

Princeton University since 1986. I am serving as an expert witness in this case.

2. I submit this certification to demonstrate the ease with which Sequoia AVC Advantage DREs can be manipulated to throw an election. Although it has been argued that hackers would not be able to obtain a voting machine on which to perform their experiments, if this was ever true it is certainly no longer. I recently obtained five AVC Advantage DREs for a price of \$82. Those DREs were being auctioned on a government on-line auction site, where no-longer-needed government property is sold to the highest bidder.
3. In early January 2007, the county of Buncombe in North Carolina advertised for sale on the Internet auction site govdeals.com several Sequoia AVC Advantage voting machines. There were 136 machines sold, in lots of 10 machines, 4 machines, and 5 machines, for a total of 18 lots. The auctions closed on January 16 and January 26, depending on the lots. I attach a printout from the govdeals.com site showing that the lots of voting machines all sold to various bidders for prices ranging from \$7 to \$140 per lot (Exhibits A and B). I also attach a printout from the govdeals.com site showing a description of the merchandise (Exhibit C). The auction

site govdeals.com is, apparently, meant for federal, state, and local governments to sell surplus equipment. Any person can qualify to bid on and purchase equipment through this site.

4. I purchased one lot of 5 machines, for a price of \$82 for the lot. In registering to bid, I did not have to present any credentials other than my name, address, e-mail, and telephone number. No other questions were asked of me by govdeals.com or by Buncombe county. The government had no information about me or my motives in obtaining the voting machines at any time before or after the auction and delivery of the voting machines to me. I paid for the machines by cashier's check. I had these machines shipped to me in Princeton by commercial carrier, where they arrived on February 2, 2007.
5. The machines arrived in operating order, complete with one "results cartridge" and two sets of keys per machine. A results cartridge is used to hold the vote totals during the election, and is removed at the end of election day to transmit the results for central tabulation.
6. On February 3, 2007 I examined the machines. The machines, originally sold to Buncombe County in 1997 for \$5200 each, appear to be almost identical to machines

used in Mercer County, New Jersey, where I vote. The only difference that I discerned is that instead of a green "x" to indicate a vote, there is a green arrow. This difference is very minor and does not, for example, mean that the internal software is different.

7. I attach a photograph I took on February 3 of my Sequoia AVC Advantage voting machine in a conference room near my office at Princeton University (Exhibit D). I used the key (sold with the machine) to open the rear door, and I used an ordinary screwdriver to remove the 10 screws that hold in place a sheet-metal panel covering the internal computer circuit board of the voting machine. Although I used a key to open the lock, the lock itself is a fairly simple one: I watched a Princeton University student pick the lock of my machine in about 7 seconds.
8. I was surprised at how simple it was for me to access the ROM memory chips containing the firmware that controls the vote-counting. Contrary to Sequoia's assertions in their promotional literature, there were no security seals protecting the ROMs. Indeed, I found that certain information in the "AVC Advantage Security Overview" (from Sequoia Voting Systems, Inc., 2004; this was attached as Exhibit B to my Certification of October

14, 2004 in this case) was untrue with respect to my machine. Sequoia's document states,

"The vote counting instructions in each voting machine are written into integrated circuit chips during the manufacturing process. These chips are incorporated into each machine's circuit boards. Access to the machine should be limited by administrative procedures and is also limited by the physical design of the machines. Design features include door locks and a numbered seal on the CPU cover."

9. I found this to be incorrect, with respect to the machines delivered to me. I did not have to remove any seals, whether of tape, plastic, or wire. The sheet-metal panel covering the computer circuit board is the only component I found that could possibly be described as a "CPU cover", and it had no numbered seal.
10. The AVC Advantage can be easily manipulated to throw an election because the chips which control the vote-counting are not soldered on to the circuit board of the DRE. This means the vote-counting firmware can be removed and replaced with fraudulent firmware. Under the sheet-metal panel (the "CPU cover"), I found the circuit

board containing computer chips, other electronic chips, and four chips that--unlike most of the chips on the circuit board which are soldered in place--are mounted in sockets so that they can be removed and replaced. These are ROM (read-only memory) chips that hold the computer program (firmware) that operates the voting logic. These chips are not held in place by any seals. They can be removed using an ordinary screwdriver and they (or other ROM chips containing other firmware) can be replaced simply by pressing them into place. I attach a photograph that I took; the ROM chips are the ones with white labels pasted onto them (Exhibit E).

11. Like the purchasers of all the other lots sold by Buncombe County, I am now at leisure to examine the contents of the firmware on the ROM chips, and to modify it. If I had the inclination to cheat in an election (which I do not) I could prepare a modified version of the firmware that subtly alters votes as the votes are cast, with no indication of the alteration made visible to the voter. I would write this modified firmware onto new ROM chips. Then, if I had access to one of New Jersey's voting machines (for example, in an elementary school or firehouse the night before an election), I could open the door of the machine, unscrew 10 screws,

replace the legitimate ROM chips with my own fraudulent ones, reinstall the cover panel with its 10 screws, and close the door of the machine.

12. The expertise required to rig these machines to throw an election does not require a Ph.D. Ordinary software engineering skills will suffice at the Bachelor's degree level, and even formal college training would not be absolutely necessary. There are many tens of thousands of people in this country alone who have the necessary skills.

13. I certify that the foregoing statements are true. I am aware that if any statements are willfully false, I will be subject to punishment.

Dated: February 7, 2006
Princeton, New Jersey

Andrew W. Appel



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Inventory ID	Description ▲	Asset Location	End Date/Time ET	Start/Current Bid
1	Lot of (10) Voting Machines <small>10</small>	Asheville, NC	1/16/07 9:45 AM	\$140.00 Bids: 17
10	Lot of (10) Voting Machines <small>10</small>	Asheville, NC	1/26/07 4:30 PM	\$32.00 Bids: 9
12	Lot of (10) Voting Machines <small>10</small>	Asheville, NC	1/26/07 4:30 PM	\$32.00 Bids: 7
15	Lot of (10) Voting Machines <small>10</small>	Asheville, NC	1/26/07 4:00 PM	\$32.00 Bids: 7
17	Lot of (10) Voting Machines <small>10</small>	Asheville, NC	1/26/07 4:35 PM	\$32.00 Bids: 7
18	Lot of (30) Voting Machines <small>10</small>	Asheville, NC	1/27/07 4:00 PM	\$102.00 Bids: 27
4	Lot of (4) Voting Machines <small>10</small>	Asheville, NC	1/16/07 9:50 PM	\$20.00 Bids: 4
5	Lot of (4) Voting Machines <small>10</small>	Asheville, NC	1/16/07 9:45 AM	\$20.00 Bids: 6
6	Lot of (4) Voting Machines <small>10</small>	Asheville, NC	1/16/07 9:50 AM	\$60.00 Bids: 6
7	Lot of (4) Voting Machines <small>10</small>	Asheville, NC	1/16/07 9:50 PM	\$7.00 Bids: 2

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Exhibit A. List of lots of voting machines sold by Buncombe County via govdeals.com in January 2007, page 1.



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Inventory ID	Description ▲	Asset Location	End Date/Time ET	Start/Current Bid
8	Lot of (5) Voting Machines <small>NEW</small>	Asheville, NC	1/16/07 9:45 AM	\$42.00 Bids: 5
9	Lot of (5) Voting Machines <small>NEW</small>	Asheville, NC	1/16/07 9:45 PM	\$12.00 Bids: 3
11	Lot of (5) Voting Machines <small>NEW</small>	Asheville, NC	1/26/07 4:35 PM	\$32.00 Bids: 10
2	Lot of (5) Voting Machines <small>NEW</small>	Asheville, NC	1/16/07 9:45 AM	\$82.00 Bids: 13
3	Lot of (5) Voting Machines <small>NEW</small>	Asheville, NC	1/16/07 9:50 AM	\$80.00 Bids: 5
16	Lot of (5) Voting Machines <small>NEW</small>	Asheville, NC	1/26/07 4:35 PM	\$32.00 Bids: 8
13	Lot of (5) Voting Machines <small>NEW</small>	Asheville, NC	1/26/07 4:00 PM	\$112.00 Bids: 22
14	Lot of (5) Voting Machines <small>NEW</small>	Asheville, NC	1/26/07 4:30 PM	\$32.00 Bids: 8

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Exhibit B. List of lots of voting machines sold by Buncombe County via govdeals.com in January 2007, page 2.



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Item: Lot of (5) Voting Machines

Starting Bid: \$1.00

Bid Increment: \$2.00

Tax Imposed: NO

Auction Ended: Tuesday, January 16, 2007 at 9:45 AM ET

Sold Amount: \$82.00

Description: This lot includes: (5) Sequoia voting machines, model AUM, wheelchair accessible, not HAVA compliant (means not audio equipped), paid \$5200.00 new for each one in 1997, maintained on a very strict schedule, framework replaced 5 years ago. Software and Battery chargers not included.

Quantity: 1 Lot

Condition: Good

Seller Name: Buncombe County, NC

Asset Location: 44 Valley Street
Asheville, NORTH CAROLINA 28801
[Map to this location](#)

Special Instructions: If you are interested or wish to schedule an inspection, please contact Shirley Jones at (828) 250-4802 or contact by email shirley.jones@buncombecounty.org. Please note all items are sold as is: We believe to the best of our knowledge that the items are in good working order, however Buncombe County makes no guarantees concerning the future operation of these items nor will be held responsible for any subsequent parts or labor that may be needed. Buncombe County reserves the right to reject any and all bids.

Inventory ID: 2

Category: Election Equipment

Auction Closed

Click on Terms and Conditions in the menu bar to get details of this sale.

Exhibit C. Description of one lot of voting machines offered for sale by Buncombe County, NC in January 2007.



Exhibit D. Sequoia AVC Advantage voting machine, purchased by Andrew W. Appel from the County of Buncombe, North Carolina.

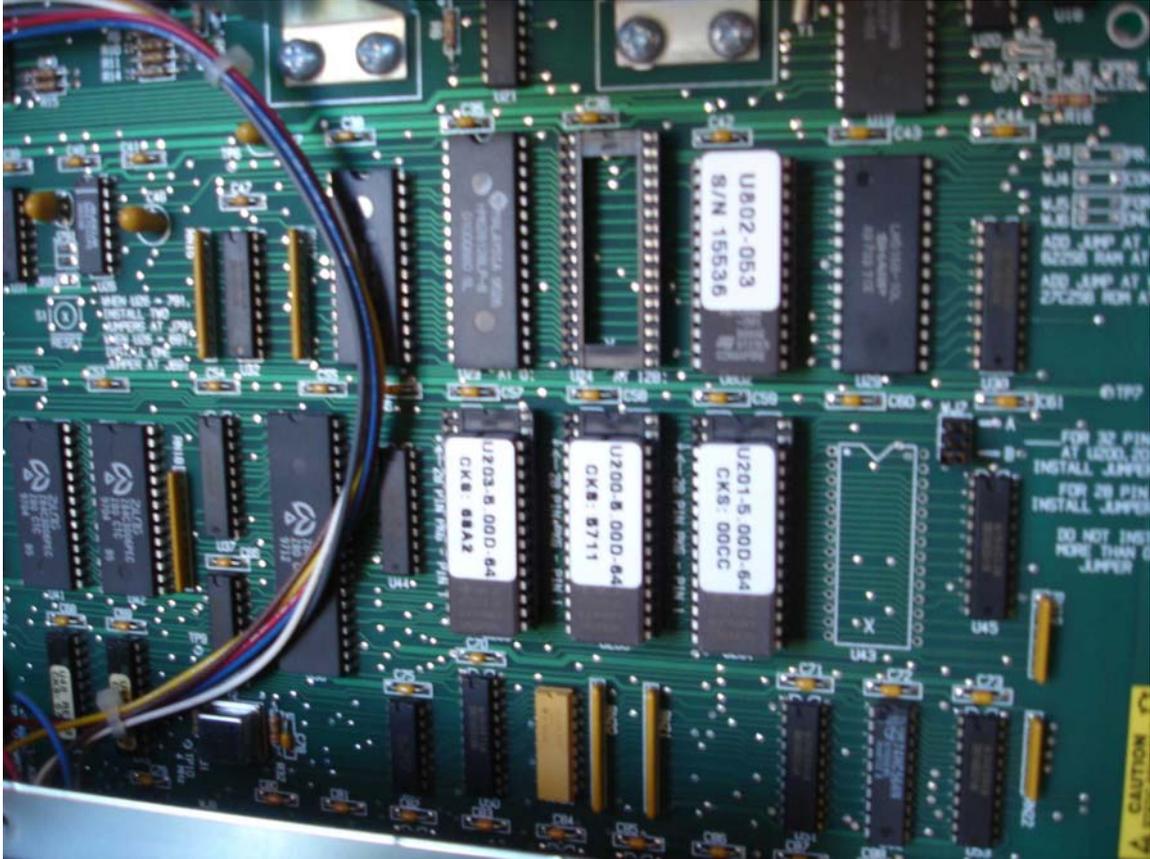


Exhibit E. Photograph of internal circuit board of AVC Advantage voting machine, showing ROM chips (with white labels) that can be removed and replaced to change the operating firmware.