IN THE UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF PENNSYLVANIA

JILL STEIN, et al., Plaintiffs, v. KATHY BOOCKVAR, in her official capacity as Secretary of the Commonwealth; and JONATHAN MARKS, in his official capacity as Commissioner of the Bureau of Commissions, Elections, and Legislation, Defendants.	CIVIL ACTION NO. 16-CV-6287 (PD)

AMICUS ELECTION SYSTEMS & SOFTWARE, LLC'S PROPOSED FINDINGS OF FACT

Amicus Election Systems & Software, LLC ("ES&S"), by and through its undersigned counsel, respectfully submits the following proposed findings of fact.

ES&S & DEAN BAUMERT

1. ES&S formed in 1998 from a merger of two predecessors: (1) American Information Systems and (2) the Election Division of Business Records Corporation. Feb. 19, 2020 Transcript ("Tr.") at 182:9-15. The company employs roughly 500 people. *Id.* at 181:22. Its business is focused exclusively on voting and elections. *Id.* at 182:6-8.

2. ES&S has thousands of governmental entities as customers, including counties, cities, and states. *Id.* at 182:16-24.

3. Dean Baumert is the principal product manager at ES&S and has been at ES&S for more than 12 years. *Id*. at 179-80.

4. Mr. Baumert has significant project management and project development experience at ES&S. As project manager, he led the development of the ES&S DS850 High

Speed Central Scanner. He was also project manager and product manager for development surrounding ES&S's precinct scanners, and the full product manager for ES&S's ballot tabulation systems. Mr. Baumert was the product manager for the ExpressVote voting system and worked as the product manager to develop the ExpressVote XL, the machine used by the City of Philadelphia and repeatedly certified by the Commonwealth of Pennsylvania and the federal Election Assistance Commission. *Id.*

THE EXPRESSVOTE XL

5. The ExpressVote XL is a combination scanner and tabulator. *Id*.

6. XL stands for 'extra large.' It is a functionally similar version of the ExpressVote, but is physically larger, among other differences. *Id.* at 190:10-14.

7. The ExpressVote XL has numerous features that facilitate efficient, auditable voting. It has a screen that permits a full-face ballot. *Id.* at 191:3-17. It contains a scanner, a printer and a paper path module. *Id.* at 191:3-7. The XL cart allows it to be wheeled in and locked into place so it can be set up by the City of Philadelphia staff at a poll site. *Id*. at 191.10-14.

8. The machine arrives at the polling place with a seal bearing a specific seal number. *Id.* at 191:18-24.

9. The poll worker records the seal number and breaks the seal or cuts it to initiate use that day. *Id*.

10. The cover is removed and the second cover for the paper path module is then removed. *Id.* at 192:9-11. A separate seal covers the storage unit at the back of the machine. That seal also bears a unique number. *Id.* at 192:12-19.

11. The machine is equipped with an ADA-compliant audio/tactile interface to permit a blind or motor-impaired voter to navigate the ballot using the interface and/or headphones. *Id.* at 193:2-11.

12. The audio/tactile interface also contains a two-switch interface that permits the user to navigate the ballot without touching the screen. *Id.* at 193:11-20.

13. The ExpressVote XL also contains a sip-and-puff tool which allows a motor-impaired voter to navigate and make selections. Voters, such as those who are motor-impaired or paralyzed, can and have voted on this machine. *Id.* at 193:18-20.

14. To further assist voters with mobility issues, the screen may also be adjusted for a standing or seated voter. *Id.* at 195:6-10.

15. There is no challenge by the Plaintiffs in this case to the accessibility of the machines by the handicapped or disabled. *Id.* at 194:4-6.

16. The XL is equipped with sealed, lead acid batteries, two of which provide (together) seven hours of life. *Id.* at 193:21-25.

17. The XL also contains a compartment at the top that is locked and sealed. *Id.* at 196:4-18.

THE XL IS NOT A DRE WITH VVPAT

18. The XL is not a direct recording electronic ("DRE") voting system. In a DRE, the voter selections are directly recorded into the permanent memory electronically. The voter-verifiable paper audit trail ("VVPAT") is a "cash register receipt" equivalent. The DRE records the data separately and independently from the piece of paper. *Id.* at 188:5-14.

19. The DRE uses paper as an audit trail only, not for the tabulation or storing of the data in any fashion. *Id.* at 188:12-14.

20. Unlike a DRE, the ExpressVote XL tabulates data from scanning information off of the piece of paper. *Id.* at 188:18-24.

21. The ExpressVote XL is not a DRE with VVPAT. *Id.* at 187:18-20.

CONFIGURATION & SECURITY

22. The XL machine is configured to run the elections that take place in the City of Philadelphia. The XL is prepared for that specific set of elections through the election management system known as "Electionware." *Id.* at 197:1-17. This system formats the ballots and lays out the voting options as they appear for the voter.

23. The election configuration is encrypted and written to a USB media. The USB media transfers the election configuration (often called the election "definition") to the XL. *Id.* at 197:10-17.

24. The Electionware creates election qualification code ("EQC") media. This separate piece of USB media is used to load the encryption keys and the specific elections onto the machine. *Id.* at 197:18-25. The USB media are manufactured by Delkin and are specific to the XL machines. *Id*. at 283:8-14.

25. USB access ports are locked down and programmed to only recognize ES&S's own particular type of USB stick. Upon the USB stick being inserted, the XL checks to confirm the USB stick is the appropriate type and is programmed for the specific function that is being performed. Indeed, if a worker attempts to load an incorrect stick, the XL identifies the difference and does not allow the improper stick to activate the machine. *Id.* at 198:11-18.

26. Furthermore, the XL verifies the digital signature of the data on the USB stick and determines that the data has not been changed since it was sent from the trusted source (i.e. ES&S). The XL checks to make sure that the data retains its integrity and then loads that data in

an encrypted form onto the internal data drives of the XL, where it is stored and encrypted. *Id.* at 198:19-199:2.

27. There are layers of security for the USB sticks and access ports. The XL will ignore anything inserted in the USB access port that the XL does not identify as a certified part of the system. *Id.* at 199:8-14.

28. ES&S typically does not train poll workers. ES&S trains customer representatives and staff, and the customer trains its poll workers. *Id.* at 199:19-21.

29. Once the XL is powered on and the poll open process is initiated by the pollworker, it prints a "zero tape," which confirms that the polls have not yet been opened (reflecting voting results as zero). *Id.* at 201:17-25.

30. The XL has numerous security features to render the internal workings of the machine inaccessible to the user. *Id*. at 202:7-23.

31. Once the paper card is marked, ES&S may refer to it as the "ballot." *Id*. at 203:15-18.

32. The ballot demonstrated was 14 inches long, 4¼ inches wide. The length matches the length of an oval-filled ballot if it is used in the same election. *Id*. at 205:1-11.

33. There is no ink used to print on the ballot (and thus the XL cannot "run out" of ink). The ballot consists of thermal paper coated on one side, and the print head burns an image of the vote selection onto the card. *Id*. at 205:11-20.

34. The XL can be configured for up to 12 languages. *Id*. at 207:12-13.

35. The XL will not let the voter select more candidates than they are authorized to vote (i.e. overvote), and there are similar protections that can be activated (for some or all of the races) to alert a voter that he or she has not voted in all possible races. *Id.* at 208:12-23.

36. The user interface can also be configured to prompt a voter that that attempts to cast a blank ballot to confirm that this was their intent. *Id.* at 209:22-210:2.

37. Users can cast write-in choices. *Id.* at 211:3-19. When the paper prints and is moved into the access panel for viewing by the voter, the paper moves slower and the machine is noisier due to the thermal printing. *Id.* at 211:1-8.

38. When the voter casts the ballot, the paper moves and the machine makes a higher-pitched sound because the paper is moving faster and no printing is taking place. *Id.* at 211:20-24.

39. The bin containing cast ballots can only be removed using a release lever that is located behind an access door that can be both locked and sealed. Once removed at poll closing, the bin's access door can be sealed for transport. *Id.* at 212:7-23.

40. The paper path module ("PPM") contains the print head and the scanner. Accessing these components requires using release levers that are behind an access door that can be both locked and sealed and when the release levers are pressed, PPM operation is suspended and an alert is displayed with a corresponding series of audible tones. Access allows both the print head and scanner to be easily cleaned and when the PPM is closed, the machine does a self-check to confirm it is working properly. *Id.* at 212:20-213:15.

SPOILING THE BALLOT

41. The XL permits a voter to—before the selections are cast—discard his or her ballot card without the selections being counted (i.e. "spoil" the ballot). *Id.* at 214:1-22.

42. When a ballot is spoiled, a poll worker will be notified through an audible alert. The poll worker will enter a passcode and follow procedures for allowing the voter to cast a valid ballot, should he or she choose to do so. *Id.* at 214:6-25.

43. The software logic of the XL is such that whenever a card comes out the front, i.e. as a spoiled ballot, the vote data is destroyed and erased in the working memory. Anytime the card goes out the back of the paper path module and into the bin, the data is tabulated. *Id*. at 216:5-16.

44. Printing and scanning work in tandem, such that as soon as the voter's choices are printed on the paper, they are immediately scanned. *Id*. at 217:5-6.

45. The XL PPM is designed to lift the print head and move the paper at a higher speed anytime it is not printing selections on the card. This occurs when the voter chooses to cast his or her ballot and the ballot is ejected into the bin. *Id*. at 220:1-10.

46. Printer sensors indicate whether the print head is down. The functionality of the printer has no election knowledge, meaning that it simply prints what it is directed to print. *Id*. at 220:10-17.

THE XL HAS BEEN CERTIFIED AND RE-CERTIFIED

47. The ExpressVote XL was certified by the U.S. Election Assistance Commission ("EAC"). *Id*. at 222:1-6.

48. The EAC certification process involved testing for security issues. *Id*. at 222:7-9.

49. A separate examination of the ExpressVote XL was conducted as part of the Commonwealth of Pennsylvania's certification process. The ExpressVote XL was later reexamined by the Commonwealth of Pennsylvania as a result of a petition for reexamination that was filed. After completing that reexamination, the XL was once again certified. *Id*. at 222:7-22.

50. The XL has been certified in states other than Pennsylvania. It has been certified in New Jersey, Delaware, California, Texas and Mississippi. *Id*. at 222:2-6.

THE XL HAS BEEN SECURELY USED IN MULTIPLE RECENT ELECTIONS

51. The XL was used in elections prior to November 28, 2018, in approximately 11 to 12 different states and municipalities. *Id.* at 224:9-25.

52. The XL was used in the Commonwealth of Pennsylvania after the Commonwealth informed all county boards of elections of the need to transition to more resilient electronic voting systems. Feb. 18, 2020 Transcript ("Feb. 18, 2020 Tr.") at 64. Jonathan Marks, the Commissioner for the Bureau of Commissions, Elections and Legislation, directed that, to ensure the next generation of voting systems conforms to enhanced resiliency, auditability and security standards, all voting systems purchased after February 9, 2020 must employ a voter-verifiable paper ballot or a voter-verifiable paper record of the votes cast by a voter. *Id.*

53. ES&S's XL machine has advantages over machines that rely on optical character recognition—computerized scans of words and digits themselves—and indeed no county in Pennsylvania has adopted optical character recognition machines. Feb. 18, 2020 Tr. at 120.

54. While Dr. Halderman speculated about the possibility of a mismatch between the bar code information and the voter verifiable text information, to ES&S's knowledge, that has not ever occurred in elections using the XL machine, nor has it occurred in a test of the XL. Tr. at 225:1-15.

55. The XL tabulator has been rigorously tested. *Id.* at 225:20-25.

56. The XL machine has numerous features designed to prevent the kind of mismatch that Dr. Halderman speculates could happen. *Id.* at 226:4-19. These features include the software programming, data encryption and digital signing, as well as the physical controls of the machine to ensure that intruders cannot access it. *Id.* at 226:4-19.

SOFTWARE DEVELOPMENT AND PRODUCT DEVELOPMENT

57. ES&S designed the software used in the XL. *Id.* at 227:8-9.

58. The software is most often installed onto the XL machines in ES&S' secure warehouse facilities. Upgrades can be done by trained technicians at a customer site. *Id.* at 231:5-8.

59. ES&S provides the ability to verify that the software loaded onto the machines is correct and accurate. *Id.* at 228:6-23.

60. The EAC also subjects software to a rigorous examination. *Id. at* 228:18-229:23.

61. It is extremely improbable that an individual or individuals would be able to install malware on the XL machine while still on the ES&S campus. Such an act would require breaking into the ES&S facility, then breaking into multiple machines, and then replacing data drives that contain the operating system. *Id.* at 229:15-25.

62. It is not plausible that malware could be entered into the hard drive or installed at the customer site. *Id.* at 231:8-25.

63. ES&S' proprietary software is made available to the customer through a License Agreement. *Id.* at 232:12-23.

64. There are stringent physical security procedures at ES&S's Omaha headquarters to prevent intruders from entering the buildings. *Id.* at 233:7-19.

65. The hard drive in the XL is under a sealed compartment. An individual would have to break several seals to access that aspect of the XL and likewise be able to physically pull the card out and tamper with the card or put a substitute card in. *Id.* at 234:1-23.

66. Such unlikely conduct would take five to ten minutes of alone time with the machine to access it, remove the card, insert a substitute card, reseal the machine and leave without being detected. *Id. at* 235:15-22. If an intruder did not have a replacement card but

wanted to attempt to reconfigure or reprogram the card, that would require 10 or 15 minutes to wipe the card and load something new onto it. Thus, depending on how well equipped the hypothetical intruder was (after somehow gaining entry), it could take between 5 and 25 minutes to attack one machine. *Id.* at 236:1-13.

BARCODES

67. Barcodes provide significant security protections. The barcode used by the XL is exceptionally difficult to modify. The barcode encodes information into the bars and spaces but also calculates a check digit to prevent improper changing of the value in the barcode. *Id. at* 243:22-244:9.

68. Dr. Halderman's far-fetched, hypothetical scenario—that a machine could be corrupted to cause a mismatch between the barcode and the text on the ballot—is not only extremely unlikely in practice but would be immediately detectable through an audit. *Id.* at 237:12-238:23.

69. ExpressVote machines are not the only voting systems that use barcodes or other human-inscrutable coding to tabulate the vote. Nearly all of the machines on the market today use some form of the barcode. Even hand-marked paper ballots are tabulated through a series of squares and dots, not by looking at the text. *Id.* at 238:18-239:16.

70. The type of hypothetical mismatch that Dr. Halderman speculates about is possible in a hand-marked paper ballot system and any number of different use scenarios and systems. *Id.* at 239:17-23. Indeed, hand-marked paper ballots are more susceptible to mismatches of different sorts than a ballot marking device such as the XL. *Id.* at 240:1-241:6.

71. The ExpressVote XL is significantly more difficult to tamper with than hand-marked paper ballots. *Id.* at 241:10-16.

72. Dr. Halderman speculated that it would be feasible for malware to cause the print head to add additional races or selections to a paper ballot after the voters reviewed it. To ES&S's knowledge, that has never happened in an election using the ExpressVote XL or in a test of the XL (and the XL has been tested precisely for that issue). *Id.* at 241:2-15.

73. The voter verifiable paper ballot contains a border area so that information cannot be added to the bottom. The XL also prints selections for every possible vote, and likewise indicates when no selection has been made. *Id.* at 244:10-24.

74. It is simply wrong to suggest that, after the voter has verified his or her selections, the XL could print on the ballot, as the ballot passes under the print head a second time. The printer prints from bottom to top. When the card is pushed back a second time, the printer would have to print from top to bottom – the printer is not designed to do so. *Id.* at 245:6-17. On top of all the different features designed to prevent tampering by malware or otherwise, a voter or pollworker could hear and detect the printing sound if the printer began printing a second time. *Id.* at 246:22-247:8.

THE XL DOES NOT COUNT SPOILED BALLOTS

75. Dr. Halderman also speculated that it would be feasible for malware to cause paper records that have been rejected by voters to be tabulated—such speculation is squarely at odds with the facts. *Id.* at 248:19-249:22.

76. The speculation that a machine could count a spoiled ballot is unfounded. Anytime the ballot has been ejected from the front of the XL, the data is deleted. *Id.* at 249:15-250:22.

77. The speculation that a ballot scanner could somehow improperly or erroneously count a voter's choice on a spoiled ballot is speculation that applies to all ballot scanners, not just the XL. *Id.* at 250:23-251:23. There are a number of layers of security that prevent a spoiled

ballot from being tabulated as an actual ballot, including digital security, physical controls, physical locks and seals and the chain of custody. Mr. Baumert has never witnessed a spoiled ballot tabulated in any election involving the XL. *Id.* at 252:10-21.

78. ES&S, as a voting machine vendor supplying thousands of municipalities, uses general and generic terms in describing its machines and equipment, not jurisdiction-specific terms. *Id.* at 253:4-18.

79. A ballot is a ballot paper record and the XL uses a paper ballot – the durable record of the voter selections that can be used for post-election audits. *Id.* at 253:5-18.

Respectfully submitted,

DUANE MORRIS LLP

Dated: March 16, 2020

/s/ Luke P. McLoughlin

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CERTIFICATE OF SERVICE

I hereby certify that on this 13th day of March, 2020, I caused the foregoing to be filed via U.S. Mail on the parties named below.

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