

**Maricopa County 2022 General Election
Ballot-on-Demand Printer Investigation**

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Introduction

On general election day in November 2022, a substantial number of ballot-on-demand (BOD) printers at vote centers in Maricopa County produced ballots that could not be tabulated by on-site tabulators. Most of the printers had been used during the August 2022 primary election, as well as in prior elections, without experiencing similar problems.¹

The Maricopa County Attorney's Office (MCAO) retained me to conduct a focused, fact-specific independent review to determine why printers that performed successfully during the primary election evidenced problems during the general election. Specifically, the MCAO asked the investigative team to determine what factor or factors caused the printing problems on general election day; why the problems had not occurred on primary election day; and whether and how Maricopa County can prevent similar problems from occurring in future elections. I was also asked to review the chain-of-custody policies affecting BOD printers and consider whether the election day issues resulted from human error or process and equipment issues.

The MCAO and Maricopa County Board of Supervisors made it clear at the outset that this investigation should be independent and free of any outside influence. We have encountered nothing during the investigation that appeared intended to or that did undermine the independence of the investigation. Both the Maricopa County Election Department (MCED or the Department) and the Maricopa County Recorder's Office personnel have provided all documents and assistance requested.

Summary

During February and March 2023, our investigative team printed and tabulated 9,100 ballots on randomly selected printers and tabulators. We interviewed, often on multiple occasions, seventeen Maricopa County and

¹ Although this investigation examines only the possible explanations for the printer malfunctions on election day, I note that subsequent proceedings have established that all votes were counted, with most of the misprinted ballots being transported to the more powerful election central tabulators, which tabulated them without issue. *Lake v. Hobbs*, CV 2022-095403 ("Plaintiff's own expert acknowledged that a ballot that was unable to be read at the vote center could be deposited by a voter, duplicated by a bipartisan board onto a readable ballot, and – in the final analysis – counted."), affirmed, Arizona Court of Appeals, 1 CA-CV 22-0779, review denied, Arizona Supreme Court, CV-23-0046-PR (March 22, 2023).

Runbeck Elections Systems employees involved with preparing, testing, deploying and operating printers and tabulators. We consulted with several persons who are experts in election procedures, and reviewed thousands of pages of documents. Based on our tests, and for the reasons described in this report, we concluded that the combined effect of using 100-pound ballot paper and a 20-inch ballot during the 2022 general election was to require that the Oki B432 printers perform at the extreme edge of their capability, a level that could not be reliably sustained by a substantial number of printers. Although we further concluded that nothing in the printers' past performance or pre-election stress testing indicated that such a failure was likely, we recommend several alternative approaches that could minimize the likelihood of a similar failure in future elections, including the use of more robust stress testing designed to mimic on-site circumstances.

Investigation Team

With the approval of the MCAO, I added several subject matter experts to the investigation team. Two of them have broad experience and expertise in conducting elections, specifically elections that use vote centers and BOD printers. Neal Kelley served more than 15 years as Registrar of Voters in Orange County, California, the fifth largest voting jurisdiction in the country and similar in size and complexity to Maricopa County. Mr. Kelley presided over the transition from neighborhood polling places to vote centers in Orange County. He has been recognized for his work with county, state and national efforts to improve election administration. Lynn Constabile served as the Elections Director for Yavapai County, Arizona, from 2004 until 2022. During her tenure, Yavapai County transitioned to vote centers.² Ms. Constabile is intimately familiar with Arizona's election procedures and laws. I asked Mr. Kelley and Ms. Constabile to analyze Maricopa County's procedures and training programs related to the testing and use of the BOD printers, with the goals of identifying factors that may have contributed to the failure to anticipate the printer problems encountered in 2022 and of recommending steps that could be taken to prevent similar problems in future elections. Each worked independently; each provided us valuable

² Yavapai County, as is true of Apache, Coconino, Gila, Mohave, Pima, Pinal, and Santa Cruz Counties, transports all ballots from its vote centers to its central election office to be tabulated, rather than use on-site tabulators as does Maricopa County.

information about election systems and each assisted us in identifying areas for consideration.

We retained the services of Doug Meyer, owner and president of Meyer Enterprises, Inc., operating under the name CTS Office Supply, in Cottonwood, Arizona. For many years, Mr. Meyer has provided and maintained the BOD printers used by Yavapai County, Arizona, including Oki printers similar to those used in Maricopa County. His company also provides Oki printers to the Salt River Materials Group in their various operations in five states.³ Mr. Meyer oversaw the print tests we conducted using Oki B432 and Lexmark C4150 printers that had been used in the primary and general elections in Maricopa County and analyzed print test results. His business partner, Barbara Meyer, served as a technician throughout the testing.

Finally, I associated attorney Sandra Thomson, who recently retired after serving nearly twenty years as a permanent judicial law clerk at the Arizona Court of Appeals, the United States District Court for the District of Arizona, and the Ninth Circuit Court of Appeals. Ms. Thomson assisted in all aspects of the investigation.

Sources of Information

Although the focus of this investigation is narrowly centered on the performance of the BOD printers in the 2022 general election, understanding all the factors that could have affected their performance required that we have a broad understanding of election procedures. To learn about the procedures followed in preparing and testing the BOD printers, we spoke on multiple occasions with Scott Jarrett, Co-Director of Elections for Maricopa County. We conducted in-person interviews with employees in charge of IT for the MCED and the Recorder's Office, the Department's vote center manager and head of the election day command center, tabulation manager, tabulation analyst lead, help desk supervisor, and the personnel in charge of printer preparation and testing.

We also interviewed several temporary technical workers involved in both the 2022 primary and general elections. For the 2022 general election, Maricopa County hired approximately 60 temporary technical workers, referred to as t-

³ Maricopa County is not part of the area served by Mr. Meyer's company.

techs. Among other responsibilities, the t-techs set up and test the BOD printers after they are installed at the vote centers; they also respond to technical problems that arise during the elections. We spoke with five experienced t-techs, who had been present for both the primary and general elections and who were retained until December 2022 to assist in post-election testing, about their training, the procedure followed in setting up vote centers, and their experiences on general election day, as well as with those responsible for training and supervising the t-techs. We also spoke with experienced poll workers.

Maricopa County's election system depends in several ways upon services and assistance provided by Runbeck Election Services. To understand Runbeck's role, both before and during the primary and general elections, we spoke with Jeff Ellington, CEO of Runbeck Election Services, and Anthony Paiz, who has now retired from his position as Vice President, Field Services.

In addition, we reviewed the following documents: 2022 Elections Plans for the August Primary and November General; November General Election Canvass; 2022 November General Election Training; 2022 General Election Poll Worker Training; 2022 Vote Center Technical Procedures, including Auditor Checklist, ICX Set-up Guide, Quality Control Checklist for Vote Centers, Tabulator Setup, and T-Tech Training; Maricopa County's November 27, 2022 Response Report to the Attorney General; 2022 General Election Printer Assignments; Printer Configuration Quality Assurance Documents; 2022 Spanish Sample Quality Assurance; General Election Reporting System Tickets from Vote Centers on Election Day; and Runbeck reports of election day technical assistance.

History of Ballot on Demand Printers in Maricopa County

Prior to 2018, Maricopa County utilized a precinct model, under which voters were assigned to a single precinct on election day and could vote only at that location. In 2018, the County used a hybrid model consisting primarily of precinct locations in conjunction with a small number of vote centers using BOD printers for ballots and receipts and separate printers for envelopes. In 2020, the MCED fully implemented an in-person "vote anywhere" vote center model to provide more convenience for voters.⁴ Under that model, a voter can vote at any center regardless of the precinct in which the voter resides. Because Maricopa

⁴ Maricopa County Elections Department 2022 Elections Plan, p.7.

County must make available at each center thousands of ballot styles to assure that a voter can obtain a ballot specific to the voter's precinct, BOD printers, which can print any of the more than 12,000 ballot styles required during the 2022 general election, provide the only realistic option for making all those forms available at each center.⁵

The County made significant investments to upgrade its BOD printer fleet. In 2017, the County had acquired commercial off the shelf Oki B432 printers to use with the Oki 9650 BOD printers.⁶ In 2020, the County retrofitted the Oki B432 printers, which previously printed only voter envelopes, to function as BOD printers, capable of printing ballots, control slips, and envelopes. In 2021, the County replaced two older BOD printer models, the Oki 9650 and the Lexmark 923, with Lexmark C4150 printers.⁷

During the 2022 August primary and November general elections, the County used the retrofitted Oki B432 and the Lexmark C4150 BOD printers at the vote centers. These printers had updated firmware and were installed with uniform settings that were the same settings as those used in the 2020 August primary and November general elections.⁸ During the general election, the Department initially assigned 591 printers to the 223 voting centers.⁹

During the 2022 general election, Maricopa County increased the ballot length from 19 inches, which was used for the primary election ballot, to 20 inches. Due to the number of contests, the number of propositions, the language used to describe them, and the Spanish translation, the ballot could not fit on a typical 19-inch ballot.¹⁰

⁵ Interview with Scott Jarrett, Co-Director of Elections (Election Day and Emergency Voting), Maricopa County.

⁶ Id.

⁷ Interview with Jeff Ellington.

⁸ Id.

⁹ MCED 2022 General Printer Assignments.

¹⁰ Interview with Scott Jarrett. Maricopa County's ballot is complex, as the county includes portions of eight of Arizona's congressional districts and 22 of 30 of the state's legislative districts. Because results must be reported by precinct, a ballot must be available for each voter that reflects not only the appropriate congressional district and legislative district but also all federal, state, municipal, school district, supervisory district, precinct, and fire district races, in addition to the propositions presented and their descriptions, and all available in both English and Spanish. As a result of these requirements, the ballot for one precinct included 80 separate races and decisions and Maricopa County required more than 12,000 distinct ballots for the 2022 general election. Interview with MCED lead tabulation analyst, who prepares the ballot in accord with statutory requirements.

Pre-Election Testing of BOD Printers

August 2022 Pre-Primary Election Testing

In April 2022, prior to the August primary election, the MCED tested 100-pound ballot paper, which would be used for the first time in the primary election. The Department selected a sample of Oki B432 and Lexmark C4150 BOD printers and ran more than three hundred test prints consisting of a 19-inch ballot, a receipt, and an envelope through each selected machine. The test results showed no smearing or flaking on the ballot, receipt, or envelope. The central count tabulator successfully counted all the ballots. Accordingly, the MCED concluded that the Oki and Lexmark printers would function effectively with the change to 100-pound paper.¹¹ And, during the primary election, the on-site tabulators did successfully process more than 100,000 ballots.¹²

November 2022 Pre-General Election Testing

In September 2022, prior to the November general election, the MCED conducted an extensive stress test on the Oki B432 and Lexmark C4150 BOD printers. The Department randomly selected four Oki and four Lexmark printers for testing. Two tests used 100-pound paper and a ballot that was increased in length from 19 inches to 20 inches to accommodate the number of contests, the number of propositions, and the Spanish translations. In the first test, one hundred double-sided ballots were run through each test machine without the envelope or receipt. In the second test, the same number of ballots were run, along with an envelope and receipt. In both tests, the prints were run sequentially, but not intermittently. The media weight settings on the Oki printers were set to heavy for the ballot and medium for the envelope and receipt. The media weight was set to normal on the Lexmark printers for all three settings. The results indicated that two of the Oki printers showed speckling at the edge of the

¹¹ Maricopa Recorder Ballot on Demand Printer Testing document, p. 12.

¹² A suggestion of a problem did occur during early voting in the primary. Ballots from early voting are returned to the MCTEC in envelopes, removed by bi-partisan teams of workers, and tabulated on central equipment. Some of the workers noted flaking or speckling on some ballots and brought it to the attention of supervisors. Because the central tabulators read all ballots, however, the issue was not regarded as affecting the ability to count all ballots and no testing was done using on-site tabulators. Whether such testing would have detected the problem experienced on general election day cannot now be determined. Interview with MCED personnel.

ballot, but that the actual ballot page was clear and not damaged as to the ballot's overall integrity. The central count tabulator successfully counted all ballots, as did an on-site tabulator. In light of the successful primary election experience using 100-pound ballot paper and its additional tests, the Department concluded that the Oki and Lexmark printers would successfully print the new 100-pound, 20-inch ballot in the general election.¹³

Printer Testing On Site

In addition to the pre-election testing of printers conducted at the MCED, t-techs run test prints on site following the set-up of a vote center. The t-tech first does a speed check to determine that the SiteBooks are properly connected to the printers. The t-tech then runs test prints, printing from each SiteBook to each printer. The test prints at a minimum contain two envelopes, one "test successful" ballot, one Provisional Paper, and one ICX Paper (Accessible Voting Device). The t-tech visually inspects the test ballots, checking for flaking or speckling, and also rubs the test ballots to ensure the print is dry and doesn't smear. At the completion of the test, the t-tech spoils the ballot and places it in a secure bag identified by printer, to be returned to the MCTEC. Finally, the t-tech completes a "Site Setup: Completion Checklist" verifying the steps taken, which is then signed and dated by an Auditor.¹⁴

Assignment and Tracking of Printers

Scott Jarrett, Maricopa County Co-Director of Elections, and the vote center manager decide which printers are assigned to each vote center location. In making the assignments, they consider the size of the room, because Lexmark printers are larger than the Oki printers, as well as historic voter turnout. In general, then, they assign the Lexmark printers to the vote centers that are open for the most days for early voting, have sufficient space to accommodate the Lexmark printers, and traditionally experience heavy voter participation.¹⁵ For most vote centers, the County sends two Lexmark printers or three Oki printers, four if the Oki printers will be used in a heavy turnout area.

¹³ Id. pp. 13-15 and Supporting Document 13 #2022, Extensive Stress Test Executive Summary.

¹⁴ Interview with t-tech; Maricopa County Election Department Site Setup: Completion Checklist.

¹⁵ Interview with vote center manager.

Each printer and its associated laptop is assigned a bar code that is on a label fixed to the equipment. The bar code is scanned and assigned to a vote center at the warehouse, scanned again as the printers and laptops are loaded onto a truck for transport, again as the equipment is unloaded at a vote center, and finally when the equipment returns to the warehouse. All the data is scanned into an internal database. In addition, the County places port protectors and a socket lock on each printer for added security. As Mr. Kelley noted in his review of the chain of custody for the printers and laptops, these steps constitute good practices. While Mr. Kelley recommended added layers of protection that could provide even more security,¹⁶ there was no indication of tampering with any printer or laptop, and all port protectors remained in place at the close of the election.¹⁷

Changes Between Primary and General Elections

Maricopa County made several changes between the 2020 and 2022 elections and between the 2022 primary and general elections that could have affected the performance of the printers. We designed our tests to determine whether any of these variables, or a combination of them, caused the printer malfunction that occurred during the 2022 general election.

The first variable considered was the weight of the ballot paper. Prior to 2020, Maricopa County's ballots were printed on 110-pound paper. In 2020, Maricopa County purchased a new type of on-site tabulator that could use either 80-pound or 100-pound paper. As a result of pandemic-induced supply issues, only 80-pound paper could be obtained in sufficient quantities for the March 17, 2020 Presidential Primary Election (PPE).¹⁸ The PPE, which involved a single race and a one-sided ballot, experienced no issues with the BOD ballots. During the 2020 general election, however, on some ballots, the ink from the "Sharpie" pens provided at the vote centers bled through the paper.¹⁹ Because voting bubbles are offset on the front and back of ballots, any bleed-through cannot actually

¹⁶ Mr. Kelly suggested, for instance, that serialized tamper seals be placed over the port protectors and that the serial numbers be included in chain of custody documents.

¹⁷ Interview with MCED personnel.

¹⁸ Interview with Scott Jarrett, Director of Elections (Election Day and Emergency Voting), Maricopa County.

¹⁹ Maricopa County preferred that voters use these pens because the ink dries quickly, as opposed to ballpoint ink, which takes more time to dry and thus can transfer onto the tabulator and cause the tabulator to reject ballots because it "reads" the transferred ink and detects it as a fault.

affect the correct tabulation of votes, and all votes can be counted even if bleed-through occurs.²⁰

Within hours of the polls closing, however, a claim went viral over social media asserting that certain ballots filled out with Sharpies could not be read by vote-scanning machines in Maricopa County, a theory colloquially known as “SharpieGate.”²¹ Although the theory was unfounded, to allay voter concerns and prevent bleed-through in future elections, Maricopa County election officials decided to use heavier, 100-pound paper during 2021 and for the 2022 primary and general elections.²²

Maricopa County also changed the length of the ballot, which was 19 inches for the primary election. Due to the number of federal, state, municipal, school district, and precinct contests, the number of propositions and the language used to describe them, and the required Spanish translations, the ballot for the 2022 general election could not comply with required guidelines²³ unless it was extended to 20 inches.²⁴

One other factor changed between the primary and general elections. During the primary election, the BOD printers printed first a ballot and then the control slip that identified the voter. Because poll workers indicated it would be more convenient for them if the order were reversed, the settings for the general election changed to request that the control slip be printed first, followed by the related ballot.²⁵

Election Day Printer Issues

Beginning almost immediately on the morning of election day, the MCTEC command center received calls from poll workers reporting that some of the tabulators were not accepting ballots. Each call was memorialized as an Election Reporting System (ERS) ticket by the person receiving the call. If an issue could not be resolved by advice from the command center, a t-tech or Runbeck

²⁰ Interview with Scott Jarrett.

²¹ See, e.g., [azcentral.com/story/news/politics/elections/2020/11/05/sharpiagate-hasnt-halted-arizona-count-but-theory-persists/6180778002/](https://www.azcentral.com/story/news/politics/elections/2020/11/05/sharpiagate-hasnt-halted-arizona-count-but-theory-persists/6180778002/).

²² Interview with Scott Jarrett

²³ A.R.S. section 16-502.

²⁴ See footnote 9 above.

²⁵ Interview with Scott Jarrett.

employee went to the affected vote center to attempt to resolve the reported problem. Runbeck and County technical workers travelled to approximately 70 vote centers to troubleshoot the reports of problems with the BOD printers.²⁶

At the outset, Maricopa County and Runbeck identified the cause of the reported problem as being either the on-site tabulators or the BOD printers. As technicians and Runbeck personnel had more opportunities to examine the problematic ballots, it became clear that the ballots in question could not be read by the tabulator because the print was not properly adhering to the ballot. As a result, some print flaked off, leaving the timing marks²⁷ needed for the tabulator to record the ballot too faint to serve their purpose. The flaking print also could accumulate on the face of the tabulator, making it unable to read even properly printed ballots until it was cleaned.

After consultation among Maricopa County and Runbeck personnel, the County concluded that the printing issue was being caused by a failure of the printer fuser to maintain a heat sufficient to fuse the toner onto the paper. As explained by Mr. Meyer, the fuser consists of an upper (hollow, Teflon-coated steel) cylinder and lower (silicone) pressure roller that are supported in the fuser frame by sleeves of bearings. Heat is produced by a halogen lamp or heating grid inside the upper fuser roller and temperature is controlled by a thermistor (temperature sensor). When the printer is powered on, the fuser is energized and heats until it reaches the set temperature of approximately 190 degrees. The paper with a latent image then passes between the upper and lower rollers. The heat and pressure from the upper and lower rollers heat and press the latent toner into the paper fiber, and fusing is complete. If the fuser does not maintain an appropriate heat, the toner will not properly adhere to the paper, causing flaking and speckling.

After trying several approaches to resolve the issue, Maricopa County concluded that the most promising approach involved setting all media weight settings to “heavy,” theorizing that the fuser would then maintain a high temperature at all times and would properly fuse the toner to the paper, and

²⁶ Settings were not changed at most sites that operated without issues. And, as we found during testing, settings were not successfully changed at all sites that reported problems.

²⁷ Timing marks are the black horizontal lines along the sides of a ballot that allow a tabulating machine to “read” the ballot.

instructed its t-techs to make that change when called to a vote center. In addition to that change, Runbeck personnel called to vote centers changed the media type, or paper, setting from plain to cardstock for ballots.²⁸

Another printing anomaly occurred at several vote centers, where ballots were re-sized as “fit to page,” a process that entirely changed the location of the timing marks on the ballots and assured that neither the on-site tabulators nor the central count tabulators could read the ballots. We could not determine whether this change resulted from a technician attempting to correct the printing issues, the most probable source of change, or a problem internal to the printers. During our testing, four printers randomly printed one or a few “fit to page” ballots in the middle of printing a batch of ballots. None of the technical people with whom we spoke could explain how or why that error occurred. The ballots mis-sized on election day were delivered to bi-partisan teams that duplicated the votes on a ballot that was then tabulated at the central facility.²⁹

Testing Procedure

Selection of Printers

On the basis of the calls received and information from the t-techs and Runbeck personnel on site, Maricopa County identified approximately 60 vote centers that experienced the printer problems described above.³⁰ Because print jobs from the SiteBooks at each vote center enter a queue for printing by one of the available printers, Maricopa County could not determine which printer caused problems at each site. Hence, if a vote center experienced problems, workers were instructed to change the media weight settings on all printers at that site. In selecting printers to test, therefore, we could not select from among printers that had been individually identified as causing problems; we could only select between sites that experienced problems and those that did not.

²⁸ Interview with Jeff Ellington.

²⁹ Interviews with MCED personnel. Unlike the problems involving the toner/fuser issue, the “print to fit” issue occasionally arose on election day with both Oki and Lexmark printers.

³⁰ The number may have been somewhat higher, based on our review of the election report logs. Whatever the precise number, we can fairly state that although approximately two-thirds of the vote centers did not experience printer issues, a substantial number of the vote centers utilizing Oki B432 printers experienced problems and were not able to tabulate some ballots on site.

We designed the test of printers to utilize, at least initially, 12 printers: five Oki B432 printers from sites with known problems; five Oki B432 printers from sites with no known problems; and two Lexmark printers for comparison purposes. Maricopa County had already tested ten Oki B432 printers as part of its extensive post-election testing and review. To avoid duplicate testing, we first removed the printers tested by Maricopa County from the pool of printers and then randomly selected printers that had been used in both the primary and general elections. We also randomly selected two Lexmark printers.³¹

Following the November general election, Maricopa County election workers placed all the printers in a secure room at the MCTEC. All remained secured at the time we began this investigation. I selected the group of printers for testing and was present as they were removed from the secure room and placed in a conference room in the MCED offices. Access to the conference room was limited to those admitted when I or a member of my team was present, and I was present for all four days of testing. We recorded all results in hard copy and on free-standing laptop computers, thus avoiding use of the County internet system. At the close of each day, I placed a security tape on the conference room door. The door is also monitored by 24-hour security cameras.³² No unauthorized person accessed or attempted to access the room during the course of the investigation. After we completed our testing, under my supervision all equipment used during our tests was labelled and removed to a secure area, as were the test ballots, all closed in envelopes fastened with security tape.³³

Printer Test Settings

We designed the printer tests to determine the impact of the change from 80-pound to 100-pound paper, as well as the impact of changes between the primary and general elections to the length of the ballot and the order of printing. We tested two additional factors that may have affected the failure rate of the printers.

³¹ No Lexmark printers produced ballots that could not be read by the on-site tabulators on election day due to flaking or speckling. We therefore selected two printers at random from the entire group of Lexmark printers rather than from specific sites.

³² To further avoid any suggestion that a person other than the investigative team had access to the ballots tested, as an additional precaution we removed the ballots from the MCED offices to another secure location until all ballots had been tabulated and visually examined.

³³ The actual ballots from the 2022 election have been stored and preserved as required by A.R.S. section 16-624.

The first involved the method used to print the ballots to be tested. In the pre-election tests done before the 2022 elections, and indeed for elections in prior years, Maricopa County tested batches of ballots run sequentially, i.e., without any pause between ballots. On election day, however, the printers typically do not run constantly. Rather, they print ballots as voters send information to the printer queue and therefore experience pauses between print jobs. The interval between print jobs creates a demand for the printer alternately to heat to print and cool to idle. During the time required for the fuser to recover to optimal heat after idling, the printer could experience an inability to properly fuse the toner to the paper, which in turn would result in the flaking and speckling observed on some of the printed ballots.³⁴ We therefore added a program that incorporated short pauses between prints to allow tests of ballots produced by interval, rather than sequential, printing. For sequential printing, each “ballot batch” consisted of 50 ballots; for interval printing, each batch consisted of 25 ballots.

Finally, we tested the impact of the changes in settings that were made on election day in an attempt to improve the performance of the printers. Two settings are involved. When the printers left the Maricopa County warehouse, the media weight setting, which affects the heat produced by the fuser, was set to medium for control slips and envelopes and heavy for ballots; the media type, which is the type of paper used, was set to plain for all three types of documents. As discussed above, County technical staff who were called to vote centers experiencing printer problems changed the media weight setting to heavy for control slips and envelopes, resulting in all three document types being set to a heavy media weight. Runbeck personnel also changed the media type to cardstock. We therefore compared the performance of each printer when set as it left the warehouse (WH) to its performance with the change of media weight (CH) and to its performance with changes to both media weight and media type (CH+), as well as against the other variables noted above. In total, we printed and tested 9,100 ballots, using the Maricopa County “famous names” ballot for all tests.³⁵

³⁴ Some high-volume printers utilize multiple heaters and sensors to recover more quickly and maintain more consistent fuser heat, but the Oki B432 is constructed as a low to mid-volume printer, which can be a weakness when used as a BOD printer. Interview with Doug Meyer.

³⁵ The famous names ballot was designed to mimic the 2022 general election ballot and included federal, state, and local races, as well as propositions. The difference, of course, is in the names: the candidates for President, for

We used eight randomly-selected on-site tabulators to test the ballots. Because a tabulator will reject a ballot that does not have any of the selection “bubbles” filled, a group of MCED employees assisted us by filling in thousands of ballot bubbles. In addition, MCED employees who are expert in the operation of tabulators operated those for us.

After the rejected ballots from each printer were separated from those accepted by the tabulator, Mr. Meyer visually inspected each rejected ballot to determine the cause of the rejection. As reported below, we found multiple issues that affected the tabulator’s ability to read some ballots.

Testing Results

Attachments A through C set out our findings in detail. As explained below, the weight of the paper had the greatest impact on printer failures in our tests and printer failures were greatest when 100-pound paper was used with a 20-inch ballot. Other variables impacted results to some degree. Testing also revealed that conducting interval tests of the printers, rather than sequential tests, is more likely to identify printers that will fail under election-day conditions.

Paper Weight

Maricopa County printed its ballots on 80-pound paper for the 2020 primary and general elections. During those elections, MCTEC received no reports of flaking that caused misprinted ballots. To compare 80-pound with 100-pound paper, we first tested 500 19-inch and 500 20-inch ballots using 80-pound paper on the ten test Oki printers, using the warehouse settings for media weight and type and conducting both sequential and interval printing. We recorded just one misread³⁶ from the 1,000 test ballots. In addition, although this was not the focus of our investigation, we saw no evidence of bleed-through when we filled out ballots using the pens provided by Maricopa County during the 2022 elections. These results, coupled with the earlier positive experience of Maricopa County in using 80-pound paper, led us to conclude that additional tests of 80-pound paper were not required. We concluded that the Oki B432 printers can print either 19-

instance, are George Washington, John Adams and Alexander Hamilton, and Sandra Day O’Connor is among the judicial candidates in retention elections.

³⁶ As used in this report, “misread” refers to a ballot that cannot be tabulated due to faulty printing.

inch or 20-inch ballots on 80-pound paper without causing printing or tabulation issues.

Lexmark Printers

The results of our tests using Lexmark printers replicated the performance of those printers during the 2022 general election. We tested two randomly-selected Lexmark printers and printed 300 ballots on each, using warehouse settings, 19-inch and 20-inch ballots, and sequential and interval printing. All ballots printed could be read by the on-site tabulators. Because the Lexmark printers performed without issue using warehouse settings, we had no reason to conduct additional tests using the change settings applied in the field on election day.³⁷

Media Weight and Media Type Settings

Table 1 summarizes the test results set out in detail in Attachment A. The headings in the top row define the printing sequences and setting used: Warehouse sequential (WH Seq) and warehouse interval (WH Int), which used a media weight of heavy for ballots and medium for control slips and envelopes and used plain paper for all; change sequential (CH Seq) and change interval (CH Int), which maintained the plain paper setting but set the media weight to heavy for control slips and envelopes as well as for ballots; and change sequential plus (CH Seq+) and change interval plus (CH Int+), which used a heavy media weight for all three types of documents and also changed the media type for ballots from plain to cardstock. Group A consists of the Oki B432 printers from sites that did not report issues; Group B consists of the Oki B432 printers from sites that did report printer issues. Finally, Table 1 reports the results from tests that used a print order of control slip and then ballot, the setting used during the general election.

³⁷ As noted, the Lexmark printers printed all ballots without problem, and the Oki B432 printers produced only one faulty ballot when using 80-pound paper. Because those tests did not help identify the source of printing problems, we excluded those results from the information set out in Attachments A and B and examined the factors that did affect or could have affected ballots printed on 100-pound paper. Attachment C includes all results from Oki B432 printers, including the results from testing ballots printed on 80-pound paper.

Table 1

	WH Seq	WH Int	CH Seq	CH Int	CH + Seq	CH + Int
19-inch Misreads						
Group A	0	0	0	0	18/250	6/125
Group B	9/250	27/125	8/250	13/125	17/250	17/125
20-inch Misreads						
Group A	14/250	2/125	6/250	20/125	2/250	9/125
Group B	67/250*	36/125	31/250	7/125	9/250	16/125
19-inch Percent Misreads						
Group A	0	0	0	0	7.2	4.8
Group B	3.6	21.6	3.2	10.4	6.8	13.6
20-inch Percent Misreads						
Group A	5.6	1.6	2.4	16	.8	7.2
Group B	26.8*	24	12.4	5.6	3.6	12.8

The test results indicate that the changes made to increase the media weight and to change the media type had some impact in reducing the number of faulty ballots, but in no instance did either change eliminate the problem. In some cases, the change in settings actually resulted in an increase in faulty ballots. The negative impact of the changes is evident in the results for the Group A printers: while both the change in media weight and media type reduced the number of errors for ballots printed sequentially, the errors for ballots printed using interval printing actually increased.

The changes in settings generally did improve the performance of the Group B printers, lending support to the possibility that the fusers on these printers were less likely than those in Group A to reach the heat level required to

cause the toner to adhere to the paper under warehouse setting conditions, thus making it more likely that changes to the heat setting would improve fuser performance.

The test results are consistent with reports from the vote centers on election day. Although initially the County and Runbeck believed that the change in settings had resolved, at least to a considerable degree, the issue with faulty ballots, the command center continued to receive reports of printers not operating correctly throughout election day, although the reports diminished from the volume reported in the morning.³⁸

Sequential and Interval Testing

We anticipated that the tests would reveal more misreads using interval printing, and for the most part that was true.³⁹ The numbers noted with an asterisk in Table 1 appear to have skewed the results for this small sample of printers. Printer 404 produced 44 of 50 misread ballots in the warehouse sequential setting, a result that may reflect a transfer of ink to the tabulator, causing subsequent misreads independent of the condition of the ballots being tested. The extreme result from that one printer tends to mask the fact that, for every other printer in both groups, the misreads in the warehouse interval setting exceeded the misreads in the warehouse sequential setting. See results in Attachment A.

The test results show that, for both groups of printers, using interval printing generally resulted in the printers producing a greater number of faulty ballots. As the results in Table 1 show, the increased misreads for Group B printers on the interval setting using 19-inch ballots are striking: from 3.6 percent on the warehouse sequential setting to 21.6 on the interval setting and from 3.2 percent on the change sequential setting to 10.4 on the change interval setting.⁴⁰

³⁸ Our review of the Election Reporting System summary reveals reports about print quality and misreads from at least 38 votes centers during the afternoon of election day.

³⁹ The exceptions occurred on the Group A warehouse sequential setting, although both numbers are relatively small, and the Group B change sequential setting.

⁴⁰ Another unexpected result involved the Group A 19-inch ballot results. That group of printers produced no misreads on 19-inch ballots, except for the printing done after changes were made to both media weight and media type. In this case, the changes, designed to improve printer success, actually resulted in a substantial number of failures.

Using only sequential testing thus tends to mask difficulties the printers can experience during field printing.

Printing Order

We also tested using the alternate order of printing used in the primary election, setting the printers to print first the ballot and then the control slip. Because we were testing only whether that change in order could have caused failures on election day, we limited our testing to warehouse and change settings. Table 2 summarizes those results, which are fully set out in Attachment B.

Table 2

Groups A and B Average Misreads: Ballot/Control Slip

	WH Seq	WH Int	CH Seq	CH Int
19-inch Misreads				
Group A	9/250	6/125	11/250	8/125
Group B	6/250	4/125	0/250	6/125
20-inch Misreads				
Group A	11/250	27/125	19/250	20/125
Group B	25/250	33/125	41/250	50/125
19-inch Percent Misreads				
Group A	3.6	4.8	4.4	6.4
Group B	2.4	3.2	0	4.8
20-inch Percent Misreads				
Group A	4.4	21.6	7.6	16.
Group B	10.	26.4	16.4	40.

Several differences in result are apparent. First, printing with the ballot first generally resulted in more faulty ballots in Group A, the printers from sites with no reported issues, when compared with printing the control slip first. The percent of misreads also tends to be greater overall in the ballot-first test, as compared with the control slip-first test, particularly with regard to interval printing. The results confirmed that the change in order for the general election is

not likely to have caused more printer failures in the general election and may actually have helped printer performance.

Paper Length

With relatively few exceptions, using 20-inch, 100-pound paper resulted in more failures than did using 19-inch, 100-pound paper. See Attachment A. For the Group A printers, for instance, no failures resulted from printing ballots on 19-inch paper in the warehouse sequential setting; 14 resulted from printing on 20-inch paper. The warehouse interval setting caused only two misreads in total, both of those on 20-inch paper. The change interval setting did show a significant difference, as it resulted in no misreads using 19-inch paper and 20 using 20-inch paper.

For the Group B printers, those from sites that experienced issues, ballots printed on the warehouse sequential setting on 19-inch paper resulted in nine misreads, while those on 20-inch paper resulted in 67. The results varied relatively little on the change interval setting: 13 on 19-inch paper and 18 on 20-inch paper.

Our tests revealed more misreads using a 20-inch ballot, across categories and in both groups of Oki B432 printers. These results are consistent with the suggestion that the fusers on some Oki printers could not maintain an adequate temperature. When heavier paper is used, the fuser heat dissipates more quickly. The impact of the heat variation becomes more pronounced as the length of the ballot and therefore the area of printing increases. The combined effect of the increased ballot length and 100-pound paper on the ability of the fuser to maintain optimum fusing temperature with stability helps explain the difference between the primary and general election results.⁴¹

Pattern of Printer Failures

During our interviews, we heard varying descriptions of the type of print failure seen on the misprinted ballots: some observers reported that the failure

⁴¹ Interview with Doug Meyer.

occurred only on the bottom of the first page printed, others that the problem was more widespread. To determine the pattern of print failure and consider whether that pattern helps explain the problems seen on election day, we conducted a visual examination of all the ballots rejected during our tests.⁴²

Our examination revealed that the poor fusing identified as the source of the misprints was not limited to one portion of the ballots: poor fusing produced misprints on the first side, second side, and both sides of affected ballots.⁴³ As noted above, the poor fusing causes toner to remain on the heat roller and become “offset,” or applied further down the page or on successive pages. As a result, many of the ballots also exhibited toner offset and toner misting. The extent of printing errors varied substantially. On some ballots, the printing failure is immediately obvious, even to the untrained eye. On others, only a close examination reveals the location and extent of the failure. These results are consistent with our conclusion that some Oki B432 printers did not initially reach the optimum temperature or did not maintain sufficient, consistent heat to allow proper printing of 20-inch ballots printed on 100-pound paper.

Testing for Faulty Printers

Although most of our test printers produced faulty ballots, it is important to keep in mind the fact that, on general election day, the large majority of Oki B432 printers performed well and produced few faulty ballots. Two-thirds of the general election vote centers reported no issues with misprinted ballots; approximately 94 percent of election day ballots were not faulty. In addition, none of the tested printers produced only faulty ballots.⁴⁴ In one sense, that fact speaks well of the general capability of the Oki B432 printer. In another, the variation among printers makes designing a test procedure sufficient to detect faulty printers more difficult.

One of the most striking findings in our tests involved the considerable differences among printers. At the extremes, one printer (Printer 406), printed

⁴² To maintain consistency of observation, only Doug Meyer and Barbara Meyer reviewed the ballots.

⁴³ Of the misprints, approximately 11 percent occurred just on the first side of the ballot, 47 percent on the second side of the ballot, and 42 percent on both sides of the ballot.

⁴⁴ As Attachment A sets out, the average misprints for the Group B printers for 20-inch ballots on the warehouse interval setting was 13 and on the change interval setting was 4, with misprints varying by printer from 0 to 13. For Group A, the averages are <1 and 4, respectively, with misprints varying by printer from 0 to 11.

850 ballots at all settings with only one misread ballot. Printer 491 did almost as well, with only 13 misread ballots. In contrast, Printer 404 produced 92 misread ballots and Printer 323 produced 72. All printers are the same model Oki printer; all were tested using the same settings and same paper; all the ballots were tabulated using the same model on-site tabulators.⁴⁵ The wide range of performance among printers makes random testing of these printers an unreliable predictor of the success of any particular printer.

If the County were to test a sufficient number of printers to be confident that the group tested is representative of the printers as a whole, the County would also need to define the level of performance deemed acceptable. In the 2022 general election, 6.7 percent of the ballots were placed in Door 3 for secure transport to and tabulation at the MCTEC.⁴⁶ That percent was substantially higher than the percent of ballots placed in Door 3 in recent prior elections.⁴⁷ Assuming for discussion that the percent of ballots placed in Door 3 approximates the percent of ballot misread due to printer failure, the question is whether a five or six percent printer failure rate is acceptable or whether a higher level of performance should be required.

Assuming also that all or at least a sufficient number of printers could be tested before being used in an election, our testing indicates that a substantial number of the Oki B432 printers would fail to meet a standard that requires a failure rate of five percent or less. Among the Group A printers, two (Printers 332 and 407) had failure rates exceeding five percent on the 20-inch warehouse sequential setting (10 percent and 16 percent, respectively), although both succeeded on the interval testing. Among the Group B printers, we found substantial levels of failure. Among the printers in that group, two had more than five percent failures when tested on the warehouse sequential setting: Printer 404, 88 percent failure on 20-inch ballots and Printer 323, with a ten percent

⁴⁵ The differences also cannot be explained by comparing total pages printed. The expected print-life for the Oki B432 printers is 100,000 pages; none of the printers exceeded 20,000 by the end of the 2022 election. Interview with Scott Jarrett.

⁴⁶ Although most of these ballots resulted from printer misprints, a misprinted ballot did not cause all those rejections. In any election, ballots can be rejected or otherwise placed in Door C for several reasons: the voter used a checkmark or an x rather than fill in the ballot balloon; the voter made ambiguous marks on the ballot; the printer printed the ballot as fit-to-page; or the tabulator did not function. Interview with Scott Jarrett.

⁴⁷ In the 2022 primary election, for instance, the percent was .6; in the 2020 general election 1.2 percent; in the 2018 general election .16 percent. Id.

failure rate on 19-inch ballots and a 34 percent failure rate on 20-inch ballots. Four printers in Group B failed on the warehouse interval test, using both 19 and 20-inch ballots. (Printer 215, failure rates of 28 percent on 19-inch and 48 percent on 20-inch; Printer 404, 28 percent on 19-inch and 40 percent on 20-inch; Printer 323, 40 percent on 19-inch and 36 percent on 20-inch; and 529, 12 percent on 19-inch and 20 percent on 20-inch.) As is apparent, even if the acceptable standard were set at ten percent, these printers would fail to meet the standard.

We printed 25 ballots for each interval test. That number of ballots was sufficient to identify the relatively high failure rate of four of the five test printers that came from vote centers with reported issues. Whether such testing is possible on a large scale and whether the County has sufficient printers to serve all vote centers if a decision is made that only printers that meet the adopted standard should be used are questions of policy.

Recommendations and Conclusions

We began this investigation understanding that, on general election day, some of Maricopa County's Ballot-on-Demand printers at a number of vote centers produced ballots that could not be read by the on-site tabulators. Our task was to define the potential cause or causes of that failure and to recommend steps to take to prevent a similar failure in future elections.

During our investigation, we spoke with multiple election workers who prepared for, participated in, and conducted a post-election analysis of election procedures. In addition to the printer tests we conducted, we questioned all those interviewed about their understanding of the causes of printer failures and asked for their recommendations for reducing or eliminating similar problems in future elections. I was impressed, as were other members of the investigative team, by the knowledge and dedication the election workers bring to their jobs and by their willingness to revise practices and procedures to prevent future issues.

Two factors proved to be of primary importance in explaining the Oki B432 printer failures that occurred during the general election but not the primary election: the increased length of the general election ballot, coupled with the use of 100-pound paper for the ballot. Maricopa County's experience during the primary election amply demonstrated that printing ballots on 100-pound paper

does not exceed the capacity of the Oki B432 printer. The experience during the general election tells us that, when 100-pound paper was coupled with a lengthier, 20-inch ballot, the task being asked of the Oki B432 printer simply exceeded the capacity of many, although clearly not all or even most, of the printers.⁴⁸ The combined effect of the heavy paper, longer ballot, and intermittent burst of print demand pushed the printers to perform at the very edge of or past their capability, so that any decrease in fuser performance in an individual printer could result in problems.⁴⁹ The distinct difference in performance from one printer to another suggests that the fuser on some of the printers is not capable of recovering quickly enough to maintain optimum fusing temperature during on-site interval printing.⁵⁰

The fuser inadequacy on some printers is not a problem easily remedied, as the fuser on the Oki B432 cannot be separately replaced.⁵¹ That problem is further exacerbated by the fact that the Oki B432 manufacturer, which has withdrawn from the North and South American markets, has established December 31, 2025 as the end of life for these printers, after which repair parts and consumables will no longer be manufactured.⁵² Any decision about remedial actions obviously must take these factors into account.

Our team has identified several approaches that, based on our findings, would eliminate or greatly reduce the printer problems experienced during the general election. All involve policy issues and considerations that are beyond the scope of this report.

One approach would be to return to using 80-pound paper for ballots. Both Maricopa County's past experience and our test of the printers demonstrate the ability of the Oki B432 printers to produce readable ballots using 80-pound paper, whether the ballot is 19 or 20 inches long.⁵³ Given the prior "SharpieGate" experience, however, whether that change can be made without reducing public

⁴⁸ According to the manufacturer's instructions, the Oki B432 should have been able to print the 20-inch ballots on 100-pound paper by using custom settings. Interview with IT manager.

⁴⁹ Interview with Doug Meyer.

⁵⁰ County and Runbeck employees, as well as Mr. Meyer, have extensive experience with Oki printers. None had experienced any issues with quality control in Oki printers, specifically with the fusers.

⁵¹ Interview with Doug Meyer.

⁵² Interview with Jeff Ellington.

⁵³ If the ballot were to exceed 20 inches, further stress testing would be required.

confidence is an issue for the Board of Supervisors, the Maricopa County Recorder's Office, and the MCED. Our test experience with the pens used during the 2022 general election and 80-pound paper suggests that bleed-through would not be a problem, although additional testing designed to evaluate that factor would be advantageous.

Another approach is to eliminate the use of on-site tabulators. Maricopa County could return to its earlier practice, and that used in half of Arizona's counties,⁵⁴ and transport the ballots from vote centers to the MCTEC for tabulation in the more powerful central count tabulators. During the 2022 general election, that procedure permitted tabulation of the misprinted ballots in Maricopa County.

Replacing the Oki B432 printers with other printers is another option that could eliminate or substantially reduce the printer issues seen during the general election. During our tests, the Lexmark printers used during the general election successfully printed the 20-inch ballots on 100-pound paper without requiring any adjustment to the printer warehouse settings. If the County decides that the Oki B432 printers cannot be relied upon during future elections, deciding whether making the required expenditure to purchase new printers is the best course presents another policy issue.

If the Oki B432 printers are retained for use in future elections, the MCED should undertake more robust stress testing of printers before sending them out to vote centers. Testing using interval printing and on-site tabulators rather than sequential printing and the central count tabulators would more fairly represent election day conditions than does the sequential printing used in the past, and doing so would detect more faulty printers. As noted above, however, given the substantial variation among printers, such testing would have to be conducted on a large scale to achieve confidence that faulty printers are detected.

Additional steps could be taken if the Oki B432 printers are retained for future use. We found that the change in weight and media settings reduced, but did not eliminate, the production of faulty ballots. Given that limitation in achieving better results, the County could determine that a certain level of ballot

⁵⁴ As noted earlier, Apache, Coconino, Gila, Mohave, Pima, Pinal, Santa Cruz, and Yavapai Counties transport ballots from vote centers to their central election offices for tabulating.

errors is acceptable and undertake efforts to better educate voters about the possibility of receiving a misprinted ballot and alternatives to on-site tabulation. The County also could provide additional training to poll workers so they could better anticipate the possibility of misprinted ballots and could better reassure voters that a ballot that cannot be read on-site will be stored securely and tabulated at the central facility.⁵⁵

I note one additional element that could affect vote center equipment. Several persons with whom we spoke reported that some sites have relatively limited power sources. Because limited power can affect the operation of all the equipment at a vote center, site assessment should include an assessment of the adequacy of the available power.

Finally, we were asked to determine whether the problems occurring on election day were the result of human error, procedural shortcomings, or equipment failure. Although separating related causes is always difficult, in my judgment, the primary cause of the election day failures was equipment failure. Despite the assurances of the manufacturer, many of the Oki B432 printers were not capable of reliably printing 20-inch ballots on 100-pound paper under election-day conditions.

Any failure in process or human error relates to a failure to anticipate and prepare for the printer failures experienced. But nothing we learned in our interviews or document reviews gave any clear indication that the problems should have been anticipated. MCED leadership and staff were uniformly confident that the general election would run smoothly, and there was reason for their confidence: the Oki B432 printers had performed reliably in the past, both in Maricopa County and elsewhere; the County's experience with 100-pound paper had been positive in the primary election; and the printer stress tests with 20-inch ballots on 100-pound paper revealed no problems.

As is often the case, hindsight allows us to define changes in process that might have prevented or alleviated the printer issues encountered. But while pre-election testing that used interval testing and on-site tabulators would have been

⁵⁵ The training materials for poll workers anticipate most issues that can occur during an election and provide steps to take to remedy the issues. The unanticipated nature of the printing problems encountered in 2022 explains the lack of training in how to respond to the issue.

more likely to detect the printer shortcomings, nothing in the County's past experience or that of the employees at Runbeck suggested such testing was needed. Similarly, had the County anticipated the printer issues that occurred, specific training of poll workers about how to respond to the issue could have reduced the amount of voter confusion and concern.

The problems encountered in the 2022 general election have identified issues affecting the printing and tabulation of vote center ballots. I trust that this analysis and that undertaken by the County will help to prevent similar problems from arising in future elections.

ATTACHMENT A

Printer Order: Control Slip/Ballot

Printer Groups A and B

Paper Weight: 100-pound

Ballot Length: 19 and 20-inch

Settings: WH, CH, CH+

WH:

Media Weight: Heavy for ballots; medium for control slip and envelopes

Media Type: Plain for all

CH:

Media Weight: Heavy for all

Media Type: Plain for all

CH+

Media Weight: Heavy for all

Media Type: Cardstock for ballots; plain for control slips and envelopes

Print Sequence: Sequential and Interval

Control Slip/Ballot: Group A: No Printer Fuser Issues Reported

Printer	WH Seq: Number and Misread	WH Seq: Per- cent Mis- read	WH Interval: Number and Misread	WH Int: Percent Misread	CH Seq: Number and Misread	CH Seq: Percent Misread	CH Int: Number and Misread	Ch Int: Percent Misread	Ch + Seq: Number and Misread	Ch+: Seq: Percent Misread	Ch+: Int: Number and Misread	Ch+ Int: Percent Misread	
332													
100/19	50/0	0	25/0	0	50/0	0	25/0	0	50/16	32	25/3	12	
100/20	50/5	10	25/0	0	50/3	6	25/1	4	50/2	4	25/2	8	
491													
100/19	50/0	0	25/0	0	50/0	0	25/0	0	50/1	2	25/0	0	
100/20	50/0	0	25/2	8	50/2	4	25/5	20	50/0	0	25/4	16	
407													
100/19	50/0	0	25/0		50/0	0	25/0	0	50/1	2	25/3	12	
100/20	50/8	16	25/0		50/1	2	25/11	44	50/0	0	25/2	8	
183													
100/19	50/0	0	25/0	0	50/0		25/0	0	50/0	0	25/0	0	
100/20	50/1	2	25/0	0	50/0		25/2	8	50/0	0	25/1	4	
406													
100/19	50/0	0	25/0	0	50/0	0	25/0	0	50/0	0	25/0	0	
100/20	50/0	0	25/0	0	50/0	0	25/1	4	50/0	0	25/0	0	
Total 19- inch	0/250		0/125		0/250		0/125		18/250		6/125		24/1125 2.13
Total 20- inch	6/250		2/125		6/250		20/125		2/250		9/125		45/1125 4.0
Ballots A 100-lb	500	14/50 0 2.8	250	2/250 .8	500	6/500 1.2	250	20/250 8.0	500	20/250 8.0	250	15/250 6.0	

Control Slip/Ballot: Group B: Fuser Issues Reported

Printer	WH Seq: Number and Misread	WH Seq: Percent Misread	WH Int: Number and Misread	WH Int: Percent Misread	Ch. Seq: Number and Misread	CH Seq: Percent Misread	CH Int: Number and Misread	CH Int: Percent Misread	Ch+ Seq: Number and Misread	Ch+ Seq: Percent Misread	Ch+ Int: Number and Misread	Ch+ Int: Percent Misread	
215													
100/19	50/0	0	25/7	28	50/2	4	25/3	12	50/7	14	25/5	20	
100/20	50/4	8	25/12	48	50/7	14	25/12	48	50/1	2	25/6	24	
404													
100/19	50/3	6	25/7	28	50/1	2	25/1	4	50/2	4	25/1	4	
100/20	50/44	88	25/10	40	50/20	40	25/1	4	50/1	2	25/1	4	
323													
100/19	50/5	10	25/10	40	50/5	10	25/9	36	50/8	16	25/2	8	
100/20	50/17	34	25/9	36	50/1	2	25/1	4	50/7	14	25/2	8	
408													
100/19	50/1	2	25/0	0	50/0	0	25/0	0	50/1	2	25/2	8	
100/20	50/0	0	25/0	0	50/0	0	25/2	8	50/0	0	25/2	8	
529													
100/19	50/9: fit to page	0	25/3	12	50/0	0	25/0	0	50/3	6	25/7	28	
100/20	50/2	4	25/5	20	50/3	6	25/4	16	50/1 One fit to page	0	25/5	20	
Total 19-inch	9/250		27/125		8/250		13/125		21/250		17/125		95/1125 8.44
Total 20-inch	67/250		36/125		31/250		19/125		9/250		16/125		178/1125 15.82
Ballots B 100- lb	500	76/500 15.2	250	63/250 25.2	500	39/500 7.8	250	32/250 12.8	500	30/500 6.0	250	33/250 13.2	
Total A and B	1,000	90/1000 9.0	500	65/500 13.0	1,000	45/1000 4.5	500	52/500 10.4	1,000	50/1000 5.0	500	48/500 9.6	

ATTACHMENT B

Printer Order: Ballot/Control Slip

Printer Groups A and B

Paper Weight: 100-pound

Ballot Length: 19 and 20-inch

Settings: WH, CH

WH:

Media Weight: Heavy for ballots; medium for control slip and envelopes

Media Type: Plain for all

CH:

Media Weight: Heavy for all

Media Type: Plain for all

Ballot/Control Slip: Group B: Fuser Issues Reported

Printer	WH Seq Number and Misreads	WH Seq: Percent Misreads	WH Int: Number and Misreads	WH Int: Percent Misreads	Ch. Seq: Number and Misreads	CH Seq: Percent Misreads	CH Int: Number and Misreads	CH Int: Percent Misreads	Total by 19 and 20-inch
215									
100/19	50/0	0	25/0	0	50/0	0	25/0	0	
100/20	50/7	14	25/3	12	50/17	34	25/6	24	
404									
100/19	50/1	2	25/2	4	50/0		25/2	8	
100/20	50/4	8	25/2	4	50/2	4	25/19 Toner fused to ballot	76	
323									
100/19	50/0	0	25/0	0	50/0	0	25/1	4	
100/20	50/8	16	25/3	12	50/7	14	25/8	32	
408									
100/19	50/5	10	25/1	4	50/0	0	25/0	0	
100/20	50/0	0	25/3	12	50/8	16	25/6	24	
529									
100/19	50/0	0	25/1	4	50/4	8	25/3	12	
100/20	50/1	2	25/22	88	50/7	14	25/11	44	
19-inch	5/250		12/125		4/250		6/125		27/750 3.6
20-inch	20/250		33/125		41/250		50/125		144/750 19.2
Ballots B 100- lb	500	25/500 5.0	250	45/250 18.0	500	45/500 9.0	250	56/250 22.4	
Total Ballots, B/CS	1000		500		1000		500		

ATTACHMENT C

All Printers and Groups

11
ALL PRINTERS

GROUP A		
Total Ballots	Total Failures	Total Percent Failure
50	0	0%
50	0	0%
375	51	14%
375	52	14%
50	0	0%
50	0	0%
375	1	0%
375	20	5%
50	0	0%
50	1	2%
375	6	2%
375	50	13%
50	0	0%
50	0	0%
375	0	0%
375	6	2%
50	0	0%
50	0	0%
375	0	0%
375	2	1%
50	0	0%
50	0	0%
375	24	6%
375	75	20%
50	0	0%
50	0	0%
375	20	5%
375	104	28%
50	0	0%
50	0	0%
375	36	10%
375	63	17%
50	0	0%
50	0	0%
375	10	3%
375	21	6%
50	0	0%
50	0	0%
375	21	6%
375	60	16%
8500	623	7%

GROUP B

GROUP B:		
Ballots	Failures	Percent
50	0	0%
50	0	0%
375	51	14%
375	52	14%
50	0	0%
50	0	0%
375	1	0%
375	20	5%
50	0	0%
50	1	2%
375	6	2%
375	50	13%
50	0	0%
50	0	0%
375	0	0%
375	6	2%
50	0	0%
50	0	0%
375	0	0%
375	2	1%
50	0	0%
50	0	0%
375	24	6%
375	75	20%
50	0	0%
50	0	0%
375	20	5%
375	104	28%
50	0	0%
50	0	0%
375	36	10%
375	63	17%
50	0	0%
50	0	0%
375	10	3%
375	21	6%
50	0	0%
50	0	0%
375	21	6%
375	60	16%
4250	434	10%

19" BALLOT

19" Ballot	Failures	Percent
50	0	0%
50	0	0%
375	51	14%
375	52	14%
50	0	0%
50	0	0%
375	1	0%
375	20	5%
50	0	0%
50	6	2%
375	6	2%
375	50	13%
50	0	0%
50	0	0%
375	0	0%
375	6	2%
50	0	0%
50	0	0%
375	0	0%
375	2	1%
50	0	0%
50	0	0%
375	24	6%
375	75	20%
50	0	0%
50	0	0%
375	20	5%
375	104	28%
50	0	0%
50	0	0%
375	36	10%
375	63	17%
50	0	0%
50	0	0%
375	10	3%
375	21	6%
50	0	0%
50	0	0%
375	21	6%
375	60	16%
4250	169	4%

20" BALLOT

20" Ballot	Failures	Percent
50	0	0%
50	0	0%
375	52	14%
375	52	14%
50	0	0%
50	0	0%
375	0	0%
375	20	5%
50	1	2%
50	1	2%
375	50	13%
50	0	0%
50	0	0%
375	0	0%
375	6	2%
50	0	0%
50	0	0%
375	0	0%
375	2	1%
50	0	0%
50	0	0%
375	0	0%
375	75	20%
50	0	0%
50	0	0%
375	104	28%
50	0	0%
50	0	0%
375	63	17%
50	0	0%
50	0	0%
375	21	6%
375	60	16%
4250	454	11%

80lb

80lb Ballot	Failures	Percent
50	0	0%
50	0	0%
375	51	14%
375	52	14%
50	0	0%
50	0	0%
375	1	0%
375	20	5%
50	0	0%
50	1	2%
375	6	2%
375	50	13%
50	0	0%
50	0	0%
375	0	0%
375	6	2%
50	0	0%
50	0	0%
375	0	0%
375	2	1%
50	0	0%
50	0	0%
375	24	6%
375	75	20%
50	0	0%
50	0	0%
375	20	5%
375	104	28%
50	0	0%
50	0	0%
375	36	10%
375	63	17%
50	0	0%
50	0	0%
375	10	3%
375	21	6%
50	0	0%
50	0	0%
375	21	6%
375	60	16%
1000	1	0%

100lb

100lb Ballot	Failures	Percent
375	51	14%
375	52	14%
375	1	0%
375	20	5%
375	6	2%
375	50	13%
375	0	0%
375	6	2%
375	0	0%
375	2	1%
375	24	6%
375	75	20%
375	20	5%
375	104	28%
375	36	10%
375	63	17%
375	10	3%
375	21	6%
375	21	6%
375	60	16%
7500	622	8%

Seq		
Seq Ballots	Failures	Percent
25	0	0%
25	0	0%
250	36	14%
250	24	10%
25	0	0%
25	0	0%
250	1	0%
250	3	1%
25	0	0%
25	1	4%
250	1	0%
250	23	9%
25	0	0%
25	0	0%
250	0	0%
250	1	0%
25	0	0%
25	0	0%
250	0	0%
250	1	0%
25	0	0%
25	0	0%
250	9	4%
250	36	14%
25	0	0%
25	0	0%
250	7	3%
250	71	28%
25	0	0%
25	0	0%
250	14	6%
250	40	16%
25	0	0%
25	0	0%
250	7	3%
250	8	3%
25	0	0%
25	0	0%
250	7	3%
250	13	5%
5500	303	6%

Int		
Int Ballots	Failures	Percent
25	0	0%
25	0	0%
125	15	12%
125	28	22%
25	0	0%
25	0	0%
125	0	0%
125	17	14%
25	0	0%
25	0	0%
125	5	4%
125	27	22%
25	0	0%
25	0	0%
125	0	0%
125	5	4%
25	0	0%
25	0	0%
125	0	0%
125	1	1%
25	0	0%
25	0	0%
125	15	12%
125	39	31%
25	0	0%
25	0	0%
125	13	10%
125	33	26%
25	0	0%
25	0	0%
125	22	18%
125	23	18%
25	0	0%
25	0	0%
125	3	2%
125	13	10%
25	0	0%
25	0	0%
125	14	11%
125	47	38%
3000	320	11%

Ballot/Control Slip		
Ballot	Failures	Percent
0	0	0%
0	0	0%
150	32	21%
150	39	26%
0	0	0%
0	0	0%
150	0	0%
150	7	5%
0	0	0%
0	0	0%
150	2	1%
150	28	19%
0	0	0%
0	0	0%
150	0	0%
150	2	1%
0	0	0%
0	0	0%
150	0	0%
150	1	1%
0	0	0%
0	0	0%
150	5	3%
150	27	18%
0	0	0%
0	0	0%
150	1	1%
150	26	17%
0	0	0%
0	0	0%
150	6	4%
150	17	11%
0	0	0%
0	0	0%
150	8	5%
150	41	27%
3000	275	9%

Control Slip/Ballot		
Ballot	Failures	Percent
50	0	0%
50	0	0%
225	19	8%
225	13	6%
50	0	0%
50	0	0%
225	1	0%
225	13	6%
50	0	0%
50	1	2%
225	4	2%
225	22	10%
50	0	0%
50	0	0%
225	0	0%
225	4	2%
50	0	0%
50	0	0%
225	0	0%
225	1	0%
50	0	0%
50	0	0%
225	24	11%
225	42	19%
50	0	0%
50	0	0%
225	15	7%
225	77	34%
50	0	0%
50	0	0%
225	35	16%
225	37	16%
50	0	0%
50	0	0%
225	4	2%
225	4	2%
50	0	0%
50	0	0%
225	13	6%
225	19	8%
5500	348	6%