could be something that could have happened well before election day.

Q. So, Professor Rivest, do you have any confidence based on your knowledge of computer science that the

Wisconsin election this year, the Presidential election, was not compromised in some fashion by some kind of foreign malicious attack?

MR. MURPHY: Object to foundation.

THE COURT: I'm going to overrule it.

THE WITNESS: So I should proceed to answer?

MR. BRINCKERHOFF: Yes.

A. So the evidence that I would look for to be confident that the system was not attacked would be an examination by hand of the paper ballots. That would be the level of assurance that I would look for. And so this recount with a recount by hand would provide that assurance. Absent that, my level of assurance is beneath my standards.

Q. Thank you, Professor Rivest. I don't have any further questions. We really appreciate you taking the time today, or this evening I should say.

A. Sure.

THE COURT: Counsel, cross-examination?

MR. MURPHY: Yes. Thank you.

CROSS-EXAMINATION

By Mr. Murphy:

Q. Professor, I believe you just testified that almost any system like the scanning system you've been discussing could potentially be compromised, right?

A. Almost any computer system could be compromised, yes, that's correct.

Q. So that analysis is in no way specific to voting procedures in Wisconsin, right?

A. That's not. That's correct. I mean, I think that the equipment that's used in Wisconsin is, by and large, rather generic, in fact, rather primitive in some regards compared to security systems of many computers. But, you're right. It's more of a generic system that the computer systems in general tend to be fragile and don't have the kind of security that we'd like to see them have.

Q. Is it fair to say that you have a mistrust of Opti-scanning system in elections?

A. They're a useful tool. I like optical scan systems. And I think that having a quick count by an optical scan system is nice. I think that generally they're pretty reliable. And when they're not tampered with, they're pretty accurate. I favor having a statistical audit of their results to verify that they're accurate.

In Wisconsin we have -- well, I can answer -- go on at more length about this. But, you know, they're not perfect. And I think that our statistical audit of the system is just good practice and should be followed.

Q. Are you aware of any evidence that malicious software or other compromises have been installed in Wisconsin voting machines?

A. What sort of evidence would you imagine that it might have? I don't quite understand how I would be in a position to answer that.

Q. Well, I'll start with paragraph 33 of your affidavit where you say, "I should emphasize that I have no particular evidence of manipulation or tampering of the ballots or the results of the 2016 U.S. Presidential election." Is that accurate?

A. That's correct.

Q. And that's accurate of Wisconsin as included in the U.S. Presidential election, right?

A. Yes.

MR. MURPHY: No further questions, your Honor.

THE COURT: Thank you. Any redirect?

MR. BRINCKERHOFF: No, your Honor.

THE COURT: Any questions?

MR. KAUL: No questions, your Honor.

THE COURT: All right. We'll hang up on you now. Thank you very much for your time.

THE WITNESS: Thank you very much.

(End of call.)

THE COURT: Any further witnesses?

MR. BRINCKERHOFF: No further witnesses. Although, we would, if possible, subject to the Court's permission, like an opportunity to make an oral presentation at the end of the evidentiary piece.

THE COURT: Certainly. Any witness for the defendant?

MR. MURPHY: Our first and only witness will be Mike Haas.

THE COURT: Okay.

MICHAEL HAAS,

called as a witness, being first duly sworn, testified on oath as follows:

THE CLERK: The chair does not move; the microphone does.

DIRECT EXAMINATION

By Mr. Murphy:

Q. Good afternoon, Mr. Haas. Could you state your name and spell it for our court reporter.

A. Sure. Michael Haas. M-I-C-H-A-E-L, H-A-A-S.

Q. Thank you. And what is your job?

A. I'm the administrator of the Wisconsin Elections Commission, which is the state agency that administers and enforces election laws in Wisconsin.

Q. I'm going to have you elaborate a little bit on that. What are your job functions? What do you do day to day? What do you oversee?

A. I oversee our staff of approximately 30 positions. A few of our chief responsibilities are to train and provide guidance to local clerks, county clerks and municipal clerks, who conduct elections. We publish or issue guidance in a variety of forms. We conduct training, webinars, and in-person training. We attempt to administer and implement and interpret any new legislation dealing with elections. Our staff also reviews nomination papers or election petitions that are filed at the State level. We maintain -- develop and maintain the statewide voter registration system, which is a database containing all the States' registered voters. We certify election results, among

other tasks.

Q. I'm going to ask, could you expand on that a little bit. So during and after an election, what are your tasks?

A. The agencies'?

Q. No. Well, the agency to the extent you oversee it, but regarding your knowledge.

A. Well, our tasks are, as I said, to work with clerks, work with candidates, work with the legislature, state officials, other agencies, work with federal and state agencies on securing election systems. Our agency also tests voting equipment, approves voting equipment for use in the state of Wisconsin.

Q. Okay. Let's talk a little bit about the voter equipment. What types of equipment does the state of Wisconsin use for voting?

A. Wisconsin, being one of the most or the most decentralized election system -- administration system in the country, we have 1854 municipalities. They are responsible for purchasing the voting equipment used in their municipality often purchased in coordination with the county clerk. And there's a variety -- a handful of different types of voting equipment used in the state. But generally speaking, it's optical scan tabulating equipment and electronic equipment --

electronic tabulating equipment or DREs.

Q. Okay. Of those three categories, what's a real layman's explanation of the differences between those? What do they do?

A. A DRE basically is touchscreen equipment. And so a voter can go in, instead of receiving a paper ballot, they use the touchscreen equipment. They cast their votes on the screen. There is a voter verified paper audit trail where the votes are reflected or printed, basically a receipt type of cash register spool almost. The voter can verify that the votes have been recorded properly by the touchscreen equipment. That equipment has a second spool of paper that also records the identical votes, and that is the basis for any recount of DRE cast votes is done using that paper spool, basically a hand count of that recorded vote.

Then we have the optical scan equipment where a voter uses a paper ballot, marks a paper ballot, and inserts the ballot into the tabulating equipment. Probably roughly 85 percent of ballots in Wisconsin are cast -- are tallied using optical scan equipment, 10 to 11 percent are cast using the DREs, and the remainder are hand counted ballots.

Q. Thank you. Has the State Legislature authorized the use of those categories of machines you just

described?

A. Yes.

Q. Thank you. Let's talk a little bit about the integrity of those machines. To start broadly, what does WEC do to make sure that votes are recorded as they are cast?

A. Well, I guess starting with the equipment, the equipment is certified and tested and approved at various levels starting with the federal level where it is tested by independent testing labs that are certified by the U.S. Elections Assistance Commission. Those tests and reports are submitted to the EAC, which ultimate decides whether or not to certify the equipment for technical standards, security standards, programming, things like that. And then at that point a voting equipment manufacturer can come to the state of Wisconsin, to our agency, submit an application for approval. Our agency conducts a functional test of the equipment to ensure that the equipment will do what the statutes -- our statutes require.

Q. And what happens in that test?

A. We will create test decks of ballots and run those ballots through the equipment. And with the ballots being marked up in a variety of number -- variety of ways, one of the goals being to just test the --

attempt, I guess, push the envelope with the equipment. See if the equipment will tally a vote inaccurately if we can try to trick the equipment, essentially. And then the equipment is also often taken out on the road in the field and tested in counties with municipalities in more real world conditions. And a report is then prepared for our Commission, which is the same process we used at the Government Accountability Board. If the equipment is approved, it is normally approved with a number of conditions designed to ensure that the equipment will continue on an ongoing basis to comply with the statutes and how it tabulates votes.

Once the equipment is approved for use by our agency, municipalities may purchase it. And then we, I guess, get into the election preparation mode where the equipment is tested prior to each election day.

Q. So, is there any equipment in use in Wisconsin today that hasn't been both federally tested and approved and field tested and reported on by the Elections Commission?

A. No, with the exception of some components of the equipment -- in a couple of cases there have been components of equipment that were not certified by the EAC and Wisconsin as a statute allowing for approval even without certification. And those components --

the underlying system or machine had been certified by the EAC but may be a component and not a modem, for example, and our agency then tested and approved that component.

Q. Okay. So there's no equipment being used now that has not been field tested by the Elections Commission?

A. Correct.

Q. How long have you been working in election administration?

A. Since October of 2008.

Q. Is there any equipment in use today that you're not comfortable produces accurate results of the will of the electorate in Wisconsin?

A. None.

Q. So, let's move to what you started to explain before I interrupted you. What happens with the equipment before election day to ensure that the results are going to be reliable?

A. The equipment, as I said, it needs to undergo a public test within 10 days of election day, and so each municipal clerk will provide public notice of the public test, the public is invited to come and observe the test -- the test, and in those cases a deck of test ballots is created so you have essentially a

predetermined tally. You know how those ballots should be tallied. They are run through the equipment to ensure that the equipment is accurately tabulating those ballots.

The equipment is programmed either by the county clerk or more often by a voting equipment, manufacturer, or vendor representative that will assist the county clerk in ensuring that the equipment is programmed accurately for that particular election.

Q. If a piece of equipment doesn't pass that test, is it used on election day?

A. No.

Q. What happens to the equipment after that test is run?

A. So then the equipment is secured by the municipal clerk until election day.

Q. What do you mean by "secured"?

A. Locked up. Secured. So that unauthorized individuals do not have access to it.

On election day then, the tabulating equipment, there's a protocol for the election inspectors or the poll workers to ensure that there are no votes recorded as being tallied prior to the polls being opened with the equipment.

Q. Can you just explain that one more time. I think I got it, but what's the effect of that? What is that

a safeguard against?

A. It's to safeguard -- it's to ensure that there are no votes tallied prior to the ballots being inserted into the tabulating equipment.

Q. Okay. Are the machines ever connected to the Internet before an election day?

A. Nope, the machines are not connected --

MR. BRINCKERHOFF: Objection. Foundation of what machines we're talking about.

MR. MURPHY: Voting election tabulation machines in the state of Wisconsin.

A. They are not connected to the Internet on election day.

Q. Okay. Speaking in particular about the 2016 election, are you aware of any evidence of any unauthorized access to any voting equipment in the state of Wisconsin?

A. None.

Q. What things are done -- let me back up. How are votes tallied and counted after election day in Wisconsin?

A. As I said, they could be tallied after the polls close at 8 o'clock.

Q. Who does?

A. The election inspectors tally the unofficial results on election night.
Q. Uh-huh.
A. And again, it can be by hand counting the ballots or reading the results from the optical scan equipment or the electronic equipment.
Q. And how are those results consolidated and recorded and transmitted to you? Or what happens to the transmission?
A. So each polling place can have one or more reporting units. A reporting unit can be a single ward or a combination of wards. And so the ballots are -- the results are combined. You may have a ward or a reporting unit where you have multiple types of voting going on where ballots are tallied using optical scan equipment and the DRE, or the DRE, the touchscreen, and hand counted. In most cases where the touchscreens are used, as I said, that's really usually a small percentage -- relatively small percentage of the ballots cast. And so those results are combined for the contest and then those results are conveyed or transmitted to the county clerk to be combined with the rest of the county to report the unofficial results on election night.
Q. Okay. And how are official results verified?

A. Official results?
Q. Yes.
A. The official results do not come in until the official canvas.
Q. Right. Tell us about that process.
A. Okay. So in the couple of weeks after the election, the counties will hold their official canvas where their canvas board will meet, they will review the election materials, review the results, reconcile the numbers of voters with the number of ballots, and then they will produce a certified canvas. Those official canvas results are transmitted electronically into the State's canvas reporting system. They also -- the canvas board members also sign a certification that is transmitted to our office of the official results.
Q. When you say sign one, what is that document? I mean, is it something you get in paper?
A. Yes.
Q. Okay. Thank you.
A. It's normally -- typically faxed to us.
Q. What steps are taken after election day to verify that the machines were working correctly?
A. Well, under Wisconsin statutes we have a -- after every November general election, there is a post-election voting equipment audit where we randomly select a

number of reporting units and direct municipalities to conduct an audit, essentially a hand count, of ballots. But the purpose of that is not necessarily to verify the results. It's to verify that the voting equipment is counting the ballots properly.

Q. Uh-huh. How are the audit locations selected?

A. They're selected by random. We have come up with a system of -- a computer program to randomly select those reporting units. We have a spreadsheet listing every reporting unit for that election and the program then will randomize that list.

We start out taking the first hundred reporting units selected and then we adjust it for two reasons. One is to ensure that every type of voting equipment is represented in the audit and is audited at each general election. And secondly, this year we slightly tweaked the procedures to limit the number of reporting units for any single municipality so that no municipality was required to audit more than two reporting units. So that often results in a handful of reporting units, about the 100 figure.

Q. Walk us through the mechanics of an audit. What happens at the machine?

A. Well, the -- what happens is there will be two tabulators conducting a hand count.

Q. And a tabulator is?
A. An individual.
Q. People.
A. Exactly. I'm sorry. Human tabulator. Correct. And they are tallying the ballots and determining whether the results that -- determining whether the voting equipment counted the -- counts the ballots as they should.
Q. Is that audit being done for the 2016 fall election right now?
A. It was ordered. We have currently suspended it in light of the pending recount. There were a handful of municipalities that conducted the audit even before we certified the results. But as of Monday, we advised the remaining municipal clerks to suspend the audit in light of the recount and we would reevaluate whether it would be initiated again after the recount. Because the recount in a lot of ways -- although they have separate purposes, a recount is you're intensively -- more intensively auditing many more parts of the election process than the post-election audit.
Q. What were the results of the portions of the audit that was completed before it was suspended?
A. Well, as I state in my affidavit, we received, I believe, six audits just in the last week. We haven't

had time to extensively review them. On a really quick review they show that there were no anomalies. In other words, the voting equipment accurately counted all of the ballots.

Q. Now, your declaration says that the audit found no unexplained discrepancies. Could you expand on that?

A. That's probably just terminology. I think in one of the four that we briefly examined, there was a discrepancy in the number of ballots that were tallied for write-in candidates that the equipment would not have counted. And so that was -- the clerk determined that the two individuals conducting the audit had missed those two ballots, and so they did not come up with the exact -- they were short two ballots, essentially. But the clerk was convinced that she had a reasonable explanation for why there was that discrepancy. Again, that was not a discrepancy in how the voting equipment counted the ballots.

Q. Okay. Do you know of any discrepancies in ballot voting in this election?

A. I'm sorry. Could you repeat that?

Q. Do you know of any discrepancies in any of the ballot counting for the November 2016 general election?

A. No. Maybe that's a broad question. I mean, we did say we saw some errors that were made on election night,

again, for the unofficial results.
Q. Uh-huh.
A. And then when the official results came out, there were discrepancies between those two figures.
Q. Uh-huh.
A. And there's one notable case in Outagamie County that received some attention and there was an explanation for why that discrepancy appeared.
Q. In the final results, are you aware of any problem with the vote tabulation or counting?
A. No.
Q. Are you aware of any malware in any of the machines?
A. No.
Q. Are you aware of any cyber attacks on any of the machines?
A. No.
Q. Okay. Let's talk a little bit about the recount process. I guess to start, will there be a recount?
A. As of about 4:30 this afternoon, yes. We received the funds from the Jill Stein campaign, so we have issued the recount order just earlier this evening.
Q. Okay. When will the recount start?
A. Scheduled to start 9 a.m. on Thursday morning.
Q. Through each of the three categories of the machines that you discussed at the beginning, tell us how the

recount is done mechanically -- mechanically logistically.

A. So, the canvas boards will again assemble. The county clerk is essentially in charge of managing the process, hiring as many tabulators, individuals as they feel that they need. They have a number of preliminary steps again to reconcile poll lists and other election materials, absentee ballots, envelopes, things like that. But in the end, the votes are tallied again either by hand count in the case of paper ballots that were originally hand counted, or a hand count of the audit trail from the touchscreen machines, or they will use the optical scan equipment, or a combination of those.

Q. I want to stop there to clarify that. So there's three methods of initial accounting. Am I correct that two of those are hand recounted as a matter of course?

A. Correct.

Q. Okay. For the third category, who decides whether to hand count or optically scan?

A. It's a decision of the canvas board in each county.

Q. Uh-huh. And, okay. Do you know whether counties are choosing one or the other or both or either of those mechanisms? Did they tell you?

A. In a survey we conducted so far, there's approximately 19 counties that indicated that they would use tabulating equipment for some or all of their ballots. And that's not -- those were based on responses from the county clerk who would be making that recommendation to the canvas board that would make the ultimate decision.

Q. Why do the local authorities get to choose?

A. That's what the State Statute permits.

Q. Thank you. Based on your expertise and experience, do you know why a municipality might choose hand counting as opposed to mechanical counting or vice versa?

MR. BRINCKERHOFF: Objection, calls for speculation.

MR. MURPHY: I asked him if he knows.

A. Yes, I do know.

THE COURT: I'll overrule. I think you can answer that.

A. It could be a variety of reasons. And as I indicated in my affidavit, county clerks have different viewpoints on it. So, generally speaking, we would expect that the more populous counties would lean towards using tabulating equipment. Although, it's my understanding that Dane County, our second most populus

county, intends to hand count their ballots.

There's cost factors involved. There's organizational factors involved that would weigh in favor or against either method. For instance, hand counting generally is going to require more tabulators, more individuals hand counting those ballots.

One county indicated to us that they would need 60 tabulators rather than 20, which is what they would plan for if they were using tabulating equipment. There's a cost on the other hand of programming the tabulating equipment that can be avoided if the ballots are hand counted.

There's also some sense of the time savings. The time savings in using tabulating equipment may not pay off or be as significant depending on the scale of the number of votes because each ballot needs to be examined anyway before it is put into the tabulating equipment.

So some clerks who use tabulating equipment or canvas boards that use tabulating equipment on election night may decide that they're going to hand count anyway, avoid the cost of programming if the number of ballots is not significant enough that they feel that they will get a large time savings.

Q. In your interactions with clerks, have they expressed

an accuracy difference or concern between the two methods?

A. No.

Q. Do you know if some clerks have already chosen a method of recount that they plan to use?

A. Yes. Many of the clerks have chosen what they expect and will recommend to the canvas boards. As I said, ultimately, it's up to each canvas board.

Q. And they'll start the recount when?

A. Thursday. And in the case of counties that intend to use tabulating equipment, they're already in the process of lining up the programming they need to again program and test the tabulating equipment before they can use it at the recount.

Q. And that's Thursday of this week?

A. Right. Correct.

Q. And when does the recount need to be completed?

A. Our Commission met yesterday and directed that the recount needs to be finished by 8 p.m. on December 12th. That was a deadline that the Commission imposed. There are some concerns or considerations under federal law about a deadline of either December 13th or possibly at the latest December 19th in order to ensure that Wisconsin's electoral votes are honored by Congress.

Q. Does a recount have an observation element?
A. Yes.
Q. Who can observe?
A. Either members of the public, and specifically representatives of each candidate that is a subject -- or that ran in the contest that is being recounted. Each candidate has a right to have representatives at the recount in order to observe the process and raise any objections or challenges to either the ballots or the procedures.
Q. And what can they do? How far can their observing go?
A. They can look at every ballot. They can look at the materials. They're not supposed to be touching the materials but they can be looking at every vote. They can be -- they can make their own talley if they want. And they can, as I said, raise any challenges in the case of a hand tally whether or not they agree with how the vote is being counted.
Q. All right. Just two more questions. Are you aware of any evidence at all that voting equipment in the state of Wisconsin malfunctioned or was tampered with in a way that might affect the results of the November 2016 general election?
A. No. Malfunction's a broad word, though. Voting

equipment malfunction, that's not unusual on election day. There might have to be a maintenance person that comes to repair it. But as far as malfunctions that affect ultimately the official results, the answer is no.

Q. Are you aware of any mistakes in the canvassing and vote counting process that affected the results of that election?

A. There was a minor typo in one of the official certifications that would need to be corrected if it stood for the Presidential election, but that has been fixed and that certification --

Q. Yep. And I asked an imprecise question. Are you aware of any mistake in the canvassing process that occurred due to the use of tabulating equipment?

A. No.

MR. MURPHY: I have no further questions.

THE COURT: Thank you. Cross?

MS. GREENBERGER: Thank you.

CROSS-EXAMINATION

By Ms. Greenberger:

Q. You just testified that Wisconsin purchases its voting equipment from private vendors, correct?

A. The municipalities do. Not the State.
Q. Understood. But the equipment is purchased from private vendors, right?
A. Correct. I'm not aware of any public vendors that sell voting equipment.
Q. And when the municipalities purchase the equipment from private vendors, the equipment comes pre-equipped with software to enable the equipment to scan and tabulate the ballot, correct?
A. I'm actually not sure what comes with the delivery. I wouldn't be surprised if that's the case. It needs to operate.
Q. So you certainly couldn't rebut what our experts just testified to that it came with that software technology, correct?
A. Right.
Q. Okay. And it is in fact true that when the equipment comes from the private vendor, it already has the capability to scan ballots and tabulate results, right?
A. It has the capability to do that assuming that it's programmed accurately for the specific election.
Q. And you testified that when you are looking to purchase -- or when a municipality in Wisconsin is looking to purchase new computer voting technology,

they do field testing, correct?

A. The State does the testing. When we are doing the testing, often we will -- we know which municipalities or counties are interested in that equipment. So as part of our field testing, we will try to arrange to go to those areas, but that does not mean that every municipality is involved in that testing.

Q. But as part of your field testing, it's fair to say that you don't do a forensic computer audit of the equipment, correct?

A. Yes.

Q. And as part of your field testing, you don't review the source code of the equipment, correct?

A. Right.

Q. So, and it's fair to say you don't have a computer specialist or computer forensic scientist on staff with your agency, correct?

A. Correct.

Q. So you have no way of assuring that at the time that you purchased the equipment it didn't already have malware or a bug in it, correct?

A. Well, our agency does not inspect the equipment when it's delivered at the municipality, so the answer to that would be no.

Q. And you said that a part of your field testing, you

do testing of stacks of ballots, correct?
A. Right.
Q. And the hope is that because those test samples are accurate, the ultimate vote tabulation on election day will also be accurate, right?
A. That testing along with the other measures as I indicated, correct.
Q. Are you aware of the controversy that has occurred with the Volkswagen cars where their admission testing was accurate for the testing stage but the computer software knew to distinguish between testing and actual use?
A. Not specifically, no.
Q. When you -- you said that in advance of the election -- I believe you said it was 10 days in advance -- there's a test specific to the election, correct?
A. Correct.
Q. And you said that the public is invited to that test, correct?
A. Right.
Q. But the public is not permitted to inspect the software in the machine at that stage, correct?
A. Right.
Q. They're not entitled to open the machine up at all, correct?

A. Correct.
Q. And they can't do a forensic audit, correct?
A. Correct.
Q. And they can't do a review of the source code, correct?
A. Correct.
Q. You also testified that most often the equipment is programed by a private vendor for each election specifically, correct?
A. Right.
Q. And that private vendor creates the ballot software in their own offices, correct?
A. I would assume so.
Q. Okay. And they create that software on computers, correct?
A. Again, I would assume so.
Q. And you have no way of knowing sitting here today whether those computers are connected to the Internet, correct?
A. Not directly, correct.
Q. And it's fair to say that it's likely that those computers are connected to the Internet, right?
A. I don't know.
Q. You've never required that your private vendors keep their computers not connected to the Internet,

correct?

A. The State does not. You're correct.

Q. And who the private vendors are that contract with the municipalities in Wisconsin is public information, correct?

A. Yes.

Q. Okay. And that's information that somebody who was interested in a cyber attack could determine, correct?

A. If they go to our website, sure.

Q. It would be as simple as going to your website?

A. Correct.

Q. Okay. So, just so I understand this, the ballot software is placed onto a form of removable media; is that accurate?

A. Yes.

Q. Okay. And that removable media is at some point inserted into the voting machine before the election, right?

A. Right.

Q. But the software gets onto the removable media by being connected to an actual computer, right?

A. Yes.

Q. And that actual computer is located in a private vendor's office, correct?

A. Again, I'm assuming it is. I don't know specifically where they program the media.
Q. Okay. And you already said that you have no way of knowing one way or the other whether that computer in the private vendor's office is connected to the Internet?
A. Yes. Correct.
Q. You also testified that you -- that the State of Wisconsin conducts post election audits; is that correct?
A. Yes.
Q. Okay. And those post-election audits are explicitly not to verify that the vote count was accurate, right?
A. It is to confirm that the voting equipment tabulates the votes as it should. It is not intended to be a recount or determine the winner of an election.
Q. And it's not used to verify the results of the election before they're certified, right?
A. Correct. The clerks can conduct the audit before or after the certification of the results.
Q. And the audit, you said that there's a number of counties that are chosen but -- and that there's various adjustments, correct?
A. Number of municipalities, not counties.

Q. Fair enough. And you said that there's two adjustments to the number chosen. But is it fair to say that you do not adjust for the spread of the election?
A. Correct.
Q. So even in an election that was very close like Wisconsin's was this year, you don't do an audit of a larger number of municipalities, correct?
A. Right. I believe -- that's correct. Yes.
Q. Okay. And I believe you were here when Professor Stark testified that in an election as close as this one, there's a 67 percent chance that the audit even if it was conducted completely would not determine -- would not be sufficient to determine an error if it was as large as the vote spread between the first and second place finisher.

MR. MURPHY: Object, mischaracterizes his previous testimony.

THE COURT: Why don't you restate your question.

MS. GREENBERGER: Sure.

Q. Did you hear Professor Stark's testimony that there was a 67 percent chance that the audit that Wisconsin would conduct would not be sufficient?
A. I've heard the 67 percent figure. I'm note sure

exactly what he was applying it to as a measure.

Q. And is it fair to say that the Commission has not retained its own statistician to determine how large of an audit would be necessary to ensure accuracy of the audit?

A. Yes.

Q. And you yourself and no one in the Commission has that statistical knowledge base, correct?

A. Correct.

Q. Okay. And Professor Rivest testified that a hand recount is the gold standard. Did you hear that testimony?

A. I may have been out of the room. I was out of the room during part of his testimony.

Q. Fair enough. You don't disagree that a hand recount would be the gold standard to determine the integrity of an election, do you?

A. I guess it depends what the definition of a gold standard is. A hand count, ideally, if you have all the time and all the resources. I think many election inspectors would love to use a hand count. But that is not to say that that diminishes the quality of using tabulating equipment.

Q. And you love to use a hand count so much that in Wisconsin's own audit you audit by doing a hand

count, right?

A. Well, the purpose of the audit is to determine whether the voting equipment is working properly and so we use a hand count to do that.

Q. When you were asked about anomalies in the election that occurred this year, is it fair to say that you testified that as I understand it over 5,000 votes were discovered to be mistakenly attributed to President-elect Trump that in fact were never cast?

A. I don't think I testified about 5,000 votes.

Q. Okay. Is it fair to say that there was a mistake in the vote tabulation in Wisconsin such that President-elect Trump was given over 5,000 votes more than he was ultimately entitled to?

A. You mean the unofficial results compared to the official results?

Q. Correct.

A. Right. So on election night the unofficial results showed that there was reportedly in the media about a 27,000 vote difference. Those are not results that we audited or reviewed. It was reported in the media based on what the counties had reported. The official results show a difference of 22,177 votes. I have no idea if the media made a math error or if there were errors made at the local level in reporting results.

Q. So you haven't looked into that since that information came to light on Friday?
A. No. Our elections are based on the official results, not unofficial results and not exit polls.
Q. Turning to the recount that will start on Thursday, as I understand your testimony, no county has made the ultimate decision about whether it's going to do a hand recount or an automatic recount, correct?
A. The formal decision is made by the canvas board. I think in most if not all cases, the canvas board follows the lead of the clerk who has probably conducted audits in the past and has a preferred method. But the formal decision will be made by each county at its initial canvas board meeting.
Q. And they have full discretion to ignore the clerk, correct?
A. Yes, who is on the canvas board.
Q. The election supervisor Ross Hein made a statement on November 25th to the county clerk that in discussions with Wisconsin election officials over the years, a hand count may not be as time consuming as one may think. You agree with that, right?
A. It's a pretty general statement I can agree with depending on who is thinking it, yes.
Q. Okay. And in fact he pointed out that there are

advantages to a hand count because -- and I'm quoting here -- it avoids pretesting of the equipment and reprogramming of memory devices. That's accurate too, right?

A. That was one of the trade-offs I referred to, correct.

Q. And you spoke about on the other side one of the trade-offs is cost, right?

A. Right.

Q. But under Wisconsin recount procedures, the candidate that petitions for the recount is required to absorb all the cost, correct?

A. If the margin is more than one quarter of one percent.

Q. And so in that situation there would be no cost to the public for the hand recount, no additional cost to the public from a hand recount as compared to from a manual recount, correct?

A. I would say there's no monetary cost. There's certainly a cost, a significant cost in organization, scheduling, recruiting, poll workers. We talked about the difference, significant difference in the number of individuals that you need to have. And when we have 12 days to conduct a recount, I think many clerks have expressed to us already that they are having difficulty --

MS. GREENBERGER: I'm going to --

A. -- recruiting enough people.

MS. GREENBERGER: -- object to his hearsay.

Q. Stop right there.

MS. GREENBERGER: I move to strike.

THE COURT: I will sustain that.

Q. A number of counties have determined that they -- strike that.

A number of county clerks have recommended that their counties do a hand recount, correct?

A. Yes.

Q. And that includes one of the most populous counties in the state, correct?

A. Yes.

MS. GREENBERGER: I have nothing further.

THE COURT: Thank you. Any further redirect?

MR. KAUL: And, your Honor, I will have questions. I don't know if your Honor wants me to go now or later.

THE COURT: Oh, sure. Why don't you go now.

MR. KAUL: Thank you. Sorry.

THE COURT: Thank you. Sorry about

that. You've been relatively quiet.

MR. KAUL: I understand. I'd take any opportunity I can to talk to Mr. Haas.

CROSS-EXAMINATION

By Mr. Kaul:

Q. Just briefly following up on the Ross Hein statement, that's a statement that you approved, correct?

A. I did not pre-approve it. He did not ask me if he could say that, but I don't disagree with the statement.

Q. And you were hoping the counties would do a hand recount, correct?

A. No.

Q. That communication specifically mentioned that the Stein campaign had asked for a hand recount, right?

A. I believe so.

Q. And as discussed, it mentioned that a hand recount may not be as time consuming as people might think?

A. Yes.

Q. And it indicated that was based on discussions with Wisconsin election officials over the years?

A. Correct.

Q. And that's accurate?

A. It's a subjective statement. As far as it goes, I

would say it's accurate.
Q. You mentioned before some -- a deadline, and I think you talked about -- it's what's known as the safe harbor date, right?
A. Right.
Q. And you mentioned you weren't exactly sure what that date was?
A. No, I didn't say that.
Q. Well, I think you said it could be one date or another date?
A. The safe harbor date is December 13th. The uncertainty is what would really be the practical effect of the recount not being completed by December 13th.
Q. Okay. And has Dane County -- first of all, Dane County is the one that's doing the hand recount of its optical scan ballots, the big county you were referring to, right?
A. That's my understanding based on what they've told us.
Q. And Dane County is the second largest county in the state?
A. By population, yes.
Q. And by vote total, right?
A. Yes.
Q. And has Dane County expressed to you that it has any concerns about completing its recount in time?

A. I have not talked to Dane County representatives about the timing.
Q. They would let you know if they were worried about completing it on time, right?
A. The Dane County clerk doesn't always automatically let us know his feelings about the timing of different procedures.
Q. Did you read the filings in this case?
A. I would say I skimmed the filings given the last week that we've had.
Q. Are you aware that in 2010 Minnesota conducted a recount of the Governor's race?
A. Yes.
Q. And you're aware that was completed in five days?
A. I think that's what I read, yes.
Q. You don't have any reason to dispute that?
A. No.
Q. And that was a statewide hand recount, right?
A. I believe so.
Q. And you would agree that Wisconsin can do things as well as Minnesota, right?
A. Absolutely. Except we can't seem to beat them in the voter turnout percentage.
Q. I was going to make joke about losing Super Bowls but --

Did you review the discussion in Secretary Clinton's brief about problems that have occurred with optical scan machines?

A. No.

Q. Are you aware of problems that optical scan machines had in Iowa?

A. No.

Q. How about in Florida in 2012?

A. Not specifically.

Q. You were at the predecessor agency, the Elections Commission, the GAB, in 2011 when the State Supreme recount took place, right?

A. Right.

Q. And in that election, the GAB actually sought an order from the Dane County Circuit Court that would permit to hand count some optical scan ballots, right?

A. Correct.

Q. And why was that?

A. Because of a shortage of the memory devices that would need to be available for that equipment for the recount.

Q. And there was a concern that the data on the system would be erased if a hand recount was not done, correct?

A. If the same memory devices were used as at the election, yes.
Q. And that issue was discovered during the course of the recount, right?
A. Might have been as we were preparing for the recount. I don't remember exactly when, but at some point that issue came to light.
Q. But that's not an issue that the GAB was aware of prior to the recount, correct? Or prior to the process of preparing for the recount at least.
A. Right. I mean, I think we know in general that if you in a short period of time need to come up with a large number of memory devices that that could be a challenge. But once the recount was requested, that became more of a priority issue.
Q. And you mentioned before that -- I believe it's the candidates, and even every member of the public has the right to inspect ballots during the recount process before they're run through the machines?
A. Right.
Q. So an organization potentially could try to replicate a hand recount essentially by looking at every ballot and tallying them, right?
A. Right.
Q. And that would -- but if that were to happen, that

would slow the process considerably, correct?
A. I mean, they have the opportunity to look at every ballot. I guess it depends on how quick they are in marking down the hand tallies.
Q. But if an organization were to go ballot by ballot, that would actually be much slower than just a regular hand recount, right?
A. I'm not following you. In a hand recount, they also have the right to look at every ballot.
Q. Yes. But if an organization were only interested in doing so if there was otherwise going to be a machine recount, it would slow the process, right?
A. If that was their wishes. They would have the same rights either way.
Q. Right. You mentioned before that the State does an audit, correct?
A. Right.
Q. And when it does the audit, is does so to -- you said to determine if the tallies on the voting machines were accurate?
A. Right.
Q. And you said that's why they do a hand count, right?
A. Right.
Q. But the purposes of a recount is also to determine if the tallies were accurate, right?

A. That's one of the purposes. Maybe one of the distinctions is that the -- the audit is not auditing ballots that are hand counted and so it is not tallying up the total votes in a particular reporting unit.
Q. How does that work?
A. They are -- they're using the -- they are testing the optical scan equipment to see if it worked accurately.
Q. But how do they do that?
A. They have the two individuals that are conducting a hand count of the ballots that were tabulated by the voting equipment.
Q. Right. So it's the same thing that we'd be talking about if there was a hand recount of the optical scan ballots, right?
A. Correct.
Q. Okay. And you said -- and again, those aren't audited by putting them back through the optical scan machine?
A. Right. Right.
Q. Because that would defeat the purposes of the audit?
A. Right.

MR. KAUL: No further questions.

THE COURT: Thank you. Any further direct?

MR. MURPHY: Very brief.

REDIRECT EXAMINATION

By Mr. Murphy:

Q. Are the vote tabulation machines that were in effect for the most recent fall election, were they all brand new?

A. No.

Q. Were any purchased before the candidates for that election were known?

A. Absolutely.

Q. Do you know of any hacks or malware attacks or malware affecting any of the vendors that the state of Wisconsin -- excuse me, not the state of Wisconsin, that the producers of the Wisconsin election counting equipment?

Do you know if any of these manufacturers, sellers, programmers of the equipment have any indication of any attack, malware, hacking, anything like that?

A. We have not been informed of anything like that.

Q. Is optical -- are the optical scan counters reprogrammed for each election?

A. Yes. And the manufacturers are required to certify to municipal clerks that the software that is being used is what was certified and approved both at the Federal and State level.

Q. Uh-huh. So, programming from previous elections could not alter the results of later elections with different ballots; is that right?
A. Correct.
MR. MURPHY: Nothing further.
THE COURT: Thank you. Any further cross?

RECROSS-EXAMINATION

By Ms. Greenberger:
Q. You testified that some of the voting machines were procured before the candidates were known, correct.
A. Yes.
Q. But you also earlier testified that a removable media device is inserted into those voting machines, right?
A. Yes.
Q. And that removable media device is attached to an external computer at a private vendor to get the information to then be imputed into the voting machine, right?
A. It's the vendor's programming, yes.
Q. Right. And that removable media device that's programmed by the vendors is after the candidates are known, right?
A. Yes.

Q. By definition it's after because it's putting on there which candidates are going to be on the ballot, right?
A. After our agency certifies the candidates who are on the ballot, that's when the equipment is programmed -- or the media devices are programmed.
Q. And that's when they're programmed by a third party vendor for which you have no idea what security computer protocols they have, correct?
A. I do not know specifically what protocols they have in effect.

MS. GREENBERGER: I have nothing further.

THE COURT: Any further questions?

MR. KAUL: No questions, your Honor.

THE COURT: All right. If you don't mind, I have a few questions. Sorry. Is that alright, Counselors?

MR. KAUL: Yes.

EXAMINATION

By the Court:
Q. You talked about the issue regarding the memory devices and the prior recount or special election. I can't remember which one it was. Are those memory

devices -- how is that problem fixed for this election or will be fixed for this recount?

A. Well, the touchscreen equipment will be hand counted. Those ballots will be hand counted. I don't recall specifically what the equipment was in 2011 that had the shortage of the memory devices.

Q. But is that an issue in this election?

A. No.

Q. Okay. You also told me or testified that there's a test on a deck for the machines. How big of a deck are we talking about?

A. I'm guessing a hundred. I don't know specifically.

Q. Okay. So there's like a hundred --

A. -- more than that.

Q. -- sample ballots?

A. I'm guessing.

Q. Okay. How often -- you also testified that you do these tests to make sure the equipment hasn't failed. How often has the equipment failed the test?

A. Well, if there's a problem at the public test before an election, then the clerk is required to contact the vendor and make sure that the equipment is reprogrammed or whatever malfunction is fixed, and then it needs to be tested again. If it does not fail, then the equipment is taken out of -- I mean, if it does not

pass, it's taken out of service for that election.

Q. Do you have any experience as to how often that occurs?

A. I don't -- we hear that -- we hear sort of anecdotally that it occurs occasionally. I don't know statistically how often.

Q. Okay. You also said that the machines are not connected to the Internet at the time of the election. Are they ever connected to the Internet?

A. The only time that -- some of the newer equipment -- the results could be transferred in a number of different ways: by phone, in person, over a modem, over the telephone. Some of the newer equipment does have modems that operate using wireless Internet. And so after the polls close, then when those unofficial results are transmitted, in some cases they could be transmitted. That instantaneous transaction would be conducted over the Internet.

Q. Okay. And how -- what percentage, if you know, of the machines are -- that information's transmitted that way?

A. I don't know. It's only in the new equipment, so probably not a large percentage of the overall numbers, amount of equipment in the state.

Q. Okay. You indicated that as the ballots -- at least

from what I understood, that the ballots were inspected before they're fed into the machines for the recount; is that correct?

A. Yes.

Q. Explain to me what they're inspected for.

A. Well, the two tabulators, they're looking at each ballot. They will decide whether they agree or disagree on how the ballots should be counted if they are doing a hand tally. If they're looking at it for the optical scan equipment, they're just essentially inspecting it to see if they detect any issue with the ballot or how it might be tabulated by the equipment.

Q. If they detect an issue with the ballot, what do they do with it?

A. It may be set aside for the canvas board to determine whether or not -- or how it should be counted. It also depends on if there's an objection raised by any of the parties about how to treat that ballot.

Q. And what are some of the issues they're looking for on the ballot?

A. Well, it could be, for instance, whether or not the ballot was initialed by the clerk. The ballots aren't supposed to be -- or by the clerk or the inspector. So there could be technical requirements that are required for the ballot to be counted. There could be

objections raised as to whether or not that ballot should be tabulated.

Q. Do they also look at the ballot and see if it's been filled out dark enough or anything of that nature?

A. They could be -- right. They could be inspecting for those reasons as well.

Q. Okay. And finally, does the State or the Commission undertake any audits of its vendors to inspect their security, their computer security?

A. We do not do visits of their locations. As I've said, there are a number of conditions that apply to each approval, but we don't audit their security procedures.

Q. Okay. Thank you.

THE COURT: With those questions, is there any followup questions?

MS. GREENBERGER: No, your Honor.

MR. MURPHY: Very brief clarification.

FURTHER DIRECT EXAMINATION

By Mr. Murphy:

Q. You mentioned the Internet transmission of some results. Are those the final results?

A. Those are the unofficial election results.

Q. It's not the official final results?

A. Correct.

Q. Thank you.

MR. MURPHY: Nothing further.

THE COURT: Any further questions?

MR. KAUL: No questions, your Honor.

THE COURT: Okay. You may step down. Thank you.

We need to take a break for my court reporter. She's in charge. Or my clerk. And then we'll come back and hear argument. All right?

MS. GREENBERGER: Thank you, your Honor.

THE COURT: Let's take 10 minutes. Come back at five to. So, thank you.

(A short break is taken.)

THE COURT: All right. Any further evidence from the defendants?

MR. MURPHY: No.

THE COURT: Okay. All right. So we're now at the point where I will entertain arguments. So, plaintiffs?

And I think what I'll do is I'll do plaintiffs, I'll do the intervenor just because it seems like that would be the logical, and then the defendants.

MR. BRINCKERHOFF: Good evening, your Honor. We've tried to keep this as quick as we can. I will try to be relatively brief. But we really pretty much -- I'm sorry.

The Stein campaign, our client, the candidate Jill Stein, the seriousness with which, of course, all of this is being taken -- and we're not surprised that it's being taken seriously because ensuring that the votes that are counted in Wisconsin are accurate and in no way compromised by any claims of intentional misconduct or otherwise is obviously profoundly important to the people of this state and frankly to all citizens of this country and our democracy. So we thank you for entertaining this and recognizing how important I think that it is.

So, there are a couple things that we know that I think based on the evidence that's been presented and otherwise are really basically beyond dispute.

We know that there will be a recount. We know that it's going to start Thursday morning. We know that it has at least financially been paid for and will be paid

for by people other than the people of the state of Wisconsin, that it will not cost the taxpayers any money in that sense.

We know that the only question is how that recount will be conducted. And the central question is obviously whether it will be conducted uniformly by hand or whether some jurisdictions will be allowed to re-feed the same ballot into the same machine and functionally get what one expert testified to as the same -- seeking a second opinion but from the same machine, and therefore, the same doctor. That's the question.

And the reason that this case comes here today under this statute in a way that I believe is unprecedented legally in this state is because these circumstances are unprecedented. That circumstances are unprecedented because this is the first time in any American election where there are confirmed, by the Federal Government, sustained attacks, cyber attacks, from foreign IP addresses, that have been successful all, aimed at our election systems, all aimed at potentially influencing

the outcome of the election for President of the United States. That is unprecedented, and that is a primary reason, the motivating reason, that brings us here today because of that concern.

We also know that leading up to the election what has been testified to is that the DNC was successfully hacked, one of the -- the campaign manager for the Clinton campaign was successfully hacked. Those were released in order to have an impact on the election. The Illinois elections officials were successfully hacked and 200,000 voter records were taken or removed or stolen. The Arizona election officials had a hack where there was an intrusion and records were removed. We also know from federal authorities and public reports that the Court can certainly take judicial notice of in addition to the testimony we've heard today that there were over 20 other attempts on other state election officials, offices, computers, and the like. We know all of that. That's a fact.

We know that someone was attempting to

influence this election, to influence it through cyber means. We know that they succeeded in some places. And we also know that thankfully in the state of Wisconsin, unlike some other jurisdictions, we have an absolute, reliable, verifiable way of determining whether that happened. It's right there before us. And we're going to be recounting. So we know all of that.

We know that about the attacks, but we also know from the evidence that was presented today -- and it's a bit -- or I found it a bit confusing. Perhaps no one else did. But because of it, I want to just explain it a little bit more. And that is the study that Professor Stark testified to concerning the work that was done, specific to Wisconsin and specific to this election, but the work that was done by Professor Mebane.

That work indicates that there is evidence of anomalies that are consistent with someone attempting to manipulate the results of election -- of the results of an election. That is the basic finding that

that is -- that that evidence exists, that it's an anomaly that's consistent with potential manipulation, and it's consistent with manipulation because -- and it almost seems deceptively simple. I had not heard of this kind of statistic testing before.

But basically what he looked at is we have thousands of random numbers that had been generated, the vote tallies, in all of the wards, in all of the state of Wisconsin. There's what he called the terminal digit. That's just the last number in the string of numbers. And any kind of randomness, a statistician will tell you that that number should appear equally over time if you have a large enough sample, which we certainly do. And because of that, the means should always be somewhere within a deviation of the mean, which is 4.5. And he basically analyzed those final digits and concluded that in the smaller -- sorry, the smaller wards, that there were anomalies that are consistent with some kind of potential interference.

Can we say that absolutely there was interference? No. If we could, we'd have a

different kind of case than one just attempting to verify and make sure that there wasn't.

But there are anomalies that are consistent with some kind of intrusion, and they're both on the Trump side and the Clinton side, and that's basically because they're consistent with the concept of manipulating the numbers in some fashion through three different kinds of tests. And if that were actually happening, if somebody was manipulating that piece, there's no reason to believe that they weren't manipulating other potential parts of this election. So that's what we know coming in. That is what is exceptional.

We also know, and no one can honestly seriously dispute, that all of the election systems, certainly including Wisconsin's, although it's not the worst, are absolutely vulnerable and susceptible to hacking and intrusion. There's no question about that. There are officials who are working very hard in good faith following statutes that are appropriate for preventing the kind of script

kiddie sort of hacks that Professor Rivest testified to. But they are woefully, woefully inadequate to prevent any concentrated attempt by a sophisticated group of people. And we know already that those people exist and were trying to influence this election. Okay?

So, we know all of that. And we also know -- sorry -- that -- so we know all of the vulnerabilities. And Mr. Haas has testified about the kinds of tests that they do and all the rest. And there's no doubt that I think those tests can find some errors, correct some errors. We all want accountability and verification to some point. But at the end of the day, all of the experts testified the systems are vulnerable, and they were unanimous. These are world renowned experts.

Professor Rivest is the person who invented the technology that secures all of the our communications on the Internet to the maximum degree possible, the secure communications that we pay for things on over the Internet. He created that. And he is

telling the Court -- he came here. He thought it was important enough to testify today to make it clear to the Court, along with Professor Halderman, that these systems are absolutely vulnerable to anybody who's sufficiently sophisticated, can absolutely infect them and change the outcome of the election.

The other thing that Dr. Halderman testified to that is of course critically important is that any sophisticated attempt to manipulate a vote would have by logic and commonsense focused on states -- because people understand wherever they come from how the American election system works -- where there were likely to be, based on polling and other predictive factors, a close margin. Because you don't want to try to manipulate an election that will create a result that is so widely divergent from what people expect that it would arouse suspicion and cause things like a recount by hand that would identify and verify that something had gone wrong. So, we know that Wisconsin was certainly in the very small subset of states

that would be a logical and likely target on top of everything else.

So, at the end of the day, we're going to have a recount. We've heard testimony, very clear testimony, that that recount is going to require that each ballot be examined and that everybody will have the right, including the candidates, to examine the ballot and even tabulate it on their own. What we want to have is confidence, absolute confidence in the result of this election in the state of Wisconsin. And we don't know whether we'll discover anything, but it won't take much to change the outcome of this election.

You had Dr. -- I'm sorry, Professor Stark testifying very clearly and plainly just to be clear about what the issue is. All we need is 11,000 votes to change from one column to the next column for the outcome of the election in the state of Wisconsin for the President to change. That is less than 4 tenths of one percentage point. It is nothing. It could be actually changed by errors that are not attributable to some kind

of attack, but at the same time that we're counting -- and there's a potential of serious -- a substantial potential that the outcome of the election could be changed.

If we hand count every vote, then we will walk away from the process and every citizen of the country that we live in will know that this count was the most verified, accurate, reliable count of anywhere in the United States because it will be the only one that we're aware of that will be counted completely by hand. And every expert has made it crystal clear and plain that that is the only reliable methodology. That's the reason that they insist upon in all systems that make any sense a verifiable, auditable paper trail. And we have it in Wisconsin. And we need to use it and not just shove those ballots back into the same machines that may have created a problem in the first place.

And that is the end of my argument. I just urge the Court to appreciate the power, obviously, that the Court has, which I know you know, but to make equitable

determinations in this case, to make judgment calls about what is best for the people of the state of Wisconsin, to balance the equities on some level of what it is that we're asking for, the benefits to be gained in trusting in our governmental institutions and showing that this vote count is right, or the benefit to be gained in finding out that there's something terribly wrong which we must know about. Both of those two things are critically important. Both of those things are going to further and strengthen our democracy, and we urge you to take the course to allow that to happen. Thank you.

THE COURT: Thank you. Counsel?

MR. KAUL: Thank you, your Honor. And I'm just going to speak briefly because I think we covered most of the points we wanted to in our paper filing.

I would just say that since a recount is being conducted, our position is that it should be conducted as accurately and as transparently as possible. I think it was virtually undisputed if not entirely undisputed in the testimony that the most

accurate way to conduct a recount is through a hand count. The experts testified to that. It was a gold standard for accuracy. It's the best way to ascertain vote intent, and it's the way that the State itself does its audit when it's trying to figure out if its count was correct.

We think there's no question that a hand count can be completed statewide in a timely fashion. Madison's doing it. Minnesota did a statewide count in five days. There's going to be a lot of work that goes into it, but there's going to be a lot of work that goes into this either way.

And then last I would just say, since we didn't have a chance to address the State's brief, that I think that the position the State has laid out in terms of how it's interpreting the governing statute can't be the right one because under the position they have put forward there would never be a hand recount in the state. There's no way that the test that they have set forth could possibly be met. It's also a test not consistent with the basic principles that

underlay Wisconsin's open government laws. It's brought access to government affairs generally and specifically with respect to recounts. And it's also not consistent with the State's stated policy of doing everything possible to ascertain voter intent.

And so we think that all of the factors here need to be taken into account including the nature of the recount, the most accurate method, and transparency.

So for those reasons we think that a hand recount is appropriate.

THE COURT: Thank you. State?

MR. MURPHY: Your Honor, I think one thing that's important here is what this case is not about. And this is not a case about whether the general system of counting ballots automatically is a valid one -- is a valid way to run an election.

I can't give you a cite, but I know just from general exposure that that was litigated hard decades ago when the first automatic counting and scanning machines came into effect. That is not what is at issue here. And the statute that controls here

presumes the validity of the general system of automatic counting votes.

The decision here is -- at issue here is the statutory directive to give local canvassers the discretion to decide the best way to recount votes. A court can override that statutorily mandated discretion only by clear and convincing evidence of two things: An irregularity or mistake in the automatic counting that will produce -- that produced an incorrect result, and independently, that a recount by hand will result in a substantial probability that the result will change.

There's no evidence presented today or in the papers of either of those. Not one of the experts testified that they know the problem with the Wisconsin election tabulation system or equipment. In fact, every one of them confirmed the opposite.

Mr. Mebane, of course, is not here. What we heard from is Professor Stark, an expert who did not do the study, who couldn't even answer the Court's questions about the information -- the data that went in the

study. And Professor Mebane concludes that you can't say that it was the result of any problem.

All that we have here is 100 percent hypothetical speculation about what could possibly, imaginably happen. That is far, far short of any standard. It's not clear and convincing evidence. And this decision is not a probability. This isn't a motion to dismiss type of situation or a motion to dismiss on the pleadings. This is clear and convincing evidence, and we are not in the ballpark of that.

The separate independent, excuse me, branch that must be met is that the mistake produces a substantial probability that the result will change. There's been no evidence about that whatsoever. And with not great surprise the petitioner, Jill Stein, has said publicly that she does not think there's a likelihood of that, and her campaign manager said that that is not why this lawsuit was filed.

We're left with, frankly, your Honor, not a close case. The statute presumes the

system that is in effect. It gives local canvassers the discretion for them to choose the best way how to conduct this recount absent clear and convincing evidence, and we have not -- we are not -- the petitioner's not anywhere near that standard.

THE COURT: Thank you. Any final words from petitioner?

MR. BRINCKERHOFF: No, your Honor.

THE COURT: Thank you. I'm going to take a break and then I'm going to come back and then I'm going to announce my decision, because I think it's important to deal with this tonight --

MR. MURPHY: Thank you.

THE COURT: -- for everyone. I want to say before I take the break, I'm very impressed with your abilities, your preparedness to a very quick situation, your professionalism. This has been an amazing display of excellent lawyering. However, my decision is -- and I haven't made it yet -- comes out, I want to thank all of you for your time and effort tonight, and we'll go from there. So I will try to come back as

quickly as I can. Thank you.

MS. GREENBERGER: Thank you, your Honor.

MR. BRINCKERHOFF: Thank you.

(A short break is taken.)

BAILIFF: All raise for the Court.

THE COURT: Thank you. Please be seated.

Thank you.

As I indicated before we started, I had read everything. I read all the affidavits, all the supporting detail, the briefs, and I appreciate the arguments of counsel and the witnesses.

What I want to say first is the people of Wisconsin have an absolute right to rely on the integrity of the voting process. The right to vote is the cornerstone of our democracy. A recount isn't a threat. Instead, it should be an affirmation of the democratic process. And I think we can all agree that a hand recount is the gold standard. It's the best we can do, and I don't think there's any dispute to that.

We also can probably agree that there

is no cost difference between a hand recount and recount as proposed by the various canvassing or the various counties because of the fact that the petitioner is going to pay for it.

And I also recognize that Dane County has affirmatively agreed to hand count the ballots. It is the second largest county in the state. And that is best way to determine the recount.

However, having said that, that's not the court's decision to decide what's the best way. That's not what I can do.

When I took this job -- I follow the law. That's who I am despite my personal opinions or what I feel is the best count. I have to do what the law tells me to do.

And here the law is contained in 5.90(2), and it's a two-prong test. The petitioner bears the burden of establishing by clear and convincing evidence that due to a irregularity, defect, or mistake committed during the voting process, the results of a recount using an automatic tabulating equipment will produce an incorrect recount

result, and -- this is second prong -- that there is a substantial probability that recounting the ballots by hand, or another method, will produce a more correct result and change the outcome of the election.

Based on the evidence, even if I find that there is a substantial probability that recounting the ballots by hand will produce a more correct result, which I think is undisputed, and even if I find that change the outcome of the election is met here because the outcome of the election is ambiguous doesn't mean it switches from what was originally a victory for Trump is now a victory for Clinton even if that is sufficient or it's just the number of votes change.

So, even if I find the second prong has been met here, I still have a problem with the first prong. It's clear and convincing evidence that due to a defect or mistake or something else committed during the voting that the results of recount using the equipment will produce an incorrect recount result.

So, what is clear and convincing?

The burden of proof, at least in Wisconsin jury instructions, indicate that clear, satisfactory, and convincing evidence is evidence which when weighed against that opposed it clearly has more convincing power. It is evidence which satisfies and convinces you that yes should be the answer because of its greater weight and clear, convincing power.

So, the testimony today has been that the experts have said there is a chance that the machines could have been hacked or that there are other problems with the machines, that they don't read correctly, all of which may be true, but there's nothing to link it to Wisconsin. There has to be a link to committed during the voting process. There hasn't been that link met here.

There has been the small -- there has been the allegation about the small wards that one of the other professors, his study, but he hasn't been here today. His own study indicated that he can't tell you why the outcome. And it is something that an expert

can rely on under 907.03, but it is inadmissible hearsay evidence. Though, the testifying professor can rely on it in his opinions, and I did take his opinions into weight.

But all of the experts indicated that yes, there are these potential issues. And I understand the problem. The problem is you don't know there's going to be an issue until you do it.

But under the statute, I can't speculate. I have to find by clear and convincing evidence that there is some sort of defect, mistake, or irregularity committed during the voting process that would cause the recount using the automatic tabulating equipment to have incorrect recount results. And I don't find by clear and convincing evidence that occurred here.

So then we default back to 5.90(1), which allows the board canvassers to determine how they're going to do the recount -- and the fact that they want to do a recount using the machines is their decision, it's their discretion. I may

disagree with it. I may see that the hand ballots is the best way. I think we would all agree with that. But I can't put myself in their position.

I understand it is extremely important to the people of the state of Wisconsin. I understand that it is extremely important to the Nation. But I must follow the law, and the law as set forth in 5.90(2) is there for a reason. And I just do not find clear and convincing evidence.

So, that is my decision. I'm going to allow the 19 counties to do the recount the way that they intended.

Again, I think everybody would strongly encourage them to do the hand recount, but it is their decision, and that is the -- the legislative function is to make the statutes, and in this situation, I don't have any authority to decide what is the best for those counties.

So, that's my decision. Any questions?

MR. MURPHY: No questions.

MR. BRINCKERHOFF: None.

MR. MEULER: One quick logistical. Do you need a proposed order --

THE COURT: Yes, please.

MR. MEULER: -- to that effect?

THE COURT: Yes.

MR. MEULER: Okay. So just for the reasons on the record.

THE COURT: Correct. Thank you.

MR. MEULER: Okay.

THE COURT: And again, I really appreciate the time, the effort. I know how important this is to everybody. And thank you all for taking the time to come here to argue that. So, thank you.

MR. MEULER: Thank you, Judge.

MS. GREENBERGER: Thank you, your Honor.

(End of proceedings.)

STATE OF WISCONSIN)
)SS.
COUNTY OF DANE)

I, MELANIE A. OLSEN, do hereby certify that I am an Official Court Reporter assigned to report the proceedings herein in Dane County, Madison, Wisconsin; that the foregoing pages are a true and accurate record of the proceedings held on the 29th day of November of 2016, before the Honorable Valerie Bailey-Rihn, Circuit Court Judge, Branch 3, in my presence and reduced to writing in accordance with my stenographic notes made at said time and place.

Dated this 1st day of December 2016.

_____
Melanie A. Olsen
Court Reporter

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