

**IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF GEORGIA
ATLANTA DIVISION**

**DONNA CURLING, ET AL.,
Plaintiffs,**

v.

**BRAD RAFFENSPERGER, ET AL.,
Defendants.**

**DECLARATION OF
J. ALEX HALDERMAN**

Civil Action No. 1:17-CV-2989-AT

Pursuant to 28 U.S.C. § 1746, J. ALEX HALDERMAN declares under penalty of perjury that the following is true and correct:

1. I hereby incorporate my previous declarations as if fully stated herein. I have personal knowledge of the facts in this declaration and, if called to testify as a witness, I would testify under oath to these facts.

2. I have reviewed the “Letter Report” prepared by Pro V&V concerning version 5.5.10.32 of the Dominion BMD software (Dkt. No. 939). The report makes clear that Pro V&V performed only cursory testing of this new software. The company did not attempt to independently verify the cause of the ballot display problem, nor did it adequately verify that the changes are an effective solution. Pro

V&V also appears to have made no effort to test whether the changes create new problems that impact the reliability, accuracy, or security of the BMD system.

3. This superficial testing is deeply concerning, because Pro V&V's characterization of the source code changes indicates that they are considerably more complicated than what Dr. Coomer previously testified was the threshold for considering a change to be "de minimis": "literally a one-line configuration change in some config file that would have no material impact on the system" (Dkt. No. 905 at 102:18-103:14). Instead, Pro V&V states that Dominion made two kinds of changes and modified lines in five different source code files. In general, changes that affect more lines of source code or more source code files are riskier than smaller change, as there is a greater likelihood that they will have unintended side-effects. Changes to source code files, as Dominion made here, also tend to be riskier than changes to "config[uration] files."

4. The nature of the changes gives me further reason for concern. According to Pro V&V, one change involved changing a "variable declaration" to modify the "type" of a variable. A variable's type determines both what kind of data it holds and how operations on it function. Although changing a variable declaration often involves differences in only one line of source code, the effect is a change to how the program operates everywhere the variable is used, which could involve

many parts of the source code and span multiple files. For this reason, changing a variable's type frequently introduces new bugs that are difficult to detect. I have often experienced such problems while writing software myself.

5. It is not possible to evaluate the effects of such a change by analyzing only the lines of source code that have been modified. Yet Pro V&V's description of its "source code review" is consistent with having done nothing more. The company could have engaged an expert in the specific programming language to analyze the quality of the changes and look for subtle side-effects throughout the code, but it appears that they did not.

6. Instead, the report states that "Pro V&V conducted functional regression testing." Regression testing has a well-defined meaning in computer science: checking that a change to a system does not break its existing functionality. After a change to a voting system like this, rigorous regression testing is essential for ensuring that the system's reliability, accuracy, and security are not degraded. Yet the testing Pro V&V describes performing is not regression testing at all. Instead, the company focused entirely on checking whether the ballot display problem was fixed and makes no mention of testing any other functionality whatsoever.

7. Even for this limited purpose, Pro V&V’s testing methodology is inadequate. They first tried to observe the error while using the current version of the BMD software, 5.5.10.30. They managed to trigger it using an artificial test ballot but failed to reproduce it using the real ballot design from Douglas County (where the problem was observed during L&A testing) even after 400 attempts.¹ They then performed the same checks using the 5.5.10.32 software. Pro V&V’s basis for concluding that the new software corrects the problem is that they were unable to trigger the error with either ballot after 400 tries. Yet this ignores the obvious possibility that the error might simply be eluding them, as it did with the Douglas County ballot under version 5.5.10.30.

8. That is the full extent of the testing described in Pro V&V’s report. They did not test that the other functionalities of the machine are not impacted by the change. They did not test that the BMD selected and printed results accurately, nor did they test that security was unaffected. Tests only answer the questions you ask. Here—regardless of what Pro V&V intended—the only questions asked were: “Is the stated error observed when using the old software?” and “Is the stated error observed when using the new software?” They did not ask, “Is Dominion correct

¹ It is curious that Pro V&V was unable to reproduce the problem experienced in Douglas County, but they appear not to have made any effort to investigate this.

about the cause of the problem?” They did not ask, “Does this change absolutely and completely fix the issue?” Most importantly, they never asked or answered the key question for determining whether the change is de minimis, “Will these modifications have any impact on the rest of the voting system’s functionality?”

9. Even if the change does correct the bug without introducing new problems, it still represents a significant security risk, because of the possibility that attackers could hijack the replacement software to spread malware to Georgia’s BMDs.

10. Defendants say they will guard against this using hash comparisons, but the hash comparison process they have described is inadequate in several ways.² As I have previously explained, examining the hash that the BMD displays on screen provides no security, because malware on the BMD could be programmed to calculate and display the expected hash. Although the State now says it will perform some acceptance testing at a central facility, such testing has limited value at best. Even if performed correctly—by securely computing the hash of the software using a device that is assuredly not affected by malware—acceptance testing can only

² The Pro V&V report lists the hash of a file named ICX.iso, which presumably contains the APK as well as other files. Without access to the ICX.iso file, I cannot confirm whether that the software purportedly being installed on the BMDs is the same as the software Pro V&V built and tested.

confirm that the new software was not modified between Pro V&V and the test facility. It does not ensure that the new software actually matches Dominion’s source code or that it will not be modified during later distribution to counties or installation on the tens of thousands of BMDs statewide.

11. The report mentions that Pro V&V performed a “trusted build” of the new software. This refers to the process by which Pro V&V compiled the source code to produce the APK file for distribution and installation throughout Georgia. The result of compiling source code, often called a software “binary,” is in a non-human readable format, and it is not possible in general to confirm that a binary faithfully matches source code from which it was purportedly compiled. As a result, if Pro V&V were to modify the BMD software to introduce malicious functionality—or if attackers who infiltrated their systems were to do so³—there

³ Notably, Pro V&V’s website (<http://www.provandv.com/>) does not support HTTPS encryption, and modern web browsers warn users that it is not secure, as shown below. In my experience, organizations that fail to support HTTPS are likely to be ignoring other security best practices too, which increases the likelihood of attackers successfully infiltrating their systems.



would be no readily available way for the State or Dominion to detect the change. The State's election security experts themselves have emphasized the risk of election manipulation by so-called "insiders."

12. Defendants state that Pro V&V has submitted the report to the EAC to seek approval for a de minimis change. The EAC's de minimis software change process was introduced less than a year ago, and, as far as I am aware, it has only been invoked on one or two occasions so far. In my opinion, the EAC cannot make an informed determination as to whether the new Dominion software meets the de minimis standard based on the information contained in Pro V&V's report, and I sincerely hope the agency demands more rigorous testing before allowing the software to be used under its certification guidelines.

I declare under penalty of the perjury laws of the State of Georgia and the United States that the foregoing is true and correct and that this declaration was executed this 3rd day of October, 2020 in Ann Arbor, Michigan.



J. ALEX HALDERMAN