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May 26, 2022

TO: CLACKAMAS COUNTY, OR

Sherry Hall, Clackamas County Clerk
County Board of County Commissioners:
Chair Toote Smith
Commissioner Sonya Fischer
Commissioner Paul Savas
Commissioner Martha Schrader
Commissioner Mark Shull
Clackamas County
2051 Kaen Road
Oregon City, OR 97045
503-655-8581
bcc@clackamas.us

Dear County Clerk Sherry Hall and County Commissioners:

As experts in voting systems and imaging technology, we believe we can help your county fully understand the "blurry barcode" incident. An independent view of this will be helpful because there may not be sufficient technical sophistication in county staff to perform a root-cause analysis, whereas we have a wealth of experience with a variety of voting systems. As for myself, I am an electronics and computer engineer with more than 45 years of experience in related technical fields, and have had direct experience for 17 years reviewing election systems.

We have also developed a ballot image auditing platform called **AuditEngine**, which we have recently started to deploy.

AuditEngine is a cloud-based application. The ballot images, the Cast Vote Record, the PDF Ballot Style Masters must be uploaded to secure cloud storage adjacent to computing resources where we are authorized to use up to 10,000 computers in parallel to process the election by reviewing ballot images. By doing this work in parallel, we can complete the full evaluation in minutes or hours (once fully mapped) rather than many days or weeks if a single computer were to do the same work.

The AuditEngine website can be found at this address: AuditEngine.org

In our case study of AuditEngine in three Florida Counties, Volusia, Collier, and Port St. Lucie, we processed both ES&S and Dominion ballots, and found that the AuditEngine evaluation of the vote differed from the voting system evaluation in only about 0.23% of the targets, and in those cases when we differed, we evaluated voter intent 93% more accurately than the voting system. And in those last 7% when we did not correctly evaluate the vote, generally the voting system did not either, due to very strange marking by the voter. [The case study report is available here: https://copswiki.org/Common/M1970]

We have since worked to complete audits in Bartow County, GA, Fulton County GA, Dane County, WI, among others, as a service to the community in this divisive election. We provided some important feedback to election officials, and in the case of Volusia County, provided a certificate of appreciation in completing an accurate outcome despite some unnerving failure of the ES&S system they used. AuditEngine is under the wing of CitizensOversight.org, a 501(c)3 nonprofit organization.

In Clackamas County:
AuditEngine can help in situations like what we see in Clackamas County, because it can create a fully independent tabulation of the election based on a set of ballot images -- even if those images have "blurry" barcodes.

It appears that the Hart voting system did not save the ballot image of any ballot when the barcode can't be read, which is unfortunate. However, it is certainly possible to scan the original ballots and create a complete set of ballot images, and then use those to create an independent result using AuditEngine. We believe the scanners you have now will do this, because HART uses COTS (Commercial off-the-shelf) scanners (they would be run as simple scanners and not coupled to the HART system). But we are a bit worried that the reason for the unclear barcodes might be due to those scanners rather than the printing of the barcodes, so it will be prudent to use different scanners.

AuditEngine has the capability to perform an initial full review of the images without attempting to extract the votes, to 'read' the style and other metadata on each ballot image, including the barcodes. In the sample Hart ballot in the Appendix, the number "21" at the bottom right corner is the ballot style in human-readable form in addition to the barcode. AuditEngine then makes a set of templates from those styles, so we can use our TargetMapper application to map the targets to the contests. Thus, in a nutshell, we can likely avoid the barcodes altogether and still produce an accurate tabulation.

AuditEngine has completely integrated support for ES&S and Dominion voting systems because they are the most widely installed. Although we have not completely integrated support for HART ballots into AuditEngine, we have done basic alignment and registration of the ballots, and the rest of our system should work just about as well with HART as with the other vendors. But we must acknowledge that there is some work we must do to accept those ballots and the HART cast vote record format. We are glad to have the opportunity to work with you so we can accomplish both enhancing our system and also dealing with the "blurry barcode" incident.

Our system provides an extensive report as it compares the result of our evaluation with the official result of the voting system, including any adjudications you may also perform, normally on a ballot-by-ballot basis or on an aggregated basis (say by precinct). Resolving our report to individual

ballots may not be possible in this case due to the hand-copying process, as the new ballots with clear barcodes will have different serial numbers. In such a case, we compare on an aggregated basis, such as by precinct, unless we can create the conversion list from the original to the copied serial numbers, which might be worth trying so we can find any errors in the copying process.

Our Proposal:

1. To obtain the mapping of the styles, we must obtain the "PDF Ballot Style Masters" for the election. These are the PDF files normally sent to your printer, which must be in "searchable" format. We need this to get started to configure AuditEngine
   (See "PDF Style Masters" below for details.)

2. Fully image the original ballots (about 117,000 total or as needed), to create a complete set of ballot images for the election. This can be done by your staff, but we need to be careful not to use the same scanners that may have partially caused the issue. This will take a single (long) day if we use at least two high-speed scanners. If only some of the ballots need to be rescanned, then we can reduce the impact of this step.

3. These ballot images are placed into zip files and uploaded to secure cloud storage in the AuditEngine datacenter. We also need the Cast Vote Records, when those become available.

4. AuditEngine will then perform a full metadata review of those ballot images and extract the style from the written numbers on the ballot, and also read the style and serial number barcodes if we can, to create a metadata report.

5. Use AuditEngine to create a set of style templates, and either
   a. use the PDF style masters to create the mapping (with human-eye assistance)
   b. map it fully using our TargetMapper application.

   We prefer to use the PDF style masters approach because it is faster and requires less human interaction.

6. Perform a full extraction of all ballots using AuditEngine and create an independent tabulation.

7. Compare our result with the official result on a ballot-by-ballot basis if possible, or precinct basis (since after the ballots are copied over, we cannot then easily compare on a ballot-by-ballot basis.)

8. Perhaps also get the official ballot images of the copied ballots and use AuditEngine to fully extract the vote from those, and compare the aggregated results with those of original ballots.

9. As final deliverables, we provide a full report including intermediate data for all the steps involved.

AuditEngine does have hard costs for computer resources, and of course our time to configure and run it. We believe that we can provide this result to you for $20K, if you provide the scans, and probably about $30K if we have to rescan all the ballots using our staff and equipment. Enhancements to allow AuditEngine to fully process HART ballots will be at no cost to you.

We realize that due to the need for the enhancement to support HART ballots and cast vote record formats, and to avoid bogging you down at this critical juncture, we may not be able to meet the timing window to have this work done prior to the certification deadline. We believe the result will still be of value regardless of when we complete our review, and of course we will endeavor to complete it as soon as possible. We believe that the investigation will provide value in these respects:

1. Your county will be under a great deal of scrutiny, and it will be helpful to get an independent tabulation of the results and a detailed report of any inconsistencies (or probably lack thereof) in the result.

2. We would like to help you get to the bottom of the cause of this failure. Yes, it could have been prevented by testing the ballots in the logic and accuracy test (LAT) using the ballots printed at your print shop, but unfortunately, even that may not have been possible to recover from if the ballots could not be reprinted. We are therefore concerned that the printer may not be fully to blame in this snafu and instead there may be other contributing factors.

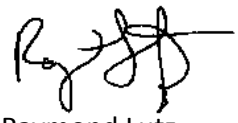
PDF Style Masters
--> Please provide the Ballot Style Masters in PDF format so we can get started adapting our target mapping software. Detailed instructions for generating these masters are at this link. You can regard this as a public records request if that is helpful to you, but please rush. We want to do this work regardless of whether you want us to help in this election in your county.
https://docs.google.com/document/d/1b16TXTZJUhbuvT-TXNU3-whLxDis0y77H1IKv1MdEuo/edit?usp=sharing

You can upload these directly to AuditEngine cloud storage. I have created a link for uploading any files from your county at this address: https://engine.auditengine.org/upload/157/OR_Clackamas

Finally, I know you are on a full-court press right now to get this election done using brute strength. We ask that you at least let us get started with the ballot style masters without any delay, and then we can talk about how we can proceed without distracting your staff from the main work at hand.

I hope we can have a phone conversation to further discuss this proposal. Please contact me by phone at your earliest convenience: 619-820-5321.

Sincerely,



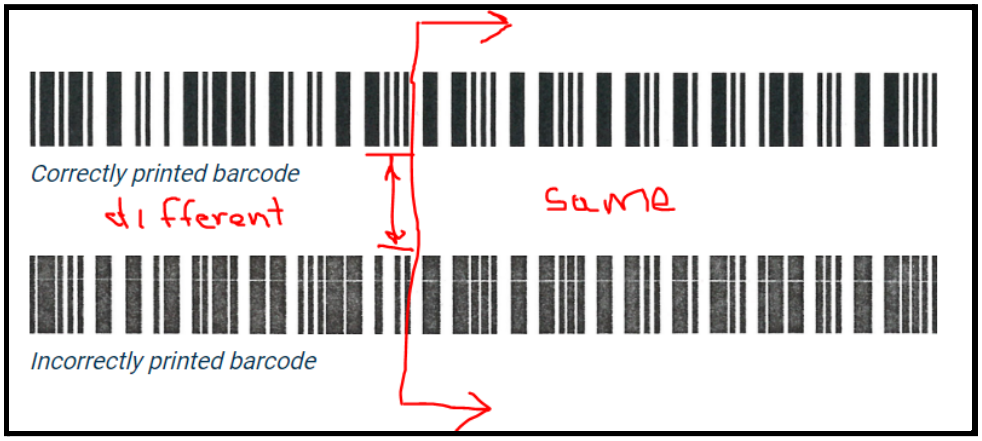
Raymond Lutz
Executive Director
Citizens' Oversight Projects

Appendix

We have very little information about this failure, but even with this limited information, please consider the following in the hopes that it will be useful.

On your website, you share two barcodes, one that you say is properly printed, and the other which is "blurry". The trouble is that we find we can scan both of these barcodes, but they are obviously not from the same exact ballot style.

I clipped the following image directly from your website showing the two barcodes. The bar codes are different from each other, it's not just that one is blurry.



Both are readable with my simple cell phone barcode scanner. These are industry standard "Code 128" barcodes.

The top barcode reads 0002440000 0000455093
The bottom one reads 0002440000 0003098433

These barcodes also have check sums that will not allow the barcode to be accidentally misread. The "incorrectly printed" barcode is not too blurry to cause it to be misread.

There are a number of possible causes:

1. Were the wrong barcodes (and style numbers) provided to the printer? This is very unlikely, but is implied by the samples above, because these do have different numbers. We are assuming the barcode samples were not of the exact same ballot style in your comparison, and thus this is not likely the reason (unless you say they were of the same style).

2. Were the printer's barcodes a bit blurry AND the HART system can't read them, even though other barcode readers can? This can be the case if the HART barcode reading code is not sophisticated enough to deal with blurry barcodes.

3. Could it be that the barcodes are a bit blurry but normally could be read, but the scanners have bad rollers or some other scanning defect causing the barcodes to not be readable in the ballot image? We believe this is the most likely.

4. Perhaps the "blurry" barcode samples provided on the website are better (because they are readable) than many other failed barcodes in your election. This might be the case but seems unlikely.

VERTICAL BARCODES ARE A DESIGN DEFECT

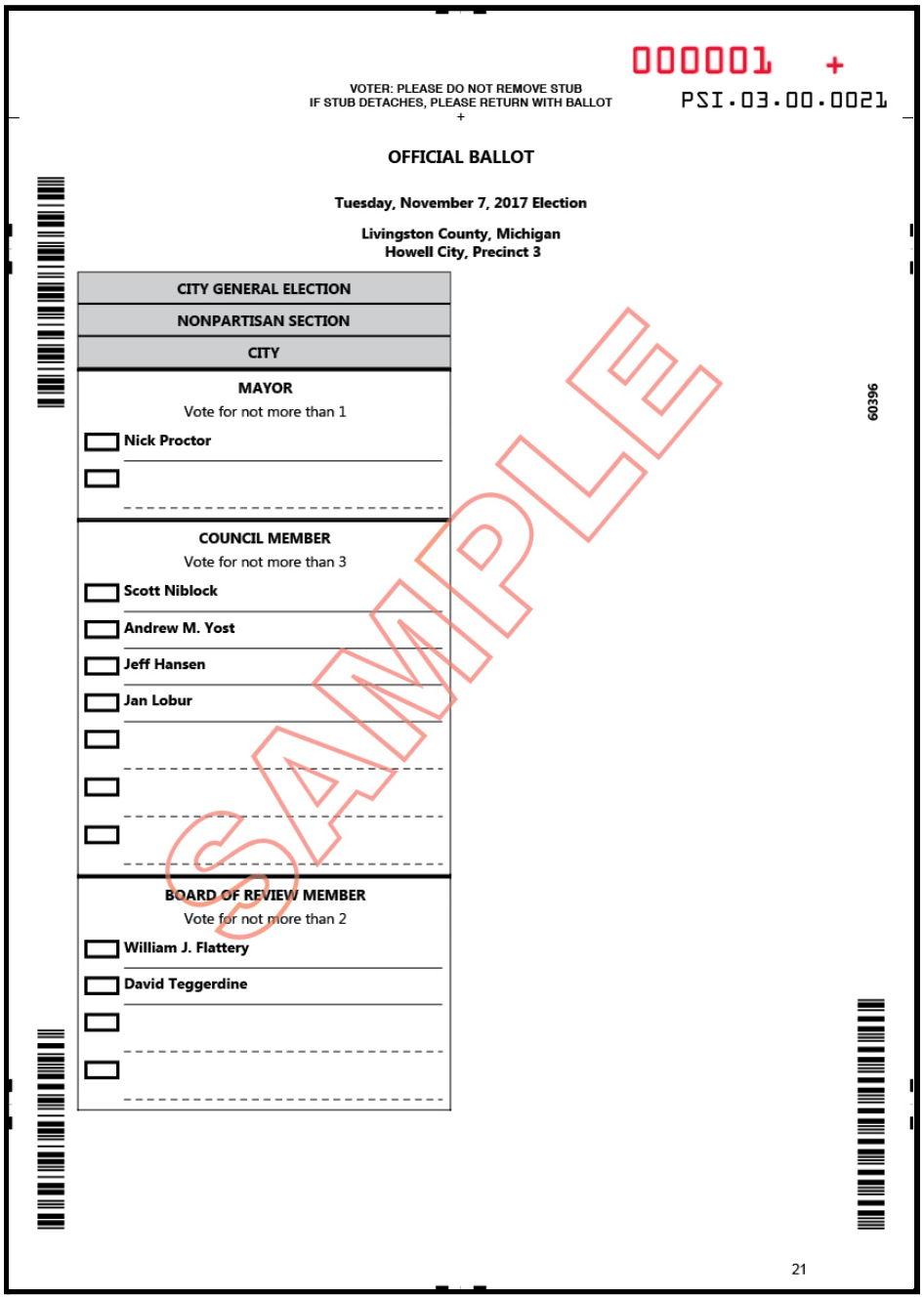
The HART election system has ballots that are designed with barcodes oriented in the vertical orientation. See the sample HART ballot on the following page.

It is our opinion that this is an unfortunate design defect in the HART system, because any jitter in feeding the paper may corrupt the barcodes. This jitter does frequently occur due to rollers that may have flat spots due to long periods in storage. All sheet-feeding scanners have some speed variations as they feed the paper sheets. The variation is sometimes not even visible to the eye, but can vary perhaps a tenth of an inch off when you get to the middle compared with a perfectly uniform scan. Sometimes, the page can get stuck briefly in one spot while the scanner continues to scan the same location. The image will appear to be "stretched" in that location. If this happened in the middle of a barcode, it could easily cause it to be unreadable in the image.

HART also does not include timing marks on their ballot to adjust for this jitter.

Thus, the root cause of this failure may be due to deficient Hart software to read the barcodes or distortion of the image by the scanner mechanism rather or in combination with somewhat blurry (but still readable) barcodes.

Sample Hart ballot from Livingston County Michigan to show the location and orientation of the barcodes.



000001 +

VOTER: PLEASE DO NOT REMOVE STUB
IF STUB DETACHES, PLEASE RETURN WITH BALLOT
+

PSI.03.00.0021

OFFICIAL BALLOT

Tuesday, November 7, 2017 Election

Livingston County, Michigan
Howell City, Precinct 3

CITY GENERAL ELECTION

NONPARTISAN SECTION

CITY

MAYOR
Vote for not more than 1

- [ ] **Nick Proctor**
- [ ]

COUNCIL MEMBER
Vote for not more than 3

- [ ] **Scott Niblock**
- [ ] **Andrew M. Yost**
- [ ] **Jeff Hansen**
- [ ] **Jan Lobur**
- [ ]
- [ ]
- [ ]

BOARD OF REVIEW MEMBER
Vote for not more than 2

- [ ] **William J. Flattery**
- [ ] **David Teggerdine**
- [ ]
- [ ]

60396

SAMPLE

21