AFFIDAVIT OF DR. THOMAS W. RYAN

I, Thomas W. Ryan being duly sworn, does hereby swear and affirm:

1. I hold a Ph.D in Electrical Engineering from the University of Arizona and have over 30-years experience with digital image creation, processing and interpretation.
2. I have over 16-years experience with election systems in Pima County, Arizona, a county that uses digital scanners. For approximately 9-years, I served as a member of the Pima County Election Integrity Commission, an appointment from the Pima County Board of Supervisors, including 4 years as Chair.
3. Pima County acquired a new central count election tabulation system in 2015. I participated in the creation of the Statement of Work as part of the Request for Proposal prior to the procurement of this system. The new system was purchased from Election Systems and Software (ES&S), a vendor that provides equipment and services to many jurisdictions across the U.S.
4. The new election system consisted of several DS850 central count ballot scanners, the Election Management System (EMS) Server and Client software, and the Election Reporting Manager (ERM) software, version EVS 5.2.0.0. This system is typical of election systems used in many states, including several counties in Florida.
5. The DS850 is a digital scanning ballot counter designed for use at a central count facility. The device receives a stack of paper ballots, processes them one by one, and places them in one of three output bins: counted, write-in, and uncounted (needs review or rescanning).
6. The system begins the ballot counting process by creating a digital image of the paper ballot. All subsequent processing is based on interpretation of the digital ballot by internal software. The interpretation of the image occurs very rapidly (approximately 0.2 seconds per ballot) allowing the ballots to be immediately sorted into said output bins. The image is binary (black and white) and is scanned at a spatial resolution of 200dpi.
7. In configuring the scanner for an election, there is an option to a) Save all processed images, or b) Save processed write-in images only, or c) Save None. Regardless of which option is chosen, the ballot image is captured and held in memory during the interpretation stage. The digital image is thus an absolutely necessary intermediate product of the DS850.
8. If the option to save all images has been selected, the DS850 stores each ballot image as a separate file with a unique filename.
9. Regardless of which image storage option is selected, the DS850 stores each associated interpretation (votes) as a Cast Vote Record (CVR). An image and its CVR are given the same file name but different file extensions so that it is easy to retrieve any image and its corresponding interpretation.
10. Each DS850 has a storage capacity of one terabyte. The images are stored in a compressed format so the storage capacity of each scanner is more than 20
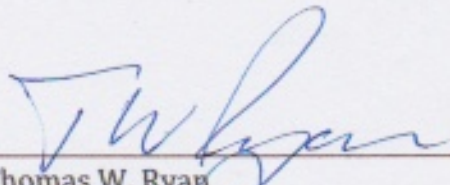
million ballot images and their CVRs. As a result, storing ballot images on the scanners during the ballot count is not a problem.

11. The DS850 provides a configuration menu with a "Ballot Images" option. This option allows the operator to determine which images, if any, are exported to the server and preserved. The user can select whether all images, only images with write-in votes, or no images are exported along with the CVRs.

12. It is possible to leave the images sitting on the DS850 and export only the CVRs. The images can be transferred to the server for retention after Election Day.

13. The votes represented by the collection of CVRs are accumulated to create vote totals for each candidate and issue represented on the ballot. The reporting software uses these tabulation figures to create election summaries that are subsequently certified by local officials during the canvass.

14. Prior to the advent of digital scanning devices, many jurisdictions used "mark-sense" scanners that detected votes directly from paper ballots. With a digital scanning system, the paper ballots are only used to create images (and to support post-election auditing in some jurisdictions).

15. The ballot images are a critical component for system diagnostics. If errors or discrepancies are discovered during post-election audits, the images are needed to determine the source of errors, be they caused by a faulty scanner, subsequent software bugs, or other external reasons. Access to the images helps to pinpoint the source of the errors.

16. Ballot images are also used by some jurisdictions to support ballot adjudication (e.g., recording of write-in votes and/or analysis of questionable ballot interpretation). These jurisdictions have used the ballot images to make tedious operations more efficient.

17. In some jurisdictions, ballot images have been declared to be public records that must be saved as long as the original paper ballots are retained. In addition, some jurisdictions release ballot images to the public on request.

18. I am of the firm opinion that ballot images created by election system scanners are critical intermediate products that must be retained just as paper ballots are retained after each election.

In Summary, deleting ballot images significantly undermines the integrity of any election system that derives all its tabulation data from those images. With today's technology and storage media, there is no good reason to delete these ballot images.

FURTHER AFFIANT SAYETH NAUGHT.

_____11/13/18_____
Date ~~11/12/2018~~ TWR

Thomas W. Ryan
9115 E Sierra St, Tucson AZ 85710

STATE OF ___AZ___
COUNTY OF ___Pima___
SUBSCRIBED AND SWORN TO BEFORE ME
THIS ___13___ DAY OF ___Nov___, 2018
BY ___Thomas W. Ryan___
_____
NOTARY PUBLIC

Luis Romero • Notary Public
Pima County, Arizona
My Comm. Expires 07-12-2022
Commission No. 549659