



# Review of Arizona Audit of the 2020 General Election in Maricopa County

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2021-10-18 Updated changes in envelope analysis

Web version: <https://copswiki.org/Common/M1980>

## I -- Introduction and Executive Summary

We now have a final report from an audit conducted by the Arizona Senate of the election held in Maricopa County, AZ, including only the Presidential and Senate contests. This is the second largest election jurisdiction in the nation, with nearly 2.1 million ballots. This document will attempt to critically review what was actually said in their report, and make recommendations which include the larger scope including the impetus for such an audit.

The presidential contest had a final margin of 0.31% state-wide, about 10K votes. So additional scrutiny was warranted of this contest in the state of Arizona. The mandated and additional optional audits conducted by Maricopa County were technically insufficient to detect a possible misstatement of the true outcome due to error or manipulation. The very close margin of victory necessitated oversight beyond what Arizona currently requires and beyond what was done by Maricopa County to audit the election. Those County audits were not strong enough to detect a malicious manipulation of specific batches and did not review voter eligibility. We are unaware of any attempt made to evaluate the eligibility accuracy of the election as part of an official audit conducted by either Maricopa County or the Arizona Secretary of State. The result of this audit did not find any massive "voter fraud" that was postulated.

The various sections of the official report can be obtained at this website:

<https://www.azsenaterepublicans.com/audit>

The contracted company, Cyber Ninjas, used innovative and often unconventional approaches. Regardless of whether their efforts were optimally designed or executed, there is a lot to learn from this extensive audit. We can learn not only about possible sources of error induced by their procedures but also inform our recommendations about how auditors should conduct audits and provide findings so as to minimize the misuse of the audit by political spin artists.

From the highest vantage point, the audit report was better than many critics thought would be the case. In a worst case it could have provided results that would add up numbers incorrectly to feed preconceived conclusions by social media activists. We must be cognizant of the fact that the audit itself was prompted by the "stop the steal" movement. One context of the audit was a stated agenda to overturn the outcome of the Presidential election. Various audit contractors hired had stated in prior social media posts that they endorsed that partisan movement.

The feature-length documentary film "The Deep Rig"<sup>1</sup> was released just as ballot counting was completed and prior to the release of the report by Cyber Ninjas. Doug Logan, Cyber Ninjas CEO appeared in an embarrassing starring role as "Anon." This film concluded by saying that the evidence was clear that the election was indeed hacked, and claimed that it involved dumps of ballots in the middle of the night in six key states, including Arizona.<sup>2</sup> The film's existence casts doubt on the credibility of Doug Logan and in turn, on the audit. However the audit report deserves an unbiased and technically proficient examination and evaluation.

During the audit, Ray Lutz and team members of Citizens Oversight, John Brakey of AUDIT USA, a group of three other election experts and others scrutinized procedures and spent many hours on site. It was our intention to ensure that the report did not cater to political pressure to provide false evidence that the election was not accurate. It seems possible that our input did provide some effective corrective feedback.

In letters to Sen. Karen Fann, Ken Bennett, and Randy Pullen, we have asserted that each official batch result should be compared to the corresponding sum of hand tally sheets and the discrepancies found and investigated. Also, we asked that the tally sheets be immediately scanned and then posted, so they could not be adjusted later without public awareness. While tally sheets were apparently scanned, they have not yet been published. The full reconciliation report, partially shown in Randy Pullen's report, has not been provided.

Hopefully, this additional information will be published so we can look more deeply into whether the tally sheets actually add up to the result published, and how the tallies of each of the

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<sup>1</sup> The Deep Rig link - free, requires sign-in: <https://deeprig.americaproject.com/>

<sup>2</sup> Citizens Oversight sent Sen. Karan Fann a letter and detailed review of the false claims in this film. See [https://docs.google.com/document/d/1em6kChUq3m\\_zbXwwKdJHL4l5beUS7rh6Z626z0Scz2M/edit?usp=sharing](https://docs.google.com/document/d/1em6kChUq3m_zbXwwKdJHL4l5beUS7rh6Z626z0Scz2M/edit?usp=sharing)

approximately 10,000 batches compare to corresponding results tabulated by Dominion. Their report only compared the count of ballot sheets among their own counting methods, and never did they compare with the voting system, even in the report by Randy Pullen.

This sophomoric approach is mathematically and procedurally unsophisticated. The Cyber Ninjas attempted to hand tally the entire county of Maricopa without any subtotalling or "divide and conquer" strategies. As a result, their total cannot be trusted because it is not supported by an evidence trail. As far as we know, it could be complete fiction.

It is important to understand that Maricopa County is extremely large, with (as of 2019) nearly 4.5 million people, 2.65 million active registered voters, and about 200K registered but inactive voters. By population, Maricopa is larger than 25 other states, and has more voters than 23 other states. It is the second largest election jurisdiction in the country. So the idea that the entire county should be processed as one lump sum, without ever comparing with any smaller divisions is nonsensical. By comparison, the state of Iowa has about the same number of voters, but they have 99 counties, and each county is responsible for their own subtotals.

For error control, Cyber Ninjas could have easily subtotalled and compared the totals of each batch, box, and/or pallet, to the totals from the official report. By doing so, they could have employed sampling techniques to statistically rule out a change of 10K votes without processing every last ballot. Those subtotals would allow them to control human error and provide evidence as to how their totals were achieved, thereby avoiding the accusation that they are making up their results. We have only one pallet with totals of the ballot sheets in each box, and the numbers are devastating.

## Findings

### 1. **Hand Counts of Ballot Sheets off by more than 30%**

The Cyber Ninjas report did not comment specifically on lack of precision in the hand count. Randy Pullen's report<sup>3</sup> (which we found was perhaps the most credible portion of the report) provided data on the counts of ballot sheets included on Pallet 15, from:

- a. the Cyber Ninja Hand Count (included the count of sheets and votes),
- b. the Bantam-1 counting machine counts,
- c. the chain of custody reports, and
- d. the paper eval counts

We have added an additional data source - the official cast vote record (CVR) from the Dominion voting system that they did not use in their work at all. This has exposed a critical apparent failure of the hand count.

The comparison here is regarding the counts only of ballot sheets, not the votes on those ballots. Remember that audit procedures need to be much more accurate than 0.31% to provide a check on the official result. The number of ballot sheets included in

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<sup>3</sup> <https://www.azsenaterepublicans.com/pullen-report>

the audit must be very precise and accurate, particularly if you process the entire district as one lump sum.

Starting with the numbers Pullen provided in his report, we added and compared with the number of ballot sheets from official CVR results from Maricopa County officials, (from the Dominion Voting System). The batch totals from the voting system were linked to the totals from the Pullen Report and the physical boxes and pallets by adding indexes to each one of the batches to match up the values used to designate a box and the batches within it, and then which pallet it was one. This was done by using the list of batches in each box in the "Ballot Custody Transfer Manifest (Pallot Manifests)"<sup>4</sup> and the "Daily Ballot Summary" log sheets<sup>5</sup> which recorded the Batch Number with the Dominion batch number, and included the total ballots scanned. Using these sources allowed us to link the batch numbers used by the Cyber Ninjas auditors to the batch numbers used by Dominion. This process was seemingly never done by Cyber Ninjas so they could do the same comparison.

In all cases reviewed, the number of ballots scanned on the hand-written Daily Ballot Summary sheets (which were created when the ballots were scanned) matched the number of ballots in the Dominion CVR. We compared our result to that provided by "The Audit Guys" as well, and we agreed with their ballot totals from the CVR. The following table summarizes the comparison.

| Count Source                     | Pallet 15 | Diff CVR | % Diff CVR |
|----------------------------------|-----------|----------|------------|
| Official CVR -- Voting System    | 48371     | 0        | 0%         |
| Bantam-I Paper Counting Machines | 48366     | -5       | -0.01%     |
| Chain of Custody                 | 46234     | -2137    | -4.42%     |
| Paper Eval                       | 48668     | +297     | +0.61%     |
| Hand Tally                       | 32674     | -15697   | -32.45%    |

These are the numbers from the Cyber Ninjas' own report, showing that on this pallet, compared to the machine count and CVR count, there was a **loss of 15,697 ballots in the hand count**, whereas all the other counts were very close (<1% difference) or somewhat close (<5% difference) with the official counts. The 32.45% loss of ballots in the hand count is hard to imagine, and the fact that the Cyber Ninjas report did not explain this is astounding.

To further investigate this, we and the public must get the scans of the original hand-tally sheets as marked by the tally teams. This is the "root evidence" derived by the audit, and

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<sup>4</sup> <https://copswiki.org/w/pub/Common/M1980/PalletManifests.zip>

<sup>5</sup> <https://copswiki.org/w/pub/Common/M1980/Daily-Batches-Summary-Sheets-Blue-Sheets.zip>

we trust nothing after that. In our experience, the tally process of the ballots is difficult to "hack" by unscrupulous actors and generally the workers are producing reliable results. These tally sheets become extremely valuable after the audit is complete because each one summarizes the vote on 100 ballots.

2. **No Fraud Discovered**

The audit did not report evidence of deliberate fraud or election violation sufficient to alter the outcome of the audited Presidential or Senatorial contests. The audit report included disclosure of numerous mistakes that are unlikely to have altered the outcome of those two contests but might be significant with respect to other narrow margins in the election. The suspicions that thousands of ballots were maliciously added to be tabulated in the early morning hours on election night was not supported by any provided evidence. .

3. **Reported Issues are minimal, likely improving stated winner's margins**

If we estimate the impact of all of the concerns, something meaningful only if they were justified, based on the partisan voter registration split but with an adjustment for the likely high false-positive rates, the D candidates could lose about 644 votes and the R candidates could lose about 1230 votes. Again, we believe most of the stated discrepancies that might add to these numbers are false positives in the auditors' attempt to find some issues with the election using lenient matching algorithms. **Yet on the whole, we estimated that the reported Presidential winner would gain approximately 587 votes if all these issues affected the election results.** The most that the R candidates can benefit is 827 votes if all that benefited the R candidates required correction of results and no corrections benefitted D candidates.

4. **No Overall Statement by Auditors**

Unfortunately, the audit report did not make an overall statement regarding whether any evidence was found to alter the final outcome. By leaving this clear statement out, it allowed false information to be more easily promulgated about the outcome of the audit.

5. **Many Issues Due to Confusion can be Easily Cleared Up**

Many of the concerns expressed were apparently due to confusion by the auditors as to the meaning of the numbers they were comparing. These could have been cleared up by communicating with the County. We understand that Maricopa County was deliberately uncooperative throughout the audit but did respond with opposition on the website <https://JustTheFacts.vote>. When issues remained in subsequent reports, these corrections were seemingly ignored. Better communication in our government institutions must be improved.

6. **Extremely Liberal Matching Used will Find False Positives**

Algorithms used to discover possible duplicate voters used only the first and last name and age in years, rather than the full demographic data available to the County. This inevitably resulted in unnecessary false positive matches that represent in reality

separate individuals rather than duplicates. Prior research suggests that the difference in matching accuracy between use of only first and last name and full date of birth compared to matching with additional demographic indicators can result in as much as 200 times more matches than are accurate. The report does not address the need to discount the number of speculative matches for lack of adequate demographic information. Our estimate is that the number of real duplicate voters could be as low as 16 or even lower.

**7. Database Matching Produced Unreliable Results But Would Have Increased The Margins Of Victory**

Research into dead and unregistered voters produced very low numbers, and the likely impact of these potentially ineligible voters suggests that eliminating those votes would have further increased the margin of victory. But also, the auditors used matching to a commercial database and did not disclose the matching algorithms, and the commercial database had a huge number of missing database entries (86,000).

**8. Studies Of Signature, Paper, Registration, Bleed Through, Etc. Not Productive**

The audit spent a great deal of time and effort on a variety of other studies of the signatures (Dr. Shiva Ayyadurai) paper, registration, bleed through, etc. and these did not produce any demonstrable results that showed any possibility of changed outcome, and did not find any evidence of ballots added during the early morning hours, as was theorized by The Deep Rig movie and other conspiracy theorists.

**9. Network And Voting Systems Produced No Relevant Data**

Although the review of the voting system produced some interesting results that should be looked into from a compliance standpoint, this information cannot alter the outcome of the hand-count tabulation because the original paper ballots were reviewed. The face-off between the Senate and the County government officials is a wild goose chase.

## Recommendations

**1. Immediately Release Audit Information:**

Scans of the original tally sheets and the digital spreadsheet which reconciles the tallied batches to the official Cast Vote Record from the county on a batch-by-batch basis, and all other information which has been collected and is not considered sensitive.

**2. Improve Mandatory Audits:**

Perhaps our most important recommendation is to improve the audits conducted by the counties in Arizona, both in terms of quality and transparency, so the public pressure and realistic need for additional audits will be reduced, including under conditions of narrow victory margins. This election had a very tight statewide margin of victory of approximately 10K votes, and 0.31%. Although there may be disagreement among election experts, we recommend that ballot image audits be combined with batch comparison audits similar to what is being used now.

3. **Formalize Audit Procedures To Improve Transparency And Public Oversight:**

We would be remiss if we did not point out a serious flaw in the hand count audits conducted post-election by Maricopa County. The hand count audit as currently conducted by the county is essentially meaningless. The 26 so-called random batches that are picked by political party observers post-election are being picked from 52 pre-selected batches (out of a total of 10,341 batches) that were selected during the high-speed scanner count and before the publication of any election results. The batches to be audited were known in advance, leaving the remaining 10,289 batches open to possible manipulation without detection<sup>6</sup>.

The ballots counted on the high-speed scanners represent 92% of the about 2.1 million ballots cast in Maricopa County in the 2020 election so it is important that the hand count audit be done correctly. The remaining 8% of the ballots are cast in precincts on Election Day. A separate hand count audit is done for the precinct ballots, and we understand that the audit is done correctly with a truly random draw after the election results have been published.

Procedures should be improved as follows:

- a. No hand count audit batches should be selected until after the election and after election results have been published.
- b. Make the ballot images and cast-vote records (CVR) public at no cost
- c. Perform a ballot image audit to more completely interpret voter intent issues.
- d. Include more batches in the hand count. The number batches tallied by the county (26) was far too few considering the tight overall state margin of victory (0.31%)
- e. Freeze and publish the complete (or nearly complete) cast vote record CVR data, including all batches, detailed to the batch.
- f. Conduct a random draw of batches using 10-sided dice, and live stream this meeting so the public can witness it.
- g. Hand tally the sampled batches, and enter the vote totals of each batch into a spreadsheet, showing the process in a livestream adequate to read the data. Compare the vote count of each batch with the official voting system result.
- h. If discrepancies exceed a preset, publicly announced threshold, then conduct a full hand count audit, statewide. (Such a full hand count audit would be similar to what was done in the AZ Senate authorized audit, except that each batch tally - obtained in blind conditions unaware of the target totals - must then be compared with the voting system report to detect any systematic errors in the audit process before they become conflated with detected errors resulting from the system subject to audit.)

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<sup>6</sup> A batch comparison audit with 5% risk limit, assuming 40% vote change limit per batch, would require no more than 44 batches to confirm the election based on the 2.2% Presidential margin in Maricopa County alone, and 193 random batches to confirm the 0.31% statewide margin. This is based on our own Monte Carlo models of batch comparison audits which we will publish soon.

- i. Allow members of the public to observe, even those not affiliated with a party or from another state.
4. **Continue To Use Batch Comparison Audits**

Batch comparison audits can be effective and are relatively easy to conduct. They avoid any interference with the integrity of batches. Other types of "risk limiting" audits sample individual ballots are more complex to conduct and are more difficult to provide full oversight by the public. Batch comparison audits are conducted in a manner similar to a full hand recount, which are already well understood by election officials. If needed, they are easy to extend to become a full hand count audit. For these reasons, we believe these are the best target for rigorous paper ballot audits.
5. **Use Ballot Image Audits**

Regardless of whether any other audits are performed, a ballot image audit is an important check on the consistency of the results and to address voter intent and public trust issues. Ballot image reviews can operate on a broader scope and address additional tabulation weaknesses that deserve correction before an outcome is affected. When used in conjunction with audits of paper ballots, such as in a batch comparison audit, this can help to catch correctable errors including those that do not affect outcome.
6. **Improve Ballot Storage**

Dominion actually does a very good job of documenting effectively organized collections of ballots and identifying the batches in digital records, but improvements in procedures are needed so each batch can be individually accessed, tallied, and compared with the official result. Further, it will be helpful to imprint identifying numbers on ballots as they are scanned so this designator will appear in the ballot image, so they can be linked together, while still respecting the anonymity of the ballot.
7. **Ballot Images And Cast Vote Records Should Be Public Records, Freely Available To The Public**

Ballot images and cast vote records should be recognized as public records accessible freely by the public, preferably posted by each county on their website or other electronic posting service. Dominion is introducing a ballot image viewer to allow any member of the public to view any batch, precinct, contest, or all the ballot images. San Francisco is a good model as they use the same generation of voting system from Dominion. San Francisco is further a good model as they post all ballot images on the elections website.
8. **Mandate Improved Double Voter Matching**

Efforts to discover duplicate voters must use all available information, such as full name, full date of birth, SSN, state ID number (eg. drivers license), etc. Individuals and for example political parties intending to verify election eligibility from public records will have difficulty obtaining adequate demographic data to perform effective searches. When using only name and birth year, many false positives will result. When inadequate information is available for identity matching, reports should mention that a factor to

discount for false-positives must be applied.

We support improving the voter registration lists to require collection of the full legal name of the applicant for registration. Privacy protective investigation by county or state employees should be used to discover and resolve any duplications in the registration list. Arizona is already a member of ERIC, the Electronic Registration Information Center, which provides an important service to identify voters who have moved both into and out of an election district.

9. **Improve Audit Issue Reporting**

All audits performed under any auspices should report with each issue the anticipated impact on envelope and or ballot sheet counts. If applicable and practicable given ballot anonymity, vote count changes for all narrow margin contests should be estimated. A statement as to whether changes will affect the outcome should be made. Doing so does not mean that we lose interest in cleaning up quality issues, but this more complete information will reduce the ability of social media and partisan operatives to use the raw number of ballots to imply that the outcome could be impacted, when in fact the evidence does not support that.

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## II. Review of the Report

We now detail any concerns regarding the Cyber Ninjas' report. Here, we look primarily at what was reported.

### IIA. Volume II: Operations and Methodology

#### Audit Operations

This section of the document contains the auditors' description of how they conducted the audit. It includes the "Facility Inspection and Setup," "Information Security (Technology and Data Storage)," "Human Resource Acquisition," "Orientation and Training," "Audit Methodology", "Voting Machines" and "Certified Results". The lion's share of the content is in the "Audit Methodology" section, which includes "Voter History", "Paper Ballots" (including Ballot Storage and Chain of Custody, Vote Tallying, Aggregation, Quality Control, Paper Examination), "Transparency and Accountability" (including Cameras and Live Streaming, Observers)"

We were able to visit the physical site where the Cyber Ninjas' audit was conducted and evaluate the effectiveness and pace of the tallying method, which utilized spinning "lazy susan" tables that would require that the talliers look up at a ballot that was spinning by, then look down at their tally sheet, refocus, and tally two contests. We believe this is less effective and likely induces additional errors at a slower pace than the traditional "read and tally" approach where the teams and talliers work together to reduce human error.

Although they did provide 7/24 video feeds of their work, the cameras were not close enough for observers to evaluate if the data was being collected faithfully. Our key objection to this approach was the lack of observability of data entry from the tally sheets into the master spreadsheet. They apparently did not error correct by comparing the hand tally results with the computer report as they proceeded. This approach would detect and correct human errors. It was almost at the end of tallying before anyone gathered data from the scanner log sheets and correlated batch sheet numbers to the batch numbers on the boxes. Likely as a result, they eventually disclosed massive differences in the counts of sheets between the hand tally results and all other counting methods.

It appears that they never did check their results until the end and then found that the numbers did not match in terms of number of ballot sheets (the physical ballot cards). Then, it appears they had to recount the ballot sheets to get some control of what was done. In other words, their second count was to determine the total number of ballot cards without looking at the votes at all. Clearly, this would not have been necessary if they had had confidence in their hand count tallies. This underlines the failure of their methodology to be precise. The lack of attempt to correlate the batch level official computer results until they had already completed their tallying process and returned the ballots is regrettable.

To date, they have not disclosed the hand written tally sheets nor the digital master spreadsheet. We cannot think of any reason to avoid presenting the tally sheets and master digital spreadsheet to the public unless they know that the tally sheets contain substantial errors that they do not want to be known. The longer they wait to present them, the less confidence anyone can have that what is presented are the original tally sheets.

The hand examination of paper and the use of high resolution imaging was, as of this writing, unproductive. Equivalent information could have been obtained by using high resolution scanners that have automatic sheet feeders, to accomplish the scanning in a fraction of the time.

## Result Details

Although issues identified in the Cyber Ninja report were prioritized in order according to the "ballots impacted", we will group them by the category of the issue and whether it may affect the outcome.

### **IIB Ballot Scoring Methodology**

The method they use to score the severity of a specific issue does not take into account whether the affected ballots might affect the outcome.

If the authors can estimate the likely margin of the votes on the affected ballots, then that should be included in the scoring methodology. In our analysis, we estimated the likely impact in each case by using the ratio of partisan voter registration as a guide.

When an audit report makes claims, those claims may be "spun" by one side or the other beyond their true implications. Statements should be further explained, and the potential impact to the outcome anticipated, with the following points always included:

1. The issue.
2. How many raw envelopes/ballots it may affect.
3. Explain what the finding means. Can it be understood as part of a proper practice?
4. If the election office or other critics have an adverse or corrective opinion about the issue, present that point of view.
5. Could this finding impact the margin of victory? If so, of what contests?
6. Could this finding impact the final outcome of the contests under scrutiny? Report if applicable the reasons why only certain contests are under scrutiny.

## III. Tally Results

The hand tally performed by the Cyber Ninjas featured unusual procedures, including rotating lazy-susan tables, ballots on easels, three independent talliers per table, and brightly colored t-shirts that identified positions by type, including orange t-shirts for observers, pink t-shirts for representatives of the Secretary of State, and other colors including green, blue, red, and yellow t-shirts to identify the functions or locations of workers in different counting zones in the building.

Tallies were entered onto tally sheets in subsets of 5 ballot sheets. But they did not provide any evidence as to the quality of the hand count, and provided no comparison with the official batch totals. We found evidence that their hand count numbers were wildly inaccurate, when using their own reports, described below.

Although not provided in the executive summary of their report, the most important parts of the audit are the final numbers. Lacking the necessary underlying supportive documentation, this new aggregate set of results leaves the public without further confidence in the result. We are asked to "Trust" the auditors, yet again.

We must note that: **The aggregate audit totals did not appreciably differ from the official counts.** But with that said, we have reservations concerning the accuracy of the hand count.

It is interesting to note the somewhat embarrassing reality that the audit did not have the same number of ballots between the two contests being reviewed, the Presidential contest and the Senate contest, losing about 263 ballots in the Senate contest. This does not inspire a great deal of confidence in the hand count, because those ballots were counted at the same time and should have been exactly the same number. It does however speak to the beneficial transparency of the reported result that exposes an internally recorded discrepancy.

| <b>Presidential Contest</b>                       |                |                  |                  |                                |                  |
|---------------------------------------------------|----------------|------------------|------------------|--------------------------------|------------------|
|                                                   | <b>Trump</b>   | <b>Biden</b>     | <b>Jorgenson</b> | <b>Write In / Over / Under</b> | <b>Total</b>     |
| <b>Audit</b>                                      | <b>995,404</b> | <b>1,040,873</b> | <b>31,501</b>    | <b>20,791</b>                  | <b>2,088,569</b> |
| <b>County Canvass</b>                             | 995,665        | 1,040,774        | 31,705           | 21,419                         | 2,089,563        |
| <b>Audit - Canvass</b>                            | (261)          | 99               | (204)            | (628)                          | (994)            |
| <b>Senate Contest</b>                             |                |                  |                  |                                |                  |
|                                                   | <b>McSally</b> | <b>Kelly</b>     |                  | <b>Write In / Over / Under</b> | <b>Total</b>     |
| <b>Audit</b>                                      | <b>983,662</b> | <b>1,064,336</b> |                  | <b>40,398</b>                  | <b>2,088,306</b> |
| <b>County Canvass</b>                             |                | 1,064,396        |                  | 40964                          | 2,089,563        |
| <b>Audit - Canvass</b>                            | (541)          | (60)             |                  | (566)                          | (1,167)          |
| <b>Machine Paper Ballot Count (Pullen Report)</b> |                |                  |                  |                                | 2,089,442        |
| <b>Machine Ballot Count - Canvass</b>             |                |                  |                  |                                | (121)            |

## What We Expected and Did Not Find

This audit was touted as a "forensic" audit, apparently meaning it is in-depth and considers all evidence including physically collected evidence. Merriam-Webster defines "Forensic" as relating to or dealing with the application of scientific knowledge to legal problems.

We expected that the audit would compare, batch to batch, for all 10,341 batches, the vote totals for each of the contest options being audited. The Dominion Voting System designates each ballot processed with a tabulator number, batch number and offset in the batch. Vote counts per candidate for each batch can be easily subtotaled directly from the cast-vote record (CVR) file, and then compared to a hand tally. The audit did not provide any result of such a comparison to the public.

For example, we have a spreadsheet of all the totals of all batches which was derived from the CVR file, and their corresponding pallet and box. The following snippet shows two boxes, each containing 7 batches of about 200 ballots each. It provides the vote counts for each candidate and each batch. These totals should be comparable to the totals from the hand tally. But neither the hand tally sheets nor master spreadsheet were provided and therefore we cannot perform the comparison.

|             |            |         |          |        |                | President |       |         |    | Trump |       | Biden | Jorg. | Senate |       |         |    | McSally | Kelly |       |
|-------------|------------|---------|----------|--------|----------------|-----------|-------|---------|----|-------|-------|-------|-------|--------|-------|---------|----|---------|-------|-------|
| batchid     | Blue Sheet | scanner | EV batch | Pallet | Box #          | ballots   | votes | writens | ov | uv    | votes | votes | votes | votes  | votes | writens | ov | uv      | votes | votes |
| 03001_00001 | 102020 p3  | H1      | 265      | 27     | EVH1/10-20/265 | 199       | 195   | 0       | 2  | 2     | 79    | 114   | 2     | 197    | 0     | 0       | 2  | 82      | 115   |       |
| 03001_00002 | 102020 p3  | H1      | 237      | 27     | EVH1/10-20/265 | 200       | 200   | 0       | 0  | 0     | 64    | 135   | 1     | 198    | 0     | 0       | 2  | 61      | 137   |       |
| 03001_00003 | 102020 p3  | H1      | 305      | 27     | EVH1/10-20/265 | 200       | 197   | 0       | 1  | 2     | 83    | 110   | 4     | 200    | 0     | 0       | 0  | 80      | 120   |       |
| 03001_00004 | 102020 p3  | H1      | 244      | 27     | EVH1/10-20/265 | 200       | 198   | 0       | 2  | 0     | 82    | 115   | 1     | 197    | 0     | 0       | 3  | 80      | 117   |       |
| 03001_00005 | 102020 p3  | H1      | 243      | 27     | EVH1/10-20/265 | 199       | 199   | 1       | 0  | 0     | 87    | 110   | 1     | 198    | 0     | 0       | 1  | 85      | 113   |       |
| 03001_00006 | 102020 p3  | H1      | 333      | 27     | EVH1/10-20/265 | 199       | 198   | 0       | 1  | 0     | 78    | 120   | 0     | 197    | 0     | 0       | 2  | 79      | 118   |       |
| 03001_00007 | 102020 p3  | H1      | 292      | 27     | EVH1/10-20/265 | 199       | 196   | 0       | 2  | 1     | 84    | 112   | 0     | 197    | 0     | 0       | 2  | 83      | 114   |       |
| 03001_00008 | 102020 p3  | H1      | 219      | 27     | EVH1/10-20/219 | 200       | 200   | 0       | 0  | 0     | 11    | 189   | 0     | 200    | 0     | 0       | 0  | 11      | 189   |       |
| 03001_00009 | 102020 p3  | H1      | 309      | 27     | EVH1/10-20/219 | 200       | 199   | 0       | 0  | 1     | 84    | 112   | 3     | 197    | 2     | 0       | 3  | 81      | 114   |       |
| 03001_00010 | 102020 p3  | H1      | 236      | 27     | EVH1/10-20/219 | 199       | 196   | 1       | 1  | 2     | 62    | 127   | 6     | 199    | 1     | 0       | 0  | 66      | 132   |       |
| 03001_00011 | 102020 p3  | H1      | 279      | 27     | EVH1/10-20/219 | 200       | 199   | 2       | 0  | 1     | 49    | 147   | 1     | 196    | 0     | 0       | 4  | 49      | 147   |       |
| 03001_00012 | 102020 p3  | H1      | 245      | 27     | EVH1/10-20/219 | 200       | 200   | 0       | 0  | 0     | 59    | 139   | 2     | 198    | 0     | 0       | 2  | 58      | 140   |       |
| 03001_00013 | 102020 p3  | H1      | 288      | 27     | EVH1/10-20/219 | 198       | 195   | 1       | 1  | 2     | 69    | 121   | 4     | 196    | 1     | 0       | 2  | 65      | 130   |       |
| 03001_00014 | 102020 p3  | H1      | 210      | 27     | EVH1/10-20/219 | 199       | 199   | 0       | 0  | 0     | 49    | 150   | 0     | 198    | 0     | 0       | 1  | 48      | 150   |       |

### **The tally sheets and the reconciliation spreadsheet should be published immediately.**

The report of the hand count provides very little detail. But assuming the aggregate sum of the hand count is as stated, we learn of no evidence that the voting machines nor the election management system was hacked. The report does not establish any indication of electronic intrusion or electronic hacking to modify the tabulation, but even if such an intrusion were documented, it is doubtful that such an intrusion would alter the paper ballots. This is an expected benefit of a substantive hand count of paper ballots. Even if concerns remain from an election quality and procedural compliance standpoint, including the complex topic of eligibility, these issues can't change the outcome of the tabulation itself as documented by the paper ballot record.

## No Ballot Image Audit Performed

Although the inspection of ballot images was part of the statement of work in the Cyber Ninjas contract and Shiva Ayyadurai of EchoMail was contracted (and we believe paid) to perform a ballot image audit, no such audit was described in the report.

Citizens Oversight has developed a ballot image auditing service called "AuditEngine"<sup>7</sup> which we proposed could be used to perform a ballot image audit for Maricopa County. AuditEngine is a cloud-based solution and can utilize up to 10,000 computers in parallel to perform image processing and recognize the vote using both mark detection and neural-network based optical character recognition (OCR). A case study of three counties in Florida included Dominion Voting System and Election Systems & Software (ES&S) ballots and data files<sup>8</sup>. The results agreed with the voting system to within 0.23%. In those cases when AuditEngine disagreed with the voting system regarding voter intent, AuditEngine correctly interpreted voter intent in 93% of those cases reviewed while the voting system correctly interpreted only 7% of those cases.

The Cyber Ninjas report included **Issue 6.5.1 Missing Ballot Images** where they claimed that 40% of the images were damaged. This is very unusual for damage of this nature to be this extensive. We have seen some images that are unreadable in other audits, but it is typically only a very small number. In this case, it could have been due to poor handling of the files by Cyber Ninjas or that the data files were not successfully reconstituted. While we can speculate on possible but unlikely reasons why images might not have been found to be readable, it is the role of the auditor to explain any obstacles to an effective audit. The report has failed in this respect.

However, even if the image files were damaged as they claim, usually they can be counted and the counts compared with the cast vote record counts to see if they were consistent in that regard. This was not done.

Also, the images that are readable could still be processed and compared with the results of the voting system, and then reported. This was not done either.

We believe the images should be made public. We agree with this recommendation by the auditors. This is probably their most important recommendation, in our view. We are still interested in conducting such an audit of this election because there are still many unanswered questions.

- **5.7.2 Batch Discrepancies.** They say that a comparison of the hand count totals to the CVR totals has revealed numerous discrepancies. They say they are "in the process of comparing the Dominion Images of Ballots to determine the cause of the discrepancy." Of course, their own hand totals could be in error here.

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<sup>7</sup> See <https://auditengine.org>

<sup>8</sup> See <https://auditengine.org/audit-results/case-study/>

- **5.6.12 Double Scanned and Counted Ballots.** They identified one batch of 50 ballots that may have been double scanned. This may be a legitimate concern. We looked at the data and we believe that perhaps one entry was for 197 and it was incorrectly entered as 147.

However, if the batches have ballots that are randomly distributed, double-counting a batch will not change the outcome, because the margin of the batch scanned again will still have the same margin as those originally scanned. Thus, the impact of this in the margin of victory is negligible. It appears there are far greater problems in the number of ballots counted, and this was added as a token to cover a far larger issue that was actually not addressed.

## **Hand Count Of Ballot Sheets Off By 15,697 Ballots**

As detailed in the summary of findings, the count of ballot sheets on pallet 15 differed between the hand tally count and all other counting methods, off by 15,697 ballots. This was detailed by Randy Pullen. He said subsequently that the hand tally was corrected, but that was not disclosed in his report. The impact of the Pullen report on the credibility of the CyberNinjas vote counts is not discussed in the report but deserves to be. One cannot place any credibility in the vote counts reported by CyberNinjas while batch sheet counts show no entries for 77 batches of pallet 15, the only pallet which was reported.

To fully investigate the accuracy of the hand tally, it will be necessary to review scans of the actual hand-tally sheets used by the talliers, and the reconciliation spreadsheet mentioned by Pullen in his report, but not made available. Continued withholding of data generated by the audit has no viable rationale. All data collected by the auditors, most particularly the hand tally sheets and reconciliation report have no privacy concerns and must be made public immediately. It has been our stated position that the hand tally sheet should be made public as they are produced, and we continue to assert that position. Why not also make all the scans produced public as well?

## **IV. Voter Eligibility**

The question of voter eligibility considers whether the ballots that were counted were from actual persons who had the right to vote and were properly registered and actually voted in a legal manner. In many of the issues listed, the auditors used comparisons using a "best of class" commercial database called "Impersonator" from Melissa to track voters. This requires that records from the voter database be matched and linked to the Melissa database. The exact methodology of comparison was not fully revealed. But as we will discuss, the auditors sometimes used very lenient comparison algorithms which compare only the name and birth year, but not other identifying information such as driver's license, SSN, and the like. Also, the audit report discloses in issue 5.7.9 that 86,391 voters are not in the Melissa database at all. The commercial database cannot be expected to be as comprehensive as the County database and therefore it does not deserve credibility as an authoritative source for eligibility.

The following issues are with respect to voter eligibility.

### **5.3.1 Mail-In Ballots Voted From A Prior Address**

The presumption here is that mail-in ballots were inappropriately voted by persons that now no longer live at an address where they were registered and to which their ballots were sent. Auditors rely on the Melissa database for information as to the current address of these individuals who moved and do not have a secondary address listed in the voter registration database. In this issue, 23,344 voters were identified as having voted using ballots sent to a "prior address."

We wonder how good the Melissa database is, and how many of the 23,344 voters were simply not in the Melissa database, as it does not list 86,391 voters at all.

It would take further investigation to understand the details surrounding each one of these cases, assuming these are more than database mismatches. For example, these could be very recent moves. Maybe the voter picked up their ballot at their prior address even though they now may have a new address. Some of these people may be "in transition", living from a car, traveling in an RV, sleeping on a couch or living in temporary arrangements and do not have a new address, but have an arrangement with the prior address to allow them to pick up their ballot, or they could be students who have a new school address but still have their ballots sent to their parents' home, which is perfectly legal.

We note that for the two contests subject to audit, the voters who moved within Maricopa County (15,032) still should be considered valid voters for this election. These 15,032 voters (if the auditors' numbers are correct and we don't know that they are) may have voted down-ballot contests that were not appropriate for their new address. But the Presidential and Senate contests ARE valid for everyone in the state. So in terms of these ballots, (and the focus of the audit) they are not improperly voted. Also, those voters may still have an interest in the areas they recently resided in, and if they did not use the proper ballot, they may not have had the opportunity to vote on some issues that were now valid at their new address. Nevertheless, these down-ballot contests were explicitly not part of this audit.

Similarly, the 1,718 voters who moved out of the county but not out of Arizona, also had the right to vote on both the contests in question had they correctly re-registered at their new address.

The number of voters who moved out of the state prior to the registration deadline, according to the auditors' unconfirmed data, and yet still voted by mail, was 6,591. Assuming these were all improperly voted, then we can apply the ratio of D and R voters to determine the likely vote count that would affect the outcome. Auditors stated that 39.5% were from the Democratic Party, and 33.0% from the Republican party. The fraction of the D party that could affect the result are those in excess of the R party. In other analyses we have performed in the past, we have found that the non-partisan voters break with approximately the same ratio as the primary party ratio, and it is rare that party-affiliated voters do not vote with their party. We can estimate

that the true impact, if all these ballots were incorrectly voted, is in the vicinity of 600 votes, reducing the margin of victory by the reported candidates by that amount.

We agree that voter rolls should be kept up to date, but it may be difficult to avoid these edge cases. Even if the auditors' numbers are correct, and we must reiterate that using a commercial database and loose comparison criteria almost assuredly means that their numbers are not correct, the cases they identify do not appear to be maliciously voted ballots, and an argument can be made that all these voters should still be allowed to vote, as long as they do not vote anywhere else. Just because you are moving should not mean that you can't vote.

#### **5.4.2 Voters That Potentially Voted In Multiple Counties**

Auditors attempted to find potential duplicate voters in other counties in AZ. It compared the first, middle, last names and birth year of the voter, and said that 5,395 ballots are likely inappropriate. This is a particularly weak filter, designed to find false positives. Why not compare all the identifying data about each voter, the full date of birth (DOB) and also the driver's license number or SSN? They also compared among ALL the counties, and found all the apparent duplicates. Not all of these exist in Maricopa, which is the subject of this audit.

Assuming that the duplicate ballots are all illegitimate, and assuming that they are spread evenly among the 15 counties in Arizona based on their registered voter populations, then about 60% of the issue would affect Maricopa. That is  $5,295 * 60\% =$  (about) 3,177 ballots. If that number of voters did vote twice -- and again, there is no reason to believe they did based on the poor comparison criteria used -- dividing the number of supposed two-time voters between expected partisan results would further lower the impact to an insignificant number.

But that is hardly the most important issue here.

Voter matching approaches of this type have been found to be inaccurate. The lack of credibility of voter identity matching is thoroughly reviewed in this peer-reviewed research, "One Person, One Vote: Estimating the Prevalence of Double Voting in U.S. Presidential Elections" 2019-01-17, by Goel, Meredith, Morse, Rothschild, and Shirani-Mehr.

<https://www.sas.upenn.edu/~marcmere/workingpapers/OnePersonOneVote.pdf>

This paper was summarized in this article, "This anti-voter-fraud program gets it wrong over 99 percent of the time. The GOP wants to take it nationwide." from the Washington Post.

<https://www.washingtonpost.com/news/wonk/wp/2017/07/20/this-anti-voter-fraud-program-gets-it-wrong-over-99-of-the-time-the-gop-wants-to-take-it-nationwide/>

That article and paper are interesting reading because they explain how these filters find so many false positives. Names are not unique and are sometimes more popular in some years than others, and thus the correlation between name and age is not fully independent. Names like "June," "April," "Autumn" etc are more common in the time periods they describe.

The article and this research paper describes the "Interstate Crosscheck System" where they compared the first name, last name and full birth date, month, day and year. The auditors in Maricopa county compared only the birth year. That can be predicted to result in even more false positives.

The *Washington Post* article has this relevant excerpt:

In theory, the program is supposed to detect possible cases of people voting in multiple locations. But academics and states that use the program have found that its results are overrun with false positives, creating a high risk of disenfranchising legal voters. A statistical analysis of the program published earlier this year by researchers at Stanford, Harvard, University of Pennsylvania and Microsoft, for instance, found that Crosscheck “would eliminate about 200 registrations used to cast legitimate votes for every one registration used to cast a double vote.”

...

For instance, in a 2007 paper, elections experts Michael McDonald and Justin Levitt examined voter files from New Jersey's 2014 elections. In those elections, the most common names — William Smith, Maria Rodriguez, etc. — showed up hundreds of times, reflecting their prevalence in the general population.

Shared birthdays are even more common — statistically speaking if you have a group of just 23 people, there's a greater than 50 percent chance that at least two of them will share the same birthday.

At 180 people, according to McDonald and Levitt, there's a 50 percent chance that two of them will share the same birth date — month, day and year.

So if you have 282 William Smiths, as in New Jersey's voter rolls in 2004, you'd expect four of them to share the exact same birthday. Those four William Smiths would be flagged as potentially fraudulent voters by Kobach's Crosscheck system.

The problems don't stop there. Voter files are notoriously messy and often incomplete. Among the 3.6 million New Jersey voters McDonnell and Levitt analyzed, for instance, nearly 1 million were missing a birth date completely. Ten thousand were listed with a birth date of Jan. 1, 1753, and another 20,000 listed as Jan. 1, 1800 — likely placeholder values that were never updated.

There's no question that incomplete voter data is a problem. But comparing incomplete data sets against each other isn't likely to solve that problem.

To its credit, the Crosscheck program recognizes some of these shortcomings. After primary matches are determined using name and birth date, it attempts to match additional fields including partial Social Security numbers, if such data is available.

But that's far from fail-safe. A working paper published this year by researchers at Stanford, Harvard, University of Pennsylvania and Microsoft quantified some of the problem. In 2012 and 2014, Crosscheck sent the state of Iowa information on nearly 240,000 voter registrations that shared a name and a date of birth with a voter in another state.

Building off McDonnell and Levitt's work, the researchers created a sophisticated model that incorporated the likelihood of shared names and birthdays, factored in Social Security number data where available, attempted to determine if both shared-name pairs actually voted in a given year, and accounted for clerical errors.

Boiling it all down, out of the 240,000 paired registrations that Crosscheck sent to Iowa, there were only six cases where it appeared that the same person registered and voted in two different states.

In other words, well over 99 percent of the 'matches' sent to Iowa were unlikely to have anything to do with even attempted voter fraud.

The above scenario using the full DOB matched 200 times more than it should have. Matching just the age will find many more false positives.

Thus, if the statistics from the studies cited are applicable, then the number of ballots affected should be further divided by more than 200, because they found 200 false positives using the full DOB, whereas here, they use just the year.  $3177/200 = 16$  ballots.

Those final 16 suspects are probably also false positives due to the use of just the birth year, but we applied the factor of 200, which was found to be the case when using the full birth date.

**If it is 32 envelopes or less that represent duplicate voting by about 16 voters, this is a small number for all but the tiniest of margins. Note that to be fair the sources of potential error must be added and the sum of likely discrepancies that affect the margin in a partisan way compared to the margin. 16 will add minimally to such a calculation.**

#### **5.5.1 Official results do not match who voted.**

Here the introductory paragraph incorrectly says this results in 11,592 ballots potentially being wrongly counted, but that is considering both the counted and uncounted ballots. The true issue in the table should consider only counted ballots, only 3,432 ballots.

But this is also easily explained by the fact that the voted history file released to the public is redacted to remove those individuals who are legally on the protected voters list. Protected voters are individuals who are not identified for security purposes to protect their home addresses and other personal information, such as judges, police, firefighters, first responders, or other persons who are in the Address Confidentiality Program due to security concerns, as

explained at this link: <https://recorder.maricopa.gov/redaction.aspx>. According to Maricopa County Recorder, Stephen Richer, there were approximately 3,400 protected voters in Maricopa County in the 2020 election.

This explanation makes sense, as we note that the two numbers are very close. This is a common issue that we see in every county we have analyzed, and was explained by Maricopa County to the auditors, and should not have been included in their issues list.

**Therefore, this is a NON-ISSUE, and it applies to all contests.**

### **5.5.3 In-Person Voters who had moved out of the county**

This is very similar to the prior issue discussed regarding by-mail voters who moved. The issue is based on a check of the VM55 "final voted file" and the Melissa database to find voters who moved out of the County (854) and out of the state (1528) prior to the registration deadline. It is not clear exactly how they conducted the matches, but as stated in the prior issue, these name-matching schemes are extremely unreliable. But even giving them the benefit of the doubt and assuming all the cases found were improper, the voters were predominantly Republican voters. Assuming the total is as stated, 2,382 ballots, then 43.37%<sup>9</sup> of those (1033) ballots were inappropriately voted by R voters, and 25.06% (597) were inappropriately voted by D voters. If this were proven to be true, and voters voted according to their party, then it could alter the outcome by approximately  $1033 - 597 = 436$  votes in favor of Biden.

Voters move at all times during the year including at election time. This is why voter rolls are typically frozen prior to election day so that uncertainty about eligibility does not affect voters rights. Arizona freezes eligibility before election day and does not allow same day registration. When voters fail to update their residence address prior to the freeze of registration, they leave their voter record subject to question for contests that are affected by ballot style. Such questions could be brought up in litigation that might accompany a narrow margin election. Once the period for an election "contest" is over, these eligibility issues become moot. The count of voters who might have been ineligible for a county contest could contribute to the grounds for an election contest during the period of time when the litigation is available. Whether the Presidential contest is subject to counting from an out of county residence address is a matter of State Statute and would be resolved in such a contest proceeding.

However, for purposes of considering the issue, the approximate calculation helps to put the issues into perspective in terms of priority.

**--> This should be classified as a NON-ISSUE as it is ineffective to change the outcome of the Presidential or Senate contests, and likely is overstated due to limited ability to match voters.**

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<sup>9</sup> Although we agree this is too much precision, we are using the exact figures from the Cyber Ninjas report so they can be easily compared. The only thing we are doing is calculating the approximate number of ballots for each candidate based on partisan split.

#### **5.5.4 Voters Moved Out of State During the 29-day period preceding the election**

Similar to the issue above, but regarding the period in the final 29-day period prior to the election, they find 2,081 may have moved out of the state. But according to AZ law, these voters still may cast a vote for president. This suffers from the same name-matching issue, which we can't evaluate because the effectiveness of their matching system has not been independently evaluated. Yet assuming all these errors were legitimately detected, if the discrepancies were handled correctly, then all those voters would have been able to vote for president, and so that contest is unaffected.

Furthermore, the voters that did vote in this manner were 41% R and 32% D. Assuming the undeclared voters split the same way as the major parties, and calculating using pairwise margins (which is conservative), then 56% of the votes were likely voted for the R candidate in the Senate race, and the change in the margin would be an additional about 250 votes in favor of the stated winner.

**Again, this should be classified as a NON-ISSUE as it cannot change the applicable outcomes, and likely is overstated by including false positives.**

#### **5.6.6 Deceased Voters**

The Final Voted File, VM55 was compared with commercial lists and identified 282 individuals who were matched as deceased.

The comments on matching lists apply here where we expect many false positives. We don't know the accuracy of the matching process. Furthermore, the voters who may have inappropriately "voted while dead" were mostly R voters. The net pickup by the D candidates was potentially 69 votes, and would only amplify the lead of those candidates and not overturn the outcome.

Further, although this is something to be defined by law, we believe that if a person were still alive during the early voting period and died before election day, that those votes should still count, to the extent Arizona law permits.

**--> Immaterial in this election, as this would likely only increase the margin of the reported winners.**

#### **5.6.8 Late Registered Voters with Counted Votes**

Previously, the auditors had publicly stated that 3,981 voters had registered after the deadline and still voted. They revised this after learning more about how the registered file is constructed. After further analysis, the auditors now claim that there were 198 voters who registered to vote

after the deadline and still voted.

The explanation for this may be that the effective date of registration is when the registration form is completed, not when the data is added to the database. Those last 198 voters may have been correctly registered but not added to the database in time. No review of registration forms was part of the audit, and it is unknown if that data was available for review.

Our recommendation is to allow same-day registration which will eliminate most of the voter registration date concerns which may have an underlying agenda to purge voters based on an arbitrary date, and instead will serve to encourage new voters to get involved.

But if all such registrations were in fact improper, those voters should not have voted. The split of voters in that category was predominantly R voters. This could have resulted in 8 fewer votes for the R candidates, and a gain in margin for the reported winner. **This would contribute only minimally to a basis for a different outcome of the Presidential contest.**

#### 5.6.9 Date of Registration Changes to an Earlier Date

This appears to be a subcategory of the prior issue, but repeated as a separate issue. These are not likely different cases. Thus, of the 198 voters, 193 had dates subsequently corrected. This is likely due to the issue described above, that the date of registration should be based on the date the voter completed their registration form, and it is not possible to have the voter registration database all corrected in the flurry of the election, but it was eventually consistent.

Again, the split of voters that were in the 193 favored R voters, and if all were invalidated, this could represent a pickup for D candidates of 5 votes.

#### 5.6.10 Duplicate Voter IDs

The auditors looked for duplicates in the voter rolls, but instead of looking for exact matches of full name DOB and address, which they have, they looked at any matches of the same first and last name, age within 10 years, and the same address in the past. This is again an even more lenient matching algorithm. Frequently, addresses are considered the "same" when, for example, students lived in a dorm or if apartment numbers are not included.

We anticipate that if these are further investigated, they will be eliminated as false positives.

Yet, this is one of the very few cases where, if all the cases were improper, the reported loser could gain some ground, potentially adding 37 votes.

## V. Voted Data Tables Misunderstood

Here, we group several issues that relate to the EV32 (voters that requested an early ballot), EV33 (listing of all voters that returned a ballot), and VM55 (final voted file). The discrepancies

reported here are all related to what we believe are misunderstandings by Cyber Ninjas about what these lists provide.

#### **5.4.1 More Ballots Returned By Voter Than Received**

The report by Cyber Ninjas says:

9,041 more ballots show as returned in the EV33 Early Voting Returns File for a single individual who voted by mail than show as sent to the individual within the EV32 Early Voting Sent File. In most of these instances an individual was sent one ballot but had two ballots returned on different dates.

We must note that the EV32 and EV33 are detailed to the individual voter. They note in their description that "We've been informed shortly before release of this report that some of the discrepancies outlined could be due to the protected voter list. This has not been able to be validated at this time, but we thought it was important to disclose this information for accuracy." However, we don't think this fact has anything to do with this issue.

There are two cases here. They say that "In most of these instances an individual was sent one ballot but had two ballots returned on different dates." But there is also the case when an individual was not sent a ballot but returned one.

This issue has been explained by Maricopa County, and is related to the earlier claim that 74,000 ballots were received but not recorded as sent. On the Maricopa County website <https://JustTheFacts.vote>, they say (underlining added):

Created daily, the EV32 file is a listing of all voters that requested an early ballot on that day, while the EV33 file is a listing of all voters that returned a ballot on that day. State law requires the County prepare these daily files for the County political parties during early voting. The EV32 file must be created up until 11 days prior to Election Day, which is the last day a voter can request a ballot in the mail. The EV33 files must be created up until the day before Election Day.

Any voter who cast an early ballot in person after Oct. 23, 2020 would not be included in the EV32 file and any voter who dropped off an early ballot on Election Day would not be included in the EV33 file. Any comparison using these files to find the total number of early voters would lead to inaccurate results. The "voted file" provides the full accounting of voters that cast a ballot in Maricopa County.

The Cyber Ninjas assumption is that every ballot that is returned and included in the EV33 is also included in the sent file. But you can get an early ballot without it being sent to you, and those files are not fully updated, only during the run-up to the election, provided for get-out-the-vote efforts by the various candidates and parties.

Unlike many jurisdictions, Maricopa County processes in-person early voted ballots in some ways similar to mail-in ballots. It appears that the 74,000 ballots were due to in-person early voting.

So they looked at their earlier claim of 74,000 and have reduced it to 9,041, and these are the cases when a voter was listed in the EV33 file as receiving a ballot, but then returned two. The easy solution for this is that the additional ballots received were those voters who voted early, either by mail or in-person, and then did so again in-person. It is important to recognize that this can occur in normal processing.

The most important aspect of this issue to understand is that when additional ballots are returned, the voting system will not allow additional ballots to be accepted and included in the tabulation. There is no evidence that ballots were incorrectly included in the tabulation.

In fact, their report says this:

NOTE: An EV33 indicates that a ballot is received and does not necessarily mean the ballot was counted. It is assumed that only the first ballot received was counted.

But if they actually did make this assumption, then the net impact would be zero, as the second ballot would never be counted.

Therefore, the severity of this issue should be classified as a NON ISSUE, since even the auditors are assuming that any additional ballots are not counted.

### **5.6.3 Ballots Returned not in Final Voted File.**

They claim that 2472 ballots were found in the VM33 early voting returns file, but were not found in the VM55 Final Voted File, but it is a different number than those that were rejected (2,042). Thus, there were apparently 430 additional ballots that were rejected over the count in the rejected list, perhaps improperly.

This is a very small number, and the partisan split was about even. But if all the ballots were improperly rejected, it could have meant a pickup of about 7 R votes, if the partisan split were resolved to votes without any variation.

Although this is a very small issue, it still would be nice if the number rejected matched the difference between the early voted ballots and the final voted file.

### **5.6.4 Mail in ballot received without record of being sent.**

At the July hearing, Logan said that there were 74,243 entries in the EV33 Early Voting Returns Files but not in the EV32 Early Voting Sent Files, and was used as justification to continue the audit. They admit this statement was "unintentionally misleading" as the other portion of that number are the ballots early voted but in person. They now claim that there are still 397 entries that were not included in either the Early Voting in-person votes or early voted by mail.

Thus, the title of this issue is still misleading, because it is not clear if the ballots were mail-in ballots or in-person ballots. The differential of 397 ballots that were in the early voting returns file (EV33) but not sent out or voted in person could be due to either the mail-in or in-person voted ballot count being off.

The county has already explained this issue, found on [JustTheFacts.vote](https://justthefacts.vote), and already quoted in Issue **5.4.1**. The EV32 and EV33 are prepared for the political parties during early voting so they can see how their party is doing in terms of turn-out, and do not represent the number of ballots submitted.

**Thus, this issue should be rated as a NON ISSUE. They ask the Attorney General to investigate the issue, but the explanation already provided should be sufficient.**

#### **5.7.4 Early votes not accounted for in EV33 -- 255,326 Early Votes show in the VM55 that do not have a corresponding EV33 entry**

This finding is in Doug Logan's presentation, but is only an informational-only finding in the report (5.7.4), yet, it is frequently misunderstood on social media in claims that there was fraud in the audit.

In essence, if you take the list of all ballots received (VM55) and subtract those returned by mail-in voters (VM33) the total remaining is the number of in-person votes cast.

This issue was brought up earlier in the July 15 hearing, claiming that about 74K additional ballots were listed. Logan now says that the number quoted in the hearing was unintentionally misleading. The County of Maricopa provided a response to this claim on their website at <https://justthefacts.vote>, as recounted in item 5.4.1, above.

This issue was deleted from the major issues in the formal report, and was moved to the informational items, and remained in the presentation. The auditors should release a correction that states that this issue in the presentation was not significant.

--> This is a non-issue, because it reflects a misunderstanding of the EV32 file, and that it is not the complete list of early ballots because it is a daily update which is not further updated after a certain point (October 23)

## VI. Processing Compliance Issues

These issues pertain to lack of clarity of documents concerning election procedures for tracking ballots in the system. However, they may result in mistakes being made. In this category, the handling of duplicates is included in several of the issues.

### 5.5.2 More Duplicates Than Original Ballots

Although the general public may think duplicated ballots may be a sign of malicious behaviour, they are instead a part of normal processing due to inevitable damage to some original ballot sheets that prevent them from being scanned. This is commonly called "remaking" the ballot to distinguish it from the idea of creating two ballots from one.

The concerns listed actually are regarding poor duplicated ballot tracking by Maricopa County. The reported numbers vary. First, "Maricopa County counted 2,592 more duplicate ballots than original ballots sent to duplication". Then, "The county reported 1688 fewer ballots sent to duplication than identified by the audit team," and finally, "the county provided 904 fewer original ballots than they reportedly duplicated."

If we accept the numbers they were able to resolve, more of the duplicated ballots were voted by R voters as opposed to D voters. Thus, it is unlikely that this issue could affect the Presidential outcome in this election.

The report correctly identifies poor handling of the duplicated ballots. Procedures should be improved and can be easily corrected in future elections.

The following issues were also regarding ballot duplication.

- 5.6.2 Duplicated Ballots Incorrect and Missing Serial Numbers
- 5.6.14 Duplicate Ballots reuse serial Numbers (6) -- This should be combined with duplication issues.
- 5.7.3 Commingles Damaged and Original ballots. This should be combined with duplication issues.

### 5.5.5. Votes Counted in Excess of the Voters who Voted

The report should have reported this issue as affecting 0 vote counts, because the apparent discrepancy is due to the protected voter list. It is likely that the 1551 votes they consider impacted becomes 0. Also, these "additional votes", even if they all were considered improper, would not alter the Presidential outcome, because they were predominantly R voters. Had these questioned ballots been removed (not a possibility after they are approved for counting) they would have likely improved the margin for the D candidates by about 900 votes.

**Again, this should be classified as a NON-ISSUE as it would not have arisen if the withheld protected voter list had been factored into the research.**

### 5.6.1 Voters Not Part Of The Official Precinct Register

Voters who voted who were not on the voter rolls as of October 22nd would have impacted 618 ballots. But review of historical voter rolls located all the missing voters. Auditors did not find any voters who were not legally registered.

It is common for election offices to maintain two or more sets of registration rolls, the active set, and a second of relatively "inactive" voters, who are registered but have not voted recently. State statute controls how long voters can stay inactive and remain registered. Because voters do not necessarily notify the county when they move (or die), this cleanup of voter rolls is standard procedure in most states. Once you are registered you can vote or not vote in any election until the registration is left inactive too long. An Internet search of this issue revealed that there are about 200,000 voters on the "inactive" registration list.

The good news is that this election was felt to be very important and inspired 618 additional voters to vote who had not voted recently. These voters were slightly more R than D, and applying mathematical prediction, we anticipate that if all these voters were ineligible, this would have improved the D margin by about 17 votes.

--> **Non-Issue.** We believe this is a misunderstanding of how voters are checked for eligibility, and would not have affected the outcome even if all those voters were indeed ineligible to vote, as the plurality were R voters. Same-day registration can ease this issue because then there would not be a claim that these voters may be ineligible.

### 5.6.5 Voters with Incomplete Names

They claim that 393 ballots were impacted, but this is a consequence of inadequate quality of the registered voter rolls, not the ballots cast. The net result of this, if all ballots were improper, would likely be a 16 vote pickup for the R candidates. But it is more likely that these are clerical mistakes because voter registration data is typically hand-entered from hand-written voter registration forms. Well designed official followup and correction of problematic registration entries is the solution to this issue.

Of course, the registrar of voters should continue to endeavor to include full names, but it would be wrong to disallow voting in the future only because of clerical error.

### 5.6.7 Audit UOCAVA Count Does not Match the EAC count.

This issue is only regarding the count reported to the EAC and does not affect the ballots actually processed. Officials appear to have failed to correctly confirm all categories of the UOCAVA ballots returned, because those returned by mail are commingled. The final reported totals to the EAC may be accurate, even if the subtotals to electronic or mail-in may not match.

The number of UOCAVA ballots returned was much higher than in past elections. No evidence was reported to the effect that the UOCAVA ballots were inappropriately processed.

--> **The possible reporting error would not affect the outcome.**

Other UOCAVA Issues should have been grouped together:

- **5.6.13 UOCAVA Electronic Ballots Double Counted (6)**
- **5.7.7 Inaccurate identification of UOCAVA ballots.** This issue amounts to poor labeling on or within boxes that is indicative of inadequate chain of custody. Labeling errors do not affect the ballots themselves but can confound attempts to audit in a responsible manner and should be corrected in future elections.

### **Issue 20 -- 5.6.11 Multiple Voters Linked by AFFSEQ**

The issue here is an internal tracking number called AFFSEQ which was found to have been reused in 101 cases. The concern does not appear to affect the ballots cast in the election, but is likely due to poor tracking of the sequence number. This number is not regulated by law but is internal to the election office.

**This should be corrected if possible with improved procedures. It would not have affected the outcome in the Presidential election.**

### **Negligible Issues:**

The following issues had negligible errors of fewer than 10 ballots affected, assuming they are salient issues.

- **5.7.1 Audit interference. Runbeck, the printing and mailing contractor was uncooperative.**
- **5.7.5 High Bleed-thru rates on ballots.** Auditors spent an incredible amount of effort on capturing data to address this issue, but the ballots are designed both to not bleed through (due to thick paper used) and the targets are offset from side to side, so bleed through is not in a target area. No inaccurate counting was attributed to this issue. The auditors devoted a significant amount of space in their report to the bleed-thru issue with dramatic pictures. While admitting they had not found even one ballot where bleed-thru had affected the vote count, their dramatic presentation makes it appear to be a problem.
- **5.7.6 Improper paper:** The much denigrated and ridiculed effort to examine paper by the auditors has not yet produced any data within view of the public nor has it reached any conclusion that would lead to concern or improvement in future practices.
- **5.7.8 Missing Subpoena Items.** These include rejected provisionals, uncured mail ballots, and undeliverable ballots. No numbers were presented in support of discovered

impacts of these items.

- **5.7.9 No Record of Voters in Commercial Database** -- They found 86,391 individuals who were registered that were not in the commercial database. This could be the fault of the commercial database chosen by the auditors, which is primarily based on the interests of merchants to sell products to customers, and is not expected to include certain classes of voters, such as voters without a stable address. Many voters do not have a computer and may not have any online presence whatsoever, reducing the possibility of being tracked by a commercial database company.
- **5.7.10 Out of Calibration Ballot Printers** -- Claims that the registration between the front and back sides is out of spec, but this is not that important in terms of evaluating the marks on each side, as they are processed separately. There is no evidence that this results in any vote changes.
- **5.7.11 Real-time provisional Ballots** -- The auditors are concerned that providing an election day ballot that is not separated as a provisional and treated separately may result in duplicate ballots processed, but no evidence of that was provided. It appears that the e-pollbooks<sup>10</sup> are working well in this respect. However, the report did not examine e-pollbooks in other respects, for example in terms of slowing voting due to glitches that were reported in the election<sup>11</sup>. It appears that the auditors have a bias toward looking for duplicate ballots rather than whether there were long lines that may have prevented voters from voting.
- **5.7.12 Voter Registration System Access Audit** -- Auditors had trouble getting access to the voter registration system. There has been no indication provided that after gaining this access, auditors would find voter registrations that may have resulted in improperly cast ballots.
- **5.7.13 Questionable Ballots** -- No evidence has been presented that improper ballot stock affected any outcome audited. One ridiculed theory (not addressed in the report) regarding speculations of bamboo infused ballots has not been supported by any evidence.
- **6.1 Voting machines** -- Concern over voting machine tabulation inaccuracy can be resolved with a high quality hand count. That quality may not have been achieved during this particular audit. Investigation into software or hardware flaws, caused either by mistake or due to malfeasance, is always desirable and auditors should remain attentive to software quality and authenticity. Voting machines need not be analyzed unless the

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<sup>10</sup> [https://en.wikipedia.org/wiki/Electronic\\_pollbook](https://en.wikipedia.org/wiki/Electronic_pollbook)

<sup>11</sup> "E-Pollbook Malfunctions To Blame For Some Maricopa County Voting Lines Tuesday Morning" -- <https://kjzz.org/content/392692/e-pollbook-malfunctions-blame-some-maricopa-county-voting-lines-tuesday-morning>

hand count identifies a difference between the machine and hand counts.

- **6.2 Digital Analysis** -- The reported purging of log files, access to the internet, and the use of common login and password and other issues cannot affect the paper record, and thus not the substance of this election **should be investigated**. These technical flaws can be indications of poor policy with inadequate oversight that will likely lead to side effects that affect results and outcomes in the future. These, like all other discrepancies discovered, cannot change the outcome of a past election.

We are concerned about the purges of the voting system logs, and the poor practice allowing multiple people to use the same log in names.

## VII. Summary of the potential impact of the issues

Almost all of the issues above are easily explained and are misunderstandings by the auditors. Yet, we can still estimate the impact of these issues to the outcome. To do so, we must adjust their raw numbers of ballots impacted according to the discussion of each issue above, and recognize that false positive matches will occur using their lenient matching method, and make a reasonably accurate assumption that registration affiliation is a viable predictor for the vote. Under those caveats, the following table lists approximate predictions of the potential impact on the vote margin of the contests in question.

| Issue                    | Description                                                                                        | D      | R    |
|--------------------------|----------------------------------------------------------------------------------------------------|--------|------|
| 5.6.12                   | Double Scanned and Counted Ballots                                                                 | --     | --   |
| <b>Voter Eligibility</b> |                                                                                                    |        |      |
| 5.3.1                    | MAIL-IN BALLOTS VOTED FROM A PRIOR ADDRESS                                                         | -591   |      |
| 5.4.2                    | VOTERS THAT POTENTIALLY VOTED IN MULTIPLE COUNTIES -- but these are also probably false positives. | +/- 16 |      |
| 5.5.1                    | Official results do not match who voted.                                                           | --     | --   |
| 5.5.3                    | In-Person Voters who had moved out of the county                                                   |        | -2   |
| 5.5.4                    | Voters Moved Out of State During the 29-day period preceding the election                          |        | -249 |
| 5.6.6                    | Deceased Voters                                                                                    |        | -69  |
| 5.6.8                    | Late Registered Voters with Counted Votes                                                          |        | -8   |
| 5.6.9                    | Date of Registration Changes to an Earlier Date                                                    |        | -5   |
| 5.6.10                   | Duplicate Voter IDs                                                                                | -37    |      |

| <b>Voted data tables mismatch -- Largely due to misunderstanding EV32, EV33, VM55</b> |                                                                                                                                                                                                                    |      |       |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|
| 5.4.1                                                                                 | MORE BALLOTS RETURNED BY VOTER THAN RECEIVED -- (but they are not included in the tabulation)                                                                                                                      | --   | --    |
| 5.6.3                                                                                 | Ballots Returned not in Final Voted File                                                                                                                                                                           |      | +7    |
| 5.6.4                                                                                 | Mail in ballot received without record of being sent                                                                                                                                                               | --   | --    |
| 5.7.4                                                                                 | 255,326 Early Votes show in the VM55 that do not have a corresponding EV33 entry                                                                                                                                   | --   | --    |
| <b>Processing Compliance</b>                                                          |                                                                                                                                                                                                                    |      |       |
| 5.5.2<br>5.6.2<br>5.6.14<br>5.7.3                                                     | <b>REMADE BALLOTS</b><br>More Duplicates Than Original Ballots<br>Duplicated Ballots Incorrect and Missing Serial Numbers<br>Duplicate Ballots reuse serial Numbers (6)<br>Commingles Damaged and Original ballots | --   | --    |
| 5.5.5.                                                                                | Votes Counted in Excess of the Voters who Voted -- Explained as due to the protected voter list.                                                                                                                   |      | -904  |
| 5.6.1                                                                                 | Voters Not Part Of The Official Precinct Register -- but found by looking at the inactive voter list.                                                                                                              |      | -17   |
| 5.6.5                                                                                 | Voters with Incomplete Names                                                                                                                                                                                       |      | +16   |
| 5.6.7                                                                                 | Audit UOCAVA Count Does not Match the EAC count                                                                                                                                                                    | --   | --    |
| 5.6.11                                                                                | Multiple Voters Linked by AFFSEQ                                                                                                                                                                                   | --   | --    |
|                                                                                       | TOTALS IF ALL WERE EFFECTIVE DISCREPANCIES                                                                                                                                                                         | -644 | -1231 |

Within the constraints mentioned, the D candidate would lose perhaps 644 votes and the R candidate would lose 1231 votes. We believe most of these are false positives due to using lenient matching algorithms. The reported winner would under these unlikely scenarios gain about 600 votes. Under an even less likely scenario in which only discovered discrepancies that benefit a Republican candidate were considered correctable and corrected, the margin for the Republican would increase by about 800 votes.

This estimate is based on re-evaluating the number of false positives in the duplicate voter matching by a discount of 200 to 1 as found in the cited research. This false positive rate we have chosen to use is probably too low and hence our prediction is conservative.

## VIII. Missing Signature Review on Envelopes

We reviewed the analysis by Shiva Ayyadurai and EchoMail, and provisionally concluded that his limited analysis could not have provided evidence of improper handling of signatures..

In Maricopa County all signatures are reviewed in electronic form by human reviewers. It seems Ayyadurai may be unaware that cure of blank signatures can be done by phone contact as part of signature verification.. We are told that 100% of signatures are reviewed, according to Maricopa County statements.

Signature review from the county's point of view can be found here:

<https://content.govdelivery.com/accounts/AZMARIC/bulletins/2e19cb7>

100% of mail-in ballot signatures are reviewed by trained staff. The multi-tier signature verification process includes a manager review of all questioned signatures or blank envelopes, and a 2% daily audit of all good signatures before any ballot is counted. Learn more about early ballot verification and oversight [here](#).

- **DID YOU KNOW:** Maricopa County attempts to contact every voter with a questioned signature or if a ballot is returned in an unsigned affidavit envelope. Maricopa County voters can also track their ballot for each election at [BeBallotReady.Vote](#) or by texting 'JOIN' to 628-683 to get ballot status automatically sent to them. This resulted in just 0.1% of early ballots in the 2020 General Election that were not counted.

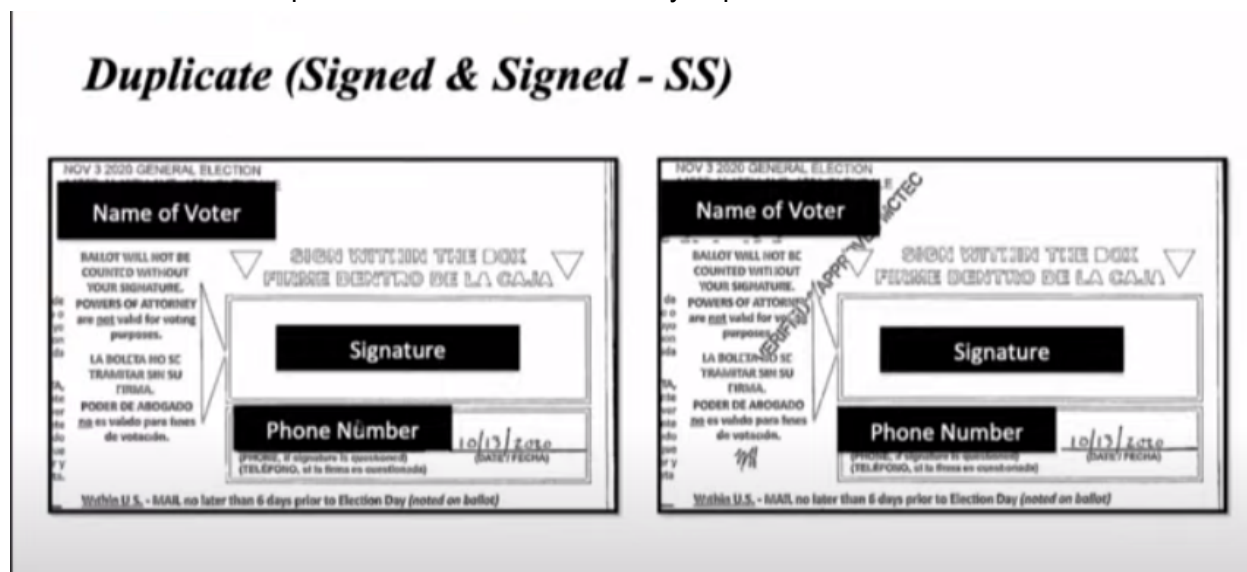
The notion promoted by Ayyudurai that the ones that were blank are not verified does not match County procedure. He talked of "Standard Operating Procedures" but may not have adequately reviewed their procedures. Maricopa County staff commonly call and authenticate the voter using the voter's last 4 digits of SSN, DOB, etc. Staff then confirm the ballot was returned by the voter. They do not handle the ballot envelopes physically at all. The stamps shown in the Shiva report are apparently digital edits of digital scans of physical envelopes made at Runbeck facilities.

Ayyudurai says on his slide that "17,126 voters sent in two or more ballots."



But even if two images exist, it does not necessarily mean that 17,126 voters returned two or more ballots. The existence of repeated images only means that two images exist, and may not inform how they got there. [Dr. Ayyadurai did not make this same claim in his YouTube video dated Oct 14]<sup>12</sup>

For example, in this image, we see the same exact envelope image two times, with one stamped verified. You can confirm this yourself by looking at the hand written date. To write that date with the same imperfections twice is essentially impossible.



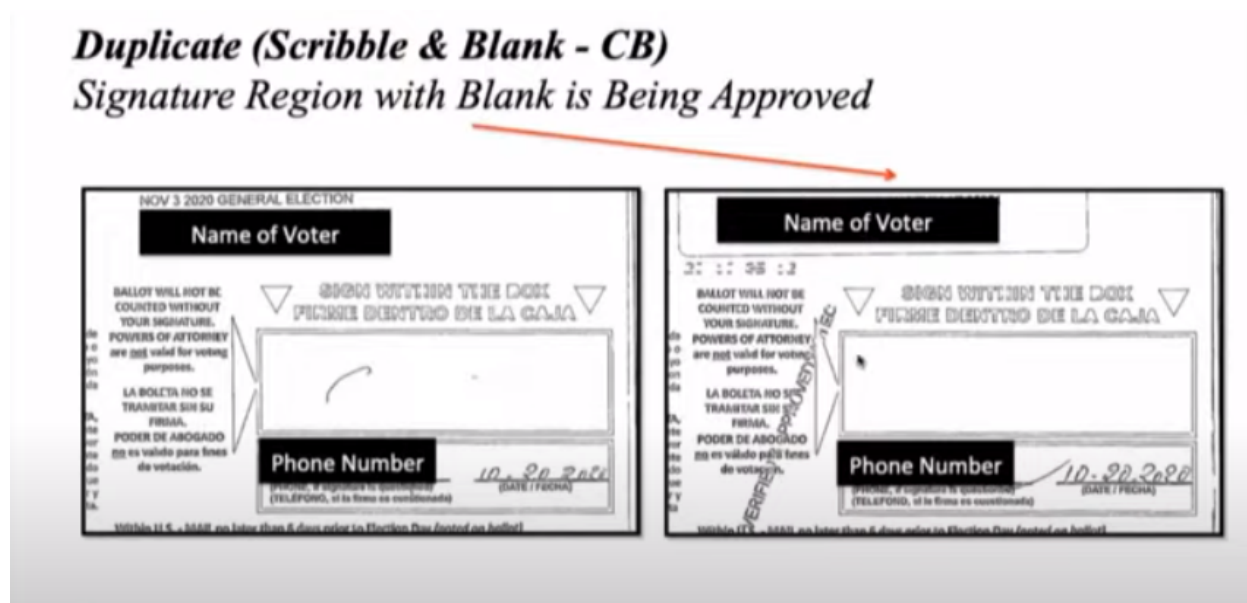
Some members of our review team think that there indeed may have been two images, one the original from Runbeck, the mailing house, and one that now has the approved digital stamp, but nothing else changed. This would be as expected when the envelope is finally approved, because you don't want to modify the original image to allow for full auditing, something we call "immutability of data". Following this rule, once an image is created, you can't change it. To endorse it as approved, a new image is created with the endorsement, and then keep both. If Ayyudurai was given just a pile of images, he may not know how they were being processed. If the signature did not match the database entry, then perhaps the process requires that the voter is contacted, and then the image is stamped. But we must admit that this is no more than speculation.

Some of the "light" signatures could be due to colored pens that were too thin to stay in the image, after thresholding to create a B&W image.

In the following case, it does appear that the images are different for the same voter. The handwritten date is from the same voter but it is not identical. But interestingly enough, they do have the same date. We note that only one of these is digitally marked as approved.

<sup>12</sup> See <https://www.youtube.com/watch?v=bF4nMoX0IkY> offset 28 minutes.

In all these cases, only one of the repeated envelope images is approved, which is correct.



## Our Tentative Findings Of This Portion Of The Audit

We do not believe that any conclusions can yet be made from all the work that was done to recognize blank signature blocks and classify the images. It may be that the auditors did not understand the processing of these images, but neither do we. We have many questions about the envelope and signature processing procedures used in Maricopa County, and will continue to pursue answers to those before we can reach final conclusions on this portion of the audit.

Updated 2021-10-18. The YouTube video <https://www.youtube.com/watch?v=bF4nMoX0IkY> starting at offset 28 minutes essentially retracted the claim that voters sent in 17,126 additional ballots or duplicate envelopes. Dr. Ayyadurai continues to make the claim that Maricopa County first filters for blanks and scribbles before performing signature verification. Maricopa County says they review all envelope images, and no filtering for blanks occurs. The filtering for blanks and scribbles is something done by the audit but has nothing to do with the procedure used by the county.

The bottomline figure of 6,545 more early voting ballots received than ballot images may be easily explained because the envelope images are apparently generated by Runbeck, the mailing subcontractor, when the envelopes and their ballots are returned by mail. But when they are dropped off at polling places on election day, they are not sent to Runbeck, but are processed internally, and they may look directly at the physical envelope and perform approval that way.

Maricopa should publish their procedures to clear up these questions.

## Conclusion

We cannot access the accuracy of this audit without more information, most importantly scans of the original hand-tally sheets and the reconciliation spreadsheet. The ballot images should be made public. We already have the full Cast Vote Record file.

We have no confidence in the hand tabulation result given the massive 77 batch difference that was revealed in the very small portion of a hand tally overview that was provided in the Pullen report.

Our key findings and recommendations are provided in the executive summary.



### About The Author

Raymond Lutz: With a Masters of Science degree in electronics engineering, Ray specialized in the office equipment industry, founding the Multifunction Products Association (MFPA) and drafting national and international standards, including a role as technical liaison to the United Nations sponsored International Telecommunications Union (ITU). Most recently (2008-present) Ray has been involved in election integrity issues, including a recent successful election audit fraud lawsuit against San Diego County. Now, he is working with CitizensOversight.org to provide a ballot-image audit solution called AuditEngine. Contact: [Support@auditengine.org](mailto:Support@auditengine.org)

## APPENDIX

### Other papers by Citizens Oversight:

**Case Study of AuditEngine -- Three Counties in Florida --**

<https://auditengine.org/audit-results/case-study/>

**Legislative Guidance for Improved Election Integrity --** This is still a draft but is firming up.

<https://docs.google.com/document/d/1RpfmmpmyHSn-Ylcwlp-Hb90wWU1n2DuyhfX43ygYPDg/edit?usp=sharing>

**Notes and questions about the AZ Audit --** These are notes and comments that were not considered appropriate for the main part of this review document

<https://docs.google.com/document/d/1ppQJdm2Sht0viVNaB7k98qjn8KP9zAtSIS87i2y46Ls/edit?usp=sharing>

**Letter to AZ State Sen. Karen Fann on June 15, 2021 re: AZ Audit --** Suggests that at least the top three counties be included, and points out that the procedures of Cyber Ninjas should include comparing with the official results batch by batch, resulting in about 50,000 comparisons

[https://docs.google.com/document/d/1QAvQm7YJZfUyumFqdxYREhYGBfI\\_d07T/edit?usp=sharing&oid=100850937464157370236&rtpof=true&sd=true](https://docs.google.com/document/d/1QAvQm7YJZfUyumFqdxYREhYGBfI_d07T/edit?usp=sharing&oid=100850937464157370236&rtpof=true&sd=true)

**Letter to AZ State Sen. Karen Fann on June 25, 2021 re: AZ Audit --** Recommends that all counties in AZ are audited using ballot image auditing technology and AuditEngine is available.

<https://docs.google.com/document/d/1I8rUxjqw6srlgBxiS8X0S1SDIPmwg0VeQbQ7-LIZAE/edit?usp=sharing>

**Letter to AZ State Sen. Karen Fann on June 29, 2021, outlining the false claims of the film "The Deep Rig" featuring Doug Logan, and asking her to disavow it.**

[https://docs.google.com/document/d/1em6kChUq3m\\_zbXwwKdJHL4I5beUS7rh6Z626z0Scz2M/edit?usp=sharing](https://docs.google.com/document/d/1em6kChUq3m_zbXwwKdJHL4I5beUS7rh6Z626z0Scz2M/edit?usp=sharing)

**Four Fatal Flaws of RLA Audits --** Risk Limiting Audits have a firm mathematical foundation, but they have certain problems when we apply these in real auditing scenarios. We now recommend Ballot Image Audits coupled with Batch Comparison audits with partial RLA escalation. <https://copswiki.org/Common/M1938>

**White Paper: Election Audit Strategy and BRAWL -- Balanced Risk Audit with Workload Limitation --** An alternative approach to RLA audits, if anyone does want to use either ballot polling or ballot comparison audits, but we don't recommend those because they disturb the batches. <https://copswiki.org/Common/M1879>

**Comprehensive Risk Estimation of Election Audits --** This paper explores the various sources of error in auditing, particularly in RLA audits vs. Ballot Image Audits.

<https://copswiki.org/Common/M1913>