

Section	Text	Rebuttal
	Pg 1 - "Applying the analysis required by Rochkind v. Stevenson, 471 Md. 1 (2020), we conclude that the examiner should not have been permitted to offer an unqualified opinion that the crime scene bullets were fired from Mr. Abruquah's gun."	<p>The Court does not further specify what is meant by an "unqualified opinion". Based on a common sense reading of this, it could be inferred that this qualification would point to the certitude of McVeigh's opinion, which should have been a source for cross examination as Justice Gould points out in dissent.</p> <p>A study involving juries and doctors' testimony concluded "This research demonstrates that the phrase 'consistent with' can be interpreted in a variety of ways: caution is therefore required when using this expression in legal proceedings. Further research regarding the best choice of terms to use in court is required."¹</p>
A1	Pg 11-Variou references to unigue	<p>Current professional guidance, such as the OSAC Draft ROC² as well as DOJ ULTR³ provide even more explicit qualifications/limitations.</p> <p>The fact that the Court starts with the recapitulation of their current understanding of the field with discussions of uniqueness, which is an impossible thing to prove, suggests that they have a fundamental misunderstanding of the current state of firearm and toolmark examination.</p>
A1	Pg 11- "As a forensic technique to identify a particular firearm as the source of a particular ammunition component, firearms identification is based on the premise that no two	<p>The AFTE theory⁴ states "...that the likelihood that another tool could have made the mark is so remote as to be considered a practical impossibility". It is possible that "likelihood" is being misinterpreted as being a function of statistics, when in fact it should be interpreted as "opportunity" as has been demonstrated by the</p>

¹ Ross R, Kramer K, Martire KA. Consistent with: what doctors say and jurors hear. Australian Journal of Forensic Sciences. 2019; 51(1):695-704.

² OSAC Firearm and Toolmarks Subcommittee. "Standard Scale of Source Conclusions and Criteria for Toolmark Examinations." Available at https://www.nist.gov/system/files/documents/2020/03/24/100_fatm_roc_and_criteria_standard_asb_mar2019_OSAC%20Proposed.pdf.

³ Department of Justice. "Uniform Language for Testimony and Reports for the Forensic Firearms/Toolmarks Discipline Pattern Examination." August 2023. Available at https://www.justice.gov/d9/2023-05/firearms_pattern_examination_ultr_5.18.23.pdf.

⁴ "Theory of Identification as it Relates to Toolmarks: Revised" AFTE Journal. Fall 2011. 43(4). Pg. 287.

	firearms will make identical marks on a bullet or cartridge case”	<p>plethora of consecutively manufactured studies.⁵</p> <p>The AFTE theory describes “another” meaning a singular, random comparison. It does not describe an intercomparison of all firearms to each other. This is a subtle yet important distinction. DNA random match probabilities use similar language, which provides the probability of a coincidental match to a singular, unknown individual and does not describe the probability of a match occurring to all individuals.</p> <p>To reiterate, it is important to note that the term “likelihood” is not being used as a function of statistics, it should be interpreted as synonymous with “opportunity.”</p>
B	Pgs 14-15, Footnote 9 “An alternative to the AFTE method is the “consecutive matching striae method of toolmark analysis” (“CMS”)... Proponents of the CMS method argue that it has a	The Court leans on CMS as a possible objective manner for determining an identification; however, the CMS approach is reliant on the underlying pattern matching method to identify consecutive matching striae. Therefore, unsurprisingly, from those who reported using CMS, there has been no indication that this supplemental method is

⁵ The following list is not all-inclusive: Biasotti AA. Rifling Methods - A Review and Assessment of the Individual Characteristics Produced. AFTE Journal. 1981;13(3):34–61; Borwn CG, Bryant WW. Consecutively Rifled Gun Barrels Present in Most Crime Labs. AFTE Journal. 1995 Jul;27(3):354–8; Brundage DJ. The Identification of Consecutively Rifled Gun Barrels. AFTE Journal. 1998;30(3):438–44; Coody AC. Consecutively Manufactured Ruger P-89 Slides. AFTE Journal. 2003;35(2):157–60; Freeman RA. Consecutively Rifled Polygon Barrels. AFTE Journal. 1978;10(2):40–2; Hamby JE, Brundage DJ, Thorpe JW. The Identification of Bullets Fired from 10 Consecutively Rifled 9mm Ruger Pistol Barrels: A Research Project Involving 507 Participants from 20 Countries. AFTE Journal. 2009;41(2):99–110; Hamby JE. The examination of bullets fired from 10 consecutively manufactured 9 mm barrels — A project involving 502 participants from 20 countries. Science & Justice. 2010 Mar;50(1):30; LaPorte D. An Empirical and Validation Study of Breechface Marks on .380 ACP Caliber Cartridge Cases Fired from Ten Consecutively Finished Hi-Point Model C9 Pistols. AFTE Journal. 2011;43(4):303–9; Lopez LL, Grew S. Consecutively Machined Ruger Bolt Faces. AFTE Journal. 2000;32(1):19–24; Lutz MC. Consecutive Revolver Barrels. AFTE Journal. 1970;2(9):24–8; Lyons DJ. The Identification of Consecutively Manufactured Extractors. AFTE Journal. 2009;41(3):246–56; Matty W. Raven 25 Automatic Pistol Breech Face Tool Marks. AFTE Journal. 1984;16(3):57–60; Matty W, Johnson TD. A Comparison of Manufacturing Marks on Smith & Wesson Firing Pins. AFTE Journal. 1984;16(3):51–6; Miller J. An Examination of Two Consecutively Rifled Barrels and a Review of the Literature. AFTE Journal. 2000;32(3):259–70; Monkres J, Luckie C, Petraco NDK, Miliam A. Comparison and Statistical Analysis of Land Impressions from Consecutively Rifled Barrels. AFTE Journal. 2013;45(1):3–20; Skolrood RW. Comparison of Bullets Fired from Consecutively Rifled Coeey. 22 Calibre Barrels. Canadian Society of Forensic Science Journal. 1975;8(2):49–52; Weller TJ, Zheng A, Thompson R, Tulleners F. Confocal microscopy analysis of breech face marks on fired cartridge cases from 10 consecutively manufactured pistol slides. Journal of Forensic Sciences. 2012 Jul;57(4):912–7; Yalçın Sarıbey A, Grace Hannam A. Comparison of the Class and Individual Characteristics of Turkish 7.65 mm Browning/.32 Automatic Caliber Self-Loading Pistols with Consecutive Serial Numbers. Journal of Forensic Sciences. 2013 Jan 1;58(1):146–50.

	“greater degree of objective certainty” than other methods...”	<p>less error prone than the existing pattern matching method.</p> <p>Additionally, several studies^{6,7} have compared examiners that report using CMS vs those who do not. In both studies, the conclusion was that the two groups showed no difference in the number of false positives. Therefore, current research does not indicate CMS or pattern matching provides superior accuracy.</p>
B	Pg 17 “However, the advent of Daubert, work exposing the unreliability of other previously accepted forensic techniques... ”	<p>The Court cites only one example, that being comparative bullet lead analysis (CBLA). To our knowledge, this technique was used by only one laboratory⁸ in the country. That laboratory, the FBI, sought external review of the technique by the National Academy of Sciences and voluntarily discontinued its use in casework in 2005. We note the stark contrast of CBLA to firearm and toolmark examination, which is currently practiced in over 200 laboratories in the United States as numerous international countries.^{9,10}</p> <p>The only similarity between CBLA and the discipline of Firearm/Toolmark examination is that they involve bullet evidence. Conflating the two, indicates a lack of understanding or miscommunication regarding the principles supporting them.</p>

⁶ Fadul, T.G., Hernandez, G.A., Stoiloff, S., and S. Gulati. “An empirical study to improve the scientific foundation of forensic firearm and tool mark identification utilizing consecutively manufactured Glock EBIS barrels with the same EBIS pattern.” National Institute of Justice Grant #2010-DN-BX-K269, December 2013.

⁷ Bajic S, Chumley S, Morris M, Zamzow D, “Report: Validation Study of the Accuracy, Repeatability, and Reproducibility of Firearm Comparisons” October 2020, Ames Laboratory-USDOE Technical Report # ISTR-5220. .

⁸ “Forensic Science Reform” Ch 1, Academic Press 2017, ISBN 9780128027196, pgs 1-23
“Compositional bullet lead analysis (CBLA) was a method used **solely** in the US by the FBI Laboratory to compare the content of bullet lead and make an attribution of source (manufacturer, production unit, box of bullets).”

⁹ Searching the ANSI National Accreditation Board (ANAB) found 209 laboratories with active accreditations that include “Firearms and Toolmarks” as a part of the laboratories’ accreditation scope. Search conducted on September 1, 2023.

¹⁰ International practice includes members from the following international countries: Australia, Austria, Bahamas, Barbados, Belgium, Bosnia & Herzegovina, Botswana, Canada, Chile, China, Czech Republic, Deutschland (Germany), Dominican Republic, England, France, Germany, Greece, Hong Kong, Iceland, Ireland, Israel, Italy, Jamaica, Japan, Kingdom of Saudi Arabia, Mexico, Northern Ireland, Netherlands, New Zealand, Norway, Pakistan, Philippines, Puerto Rico, Qatar, Republic of Belarus, Russian Federation, Singapore, South Africa, St. Croix, Sweden, Trinidad, Uganda, Ukraine, United Arab Emirates, United Kingdom.

		It should be noted that the science utilized for CBLA was given full support by the 2004 NAS Report ¹¹ and the committee did not recommend the FBI Laboratory discontinue the examination.
B	Pgs 17 to 19, starting with: "Reports issued since 2008 by two blue-ribbon groups of experts outside of the firearms and toolmark identification field have been critical of the AFTE Theory."	The Court's summaries of the two National Academy of Sciences (NAS) reports leaves a reader with an impression that the reports are <i>only</i> critical of firearms and toolmarks. The Court's summaries are missing context and thus are misleading. The purpose of the 2008 report was to assess the feasibility of building a nation-wide database of images in which test fires from all new and imported firearms were to be entered. ¹² Additionally the 2008 report states, in multiple locations, that the committee did not conduct an overall validity assessment of firearm and toolmark examination. ^{13,14} The 2009 committee's task is stated in the report's <i>subtitle</i>

¹¹ National Research Council. 2004. Forensic Analysis: Weighing Bullet Lead Evidence. Washington, DC: The National Academies Press. <https://doi.org/10.17226/10924>.

¹² "Ballistic Imaging" National Research Council, National Academies Press, 2008 ("2008 NAS"), pg 2 "...the panel's charge is to: (1) Assess the technical feasibility, through analysis of the uniqueness of ballistic images, the ability of imaging systems to capture unique characteristics and to parameterize them, the algorithmic and computational challenges of an imaging database, the reproducibility of ballistic impressions and the ability of imaging systems to extract reproducible information from ballistic impressions. (2) Assess the statistical probabilities that ballistics evidence presented would lead to a match with images captured in a database, whether and how the base rate can be estimated for those crimes that present bullet or casing evidence that do in fact come from a gun that produced a database entry, and the probabilities and consequences of false positives and false negatives. (3) Assess the operational utility of ballistics evidence in criminal investigations—that is the extent to which it is used or can be used to identify crime guns and suspects and to solve specific crimes. (4) Assess the sources of error in ballistics database matching (from examination, digitization, computer matching, chain of custody and documentation of tests, and expert confirmation), how they may be quantified, and how these errors interact."

¹³ 2008 NAS:, pg 3 "Notwithstanding this finding, we accept a minimal baseline standard regarding ballistics evidence. Although they are subject to numerous sources of variability, firearms-related toolmarks are not completely random and volatile; one can find similar marks on bullets and cartridge cases from the same gun... We also note that the committee does not provide an overall assessment of firearms identification as a discipline nor does it advise on the admissibility of firearms-related toolmark evidence in legal proceedings: these topics are not within its charge."

¹⁴ NAS 2008 pg 18, Section 1-A.2. "Limitations: What the Committee Study Does *Not* Do" "First, and most significantly, *this study is neither a verdict on the uniqueness of firearms-related toolmarks generally nor an assessment of the validity of firearms identification as a discipline.* Our charge is to focus on "the uniqueness of ballistic images"—that is, on the uniqueness and reproducibility of the markings (toolmarks) left on cartridge cases and bullets as they are recorded or measured by various technologies." (emphasis by original authors)

Pg 19: "From this perspective, some may argue that our narrow focus on the uniqueness of ballistic images amounts to missing the proverbial elephant standing in the room: that is, we should extend any conclusions on the strength or weakness of ballistic image evidence to infer the strength or weakness of ballistic toolmark evidence more globally. **We reiterate that no such broader conclusion is intended by this report, which was not developed to support more sweeping statements.**" (emphasis added)

		of the report “A Path Forward”, meaning the primary purpose of the report was to advise congress on policy and where forensic science can be improved moving forward. ¹⁵ These suggestions included recognizing the importance of accreditation, certification, and national standards; all principles with which AFTE agrees. In other words, the Report was a general evaluation of the state of all forensic sciences in the U.S. and in recognition of this, the 2009 committee made the limitations of their own report clear and while it expressed some critiques of firearm and toolmark examination, the report also did find some merit. ^{16,17}
B	Pgs 19 to 21, starting with:“In 2016, the President’s Council of Advisors on Science and Technology (“PCAST”)...”	The Court turns its attention to the PCAST report. While increased funding, transparency, and improvement are always welcome in science, the PCAST report is fraught with problems. The American Congress of Forensic Science Laboratories, ¹⁸ The American Society of Crime

¹⁵ National Research Council of the National Academies “Strengthening Forensic Science In the United States: A Path Forward” The National Academies Press, Washington DC, 2009 (“2009 NAS”) Pg xix: “In adopting this report, **the aim of our committee is to chart an agenda for progress in the forensic science** community and its scientific disciplines.” (emphasis added)

¹⁶ 2009 NAS report at pg 7: “The committee decided early in its work that **it would not be feasible to develop a detailed evaluation of each discipline** in terms of its scientific underpinning, level of development, and ability to provide evidence to address the major types of questions raised in criminal prosecutions and civil litigation” (emphasis added)

¹⁷ 2009 NAS report at pg 154: “The committee agrees that class characteristics are helpful in narrowing the pool of tools that may have left a distinctive mark. **Individual patterns from manufacture or from wear might, in some cases, be distinctive enough to suggest one particular source**, but additional studies should be performed to make the process of individualization more precise and repeatable.” (emphasis added)

¹⁸ The American Congress of Forensic Science Laboratories “Position Statement” September 21, 2016. Available at

<https://www.crime-scene-investigator.net/PDF/american-congress-of-forensic-science-laboratories-respon-se-to-forensic-science-in-federal-criminal-courts-ensuring-scientific-validity-of-pattern-comparison-metho.pdf> “[The PCAST report] was born of an imbalanced and inexperienced working group whose make-up included no forensic practitioners nor any other professionals with demonstrated experience in the practice of forensic science. The Chair of the aforementioned working group, Eric Lander, sits on the Board of Directors of the Innocence Project, a legal-activism group that has itself been publicly criticized on numerous occasions(including within peer reviewed literature) for the unfairness of its public statements and the conflicts of interest that have long called into question its motives.”

		Laboratory Directors, ¹⁹ the Department of Justice, ²⁰ and others have released statements discussing these shortcomings.
B	Pg 20- "PCAST described the AFTE Theory as a 'circular' method that lacks 'foundational validity' because appropriate studies had not confirmed its accuracy, repeatability, and reproducibility."	The PCAST report states the AFTE theory is circular, however it mischaracterizes, does not understand, or omits the basis for an examiner's identification conclusion. ²¹ The AFTE theory does not define sufficient agreement as stated by the PCAST report. Instead sufficient agreement is grounded in the purposeful comparison of both known matching (same-source) and known non-matching (different source) samples. ²² Through this experience examiners learn the observable differences between same-source and different-source comparisons. When reframed in this light, the supposed circularity fails to hold water. The "common origin" conclusion is based on "sufficient agreement" of objectively present microscopic toolmarks observed by the examiner. PCAST appears to have gotten hung up on the statement regarding the likelihood of a "practical impossibility", believing that it was the examiner who makes this determination. In reality the

¹⁹ The American Society of Crime Laboratory Directors, "Statement on September 20, 2016 PCAST Report on Forensic Science" September 30, 2016 Available at <https://pceinc.org/wp-content/uploads/2016/10/20160930-Statement-on-PCAST-Report-ASCLD.pdf> "ASCLD does not agree, however, that black box studies are the singular method through which to judge an entire forensic discipline's reliability. ASCLD does not dispute that the proposed methodologies incorporated in the report are highly aspirational and rigorous; however, ASCLD is concerned that a one-size-fits-all approach is not always appropriate due to the specific research needs and unique evidence sample traits of each discipline."

²⁰ United States Department of Justice, "United States Department of Justice Statement on the PCAST Report: Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods" Available at <https://www.justice.gov/media/1116366/dl?inline=> "Unfortunately, the PCAST Report contained several fundamentally incorrect claims. Among these are: 1) that traditional forensic pattern comparison disciplines, as currently practiced, are part of the scientific field of metrology; 2) that the validation of pattern comparison methods can only be accomplished by strict adherence to a non-severable set of experimental design criteria; and 3) that error rates for forensic pattern comparison methods can only be established through "appropriately designed" black box studies."

Pg 4- "Conclusions offered by examiners in the traditional forensic pattern disciplines are not expressed or reported as a measurement or a magnitude. To the contrary, the ULTRs specifically describe the nominal nature of the conclusions offered, along with restrictions on the use of certain terms that might otherwise imply reliance on measurement or statistics."

²¹ PCAST report at pg 60 "More importantly, the stated method is circular. It declares that an examiner may state that two toolmarks have a "common origin" when their features are in "sufficient agreement." It then defines "sufficient agreement" as occurring when the examiner considers it a "practical impossibility" that the toolmarks have different origins."

²² "Theory of Identification as it Relates to Toolmarks: Revised" AFTE Journal. Fall 2011. 43(4). Pg. 287: "Agreement is significant when the agreement in individual characteristics exceeds the best agreement demonstrated between toolmarks known to have been produced by different tools and is consistent with agreement demonstrated by toolmarks known to have been produced by the same tool."

		<p>“likelihood” is determined by numerous studies, which include consecutively manufactured studies that have shown tools made consecutively bear sufficient differences (in non-matching samples) to correctly attribute the similarities to their source.</p> <p>An unpublished draft of the PCAST report initially found firearm and toolmark identification to have tentatively demonstrated its “foundational validity” with the reviewed studies²³; however the final PCAST report found firearm and toolmark identification to lack “foundational validity.” The final report suggested the field only needed one additional study to achieve “foundational validity,” a fact reiterated by PCAST co-chair in a published article.²⁴ In 2023, with multiple “black box” studies now published, firearm and toolmarks has far surpassed PCAST’s criteria for “foundational validity.”</p> <p>We also note that PCAST created the term “foundational validity”. This fact was noted by the minority dissention, “...PCAST apparently created the term “foundational validity” as used in this context; the term began to appear in court opinions only after PCAST was published”²⁵ “Foundational validity” is not a legal standard, nor does it represent scientific consensus. It’s a threshold (which has now been met by the firearm and toolmark discipline) derived by an advisory committee.</p>
B	Pg 21- “PCAST observed that that study, which we discuss below, was not published in a scientific journal, had not been	This study has since been peer reviewed and published ²⁶ and is substantially the same, with the same false positive error rate and raw counts of identification, inconclusive, and elimination

²³ President’s Council of Advisors on Science and Technology. DRAFT v 58, Report on Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods. Washington, D.C.: Executive Office of the President; June 24, 2016.

²⁴ Lander ES “Fixing Rule 702: The PCAST Report and Steps to Ensure The Reliability of Forensic Feature-Comparison Methods in the Criminal Courts”; pg 1672: “With only a single well-designed study estimating accuracy, PCAST judged that firearms analysis fell just short of the criteria for scientific validity, which requires reproducibility. A second study would solve this problem.”

²⁵ Abruquah v Maryland, Dissenting opinion by J. Gould; pg 7.

²⁶ Baldwin DP, Bajic SJ, Morris MD, Zamzow DS. A study of examiner accuracy in cartridge case comparisons. Part 1: Examiner error rates. Forensic Science International. 2023 Aug 1;349:111733; and Baldwin DP, Bajic SJ, Morris MD, Zamzow DS. A study of examiner accuracy in cartridge case comparisons. Part 2: Examiner use of the AFTE range of conclusions. Forensic Science International. 2023 Aug 1;349:111739.

	<p>subjected to peer review, and stood alone. PCAST therefore concluded that “firearms analysis currently falls short of the criteria for foundational validity” and called for additional testing.”</p>	<p>conclusions. Additionally, multiple other “black-box” studies have since been published and all share a similarly low error rate, thus fulfilling the arbitrary PCAST threshold for “foundational validity.”</p>
<p>C</p>	<p>Pg 21- “the studies on which the State relies are flawed and were properly discounted by the NRC and PCAST, that even the best studies present artificially low error rates by treating inconclusive findings as correct, and that the most recent and authoritative study reveals “shockingly” low rates of repeatability and reproducibility.”</p>	<p>PCAST did not <i>fully</i> discount early studies: “The early studies indicate that examiners can, under some circumstances, associate ammunition with the gun from which it was fired.”²⁷ Instead, the PCAST committee concluded that the “set-to-set” design underestimated the false positive rate.²⁸ However, this is an overly simple view of the cause of and rate of false positives. For example, the 2018 Keisler et al. study, which is a “black box” (open, sample-to-sample comparisons) study had no false positives.</p> <p>PCAST recommends inconclusives be removed from false positive rate calculations (and not be counted as errors), however the report also states that including inconclusives in the denominator is of scientific interest.²⁹ The report provides false positive rates using inconclusives in the denominator. See PCAST footnote numbers 276, 280, and 334 for examples.</p> <p>PCAST was aware of the latent prints’ reproducibility and repeatability performance which is also imperfect, and similar to firearms’ performance.³⁰ PCAST is highly complementary³¹ of the latent print repeatability and reproducibility paper, and considered it when it concluded that latent prints are “foundationally valid.”</p>

²⁷ PCAST pg 111

²⁸ PCAST pg 111 “However, as described above, most of these studies involved designs that are not appropriate for assessing the scientific validity or estimating the reliability of the method as practiced. Indeed, comparison of the studies suggests that, because of their design, many frequently cited studies seriously underestimate the false positive rate.”

²⁹ PCAST pg 153 “For many forensic tests, examiners may reach a conclusion (e.g., match or no match) or declare that the test is inconclusive. SEN and FPR can thus be calculated based on the conclusive examinations or on all examinations. **While both rates are of interest, from a scientific standpoint, the former rate should be used for reporting FPR to a jury.**” (emphasis added)

³⁰ PCAST report, footnote 296 cites Ulery et al. In this paper, repeatability ranges from 92% to 69%, while reproducibility ranges from 85% to 50%.

³¹ PCAST report at pg 99 “Among work on subjective feature-comparison methods, this series of papers is unique in its breadth, rigor and willingness to explore challenging issues. We could find no similarly self-reflective analyses for other subjective disciplines.”

C	Pg 23- “The NRC and PCAST criticize such studies as not being representative of casework because, among other reasons: (1) examiners are aware they are being tested; (2) a correct match exists within the set for every sample, which the examiners also know; and (3) the use of consecutively manufactured firearms (or barrels) in a closed-set study has the effect of eliminating any confusion concerning whether particular patterns or marks constitute subclass or individual characteristics.”	In fact, often in casework, the evidence evaluated is of a closed- or partially open-set process. Open-set, sample-to-sample designs as lauded by PCAST are good for calculating a forced binary error rate, but are not representative of casework. In these studies, each comparison is pre-prescribed by the test provider. By contrast, in set-to-set design, which inter-comparisons are necessary and the result of each, is decided and tracked by each test-taker. According to a recent study, ³² even when tests are blinded, the error rate is low (none were detected in this study) and inconclusive decisions still occur. Consecutively manufactured studies do not eliminate confusion regarding whether toolmarks are subclass or individual; rather they increase the possibility that subclass characteristics are present and require the participant to discern subclass from individual characteristics.
C	Pg 27-28- “The authors viewed these percentages favorably, concluding that this level of ‘observed agreement’ exceeded the level of their ‘expected agreement.’... They did so, however, based on an expected level of agreement reflecting the overall pattern of results from the first phase of testing. In other words, the metric against which the authors gauged repeatability was, in essence, random chance.”	The Court’s understanding of observed versus expected agreement is incorrect. The observed vs expected metric is not based on random chance. In the Bajic paper, examiners had 6 possible categories to choose for each test set: Identification, Inc-A, Inc-B, Inc C, Elimination, and Unsuitable. If selections by examiners were truly random chance, then each category would be selected 1 out of six times (16.7%). The <i>overall</i> agreement for each repeatability and reproducibility in Bajic et al. far exceeds “random chance. Rather than relying upon an arbitrary threshold of what repeatability or reproducibility should be, the Bajic authors (see Appendix H), the authors’ created contingency tables for each examiner and calculated observed vs expected results for each. ³³ Thus, the plotted results are based on what can be expected from each

³² Neuman M, Hundl C, Grimaldi A, Eudaley D, Stein D, Stout P. Blind testing in firearms: Preliminary results from a blind quality control program. *Journal of Forensic Sciences*. 2022;67(3):964–74.

³³ The amount of exact agreement between two examinations and what is “good enough” is not, to our understanding, a defined quantity. This depends on many factors, such as the number of categories used, the samples being compared, the type of examination being conducted, the technique being performed, etc. This is why Bajic et al. as well as Monson et al. instead calculated the amount of agreement observed vs. expected which is based on each examiner’s individual performance. Using this statistically grounded metric, the result is that the observed exceeds the expected each time, meaning there is consistently better agreement between an examiner’s own two repeated comparisons as well as between two different examiners than what would be expected by chance, as determined by each examiner’s own accuracy.

		<p>examiners' <i>individual accuracy</i>. For more detailed discussion on this complicated statistical analysis, we propose the Court read section 2.2 of the Dr. Max Morris' article that directly addresses the Bajic et al. study.³⁴</p> <p>We also note the Reproducibility and Repeatability data from this study has been published in a peer reviewed scientific journal.³⁵ As reported by Monson et al. some disagreement is less meaningful/inconsequential. Take for example when the first examination results in "Inc B" and the second "Inc C": both results are 'inconclusive' but these differences still count against overall agreement. As noted in Monson et al, reversals of definitive conclusions (i.e. ID to Elim or vice versa) were rare. See Tables 3 and 5 from Monson et al.</p> <p>Finally, we point readers toward the dissenting opinion by Gould, who's analysis follows what happens when first round results are re-examined. The analysis shows re-examination is likely to agree with ground truth and discover meaningful error (i.e. false positives). This analysis provides further evidence that the Bajic et al./Monson et al. data scientifically supports firearm and toolmark examination, rather than undermining it.</p>
D1	Critiques of Mr. Tobin: "firearms identification is "not a science," does not follow the scientific method, and is circular"	See pages 6-7 of this document.
D1	"The AFTE Theory is wholly subjective and lacks any	Subjectivity does not invalidate a scientific field. ³⁶ In fact, the AFTE Theory has been accepted by

³⁴ Morris MD, "Comments on: A Re-analysis of Repeatability and Reproducibility in the Ames-USDOE-FBI Study, by Dorfman and Valliant" Stats and Public Policy, 2023 VOL. 10, NO. 1, 2188069: From Section 2.2 "Suppose that in a particular situation, an examiner's error rate for a specific kind of material (i.e., ground-truth) is 0.05, and that her judgements from call-to-call of the same material are independent. In this case, in two evaluations of the same evidence, she would "agree with herself" $0.052+0.952=90.5\%$ of the time; this is the value of both PE and PO for this examiner. But she's not "guessing" in any reasonable sense of the word; she's right 95% of the time in her evaluations of this kind of material, regardless of the mix of material she's asked to evaluate."

³⁵ Monson et al. "Repeatability and reproducibility of comparison decisions by firearms examiners" Journal For. Sci. 68(5) pg 1721-1740. <https://doi.org/10.1111/1556-4029.15318>.

³⁶ Evett IW. Expert evidence and forensic misconceptions of the nature of exact science. Science & Justice. 1996 Apr 1;36(2):118–22.

	<p>guidance for examiners to determine the number of similarities needed to achieve an identification”</p>	<p>the relevant scientific community and by courts, and supported by numerous studies, for more than a century.³⁷ The phrase “wholly subjective” would imply conclusions are reached without objective data to support them. The growing body of knowledge in this field would suggest otherwise.³⁸ Furthermore, the AFTE Theory of Identification is applied in 2 stages - first with an examination of class characteristics, proceeding to the second stage only if these features are in agreement. The second stage is an evaluation of the individual characteristics which concludes with an interpretation of the sufficiency of the agreement. Much of this examination is objective, such as measuring class characteristics, observing the presence of individual characteristics. The interpretation of one's</p>
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³⁷ Association of Firearm and Tool Mark Examiners. “SWGUN and AFTE Committee for the Advancement of the Science of Firearm and Toolmark Identification’s response to 25 foundational firearm and toolmark examination questions received from the Subcommittee on Forensic Science (SoFS), Research, Development, Testing, & Evaluation Interagency Working Group (RDT&E IWG) on April 18, 2011.” June 14, 2011. Available at: <https://afte.org/uploads/documents/position-rdte-iwg-2011.pdf>

³⁸ Some examples include: Baiker-Sørensen M, Alberink I, Granell LB, van der Ham L, Mattijssen EJAT, Smith ED, et al. Automated interpretation of comparison scores for firearm toolmarks on cartridge case primers. *Forensic Science International*. 2023 Dec 1;353:111858; Dong F, Zhao Y, Luo Y, Zhang W, Li Y. Objective evaluation of similarity scores derived by Evofinder® system for marks on bullets fired from Chinese Norinco QSZ-92 pistols. *Forensic Sciences Research*. 2022;7(1):40–6; Mattijssen EJAT, Witteman CLM, Berger CEH, Zheng XA, Soons JA, Stoel RD. Firearm examination: Examiner judgments and computer-based comparisons. *Journal of Forensic Sciences*. 2021;66(1):96–111; Law EF, Morris KB. Three-Dimensional Analysis of Cartridge Case Double-Casts. *Journal of Forensic Sciences*. 2020;65(6):1945–53; Roberge D, Beauchamp A, Lévesque S. Objective Identification of Bullets Based on 3D Pattern Matching and Line Counting Scores. *Int J Patt Recogn Artif Intell*. 2019 Feb 19;33(11):1940021; McClarin DS. Adding an Objective Component to Routine Casework: Use of Confocal Microscopy for the Analysis of 9mm Caliber Bullets. *AFTE Journal*. 2015;47(3):161–70; Baiker M, Keereweer I, Pieterman R, Vermeij E, van der Weerd J, Zoon P. Quantitative comparison of striated toolmarks. *Forensic Sci Int*. 2014 Sep;242:186–99; Petraco NDK, Shenkin P, Speir J, Diaczuk P, Pizzola PA, Gambino C, et al. Addressing the National Academy of Sciences’ Challenge: A Method for Statistical Pattern Comparison of Striated Tool Marks. *J Forensic Sci*. 2012;57(4):900–11; Weller TJ, Zheng A, Thompson R, Tulleners F. Confocal microscopy analysis of breech face marks on fired cartridge cases from 10 consecutively manufactured pistol slides. *J Forensic Sci*. 2012 Jul;57(4):912–7; Gambino C, McLaughlin P, Kuo L, Kammerman F, Shenkin P, Diaczuk P, et al. Forensic surface metrology: tool mark evidence. *Scanning*. 2011 Oct;33(5):272–8; Senin N, Groppetti R, Garofano L, Fratini P, Pierni M. Three-dimensional surface topography acquisition and analysis for firearm identification. *J Forensic Sci*. 2006 Mar;51(2):282–95; Bachrach B. Development of a 3D-based automated firearms evidence comparison system. *Journal of Forensic Sciences*. 2002;47(6):1253–64; Bonfanti MS, Ghauharali RI. Visualisation by confocal microscopy of traces on bullets and cartridge cases. *Sci Justice*. 2000 Dec;40(4):241–56; De Kinder J, Bonfanti M. Automated comparisons of bullet striations based on 3D topography. *Forensic Science International*. 1999 Apr 26;101(2):85–93; Biasotti AA. Rifling Methods - A Review and Assessment of the Individual Characteristics Produced. *AFTE Journal*. 1981 Jul;13(3):34–61; Deinet W. Studies of Models of Striated Marks Generated by Random Processes. *J Forensic Sci*. 1981 Jan;26(1):35–50; Murdock JE. A General Discussion of Gun Barrel Individuality and an Empirical Assessment of the Individuality. *AFTE Journal*. 1981;13(3):84–111.

		observations, (which inherently has subjective elements), is present in every scientific field that requires a human to evaluate instrumental output and interpret the significance of the data in light of the question being asked.
D1	“In the absence of standards, examiners ignore or “rationalize away” dissimilarities in samples”	Firearms Examination experts typically follow recommendations from AFTE ³⁹ , laboratory-specific policies and Standard Operating Procedures, as well as accrediting body standards. ⁴⁰ It is expected that there will be some dissimilarity of markings on ammunition fired from the same firearm, and this can be characterized by the concept of stochasticity. ⁴¹ Manufacturing tolerances and the resulting variation in pressure generated by each cartridge when it is fired are examples of why there will be dissimilarities that exist for ammunition fired in the same firearm. These differences are not “rationalized away” but rather accounted for during an examination, just as two spectra from the same chemical will have some variance, or DNA heterozygous electropherogram peaks will not always be perfectly balanced, or two fingerprints from the same finger will not have all the same minutiae reproduced. During training examiners learn how much agreement and disagreement one should expect in known matching (same source) samples as well as how much agreement and disagreement one should expect from known non-matching (different source) through rigorous and purposeful study.
D1	“examiners are incapable of distinguishing between subclass characteristics and individual characteristics... thus undermining a	While false positives can result when similarities in subclass characteristics are mistaken for individual characteristics, the literature on identifying and distinguishing subclass is replete with examples of how subclass and individual

³⁹ Association of Firearm and Tool Mark Examiners. (2021). AFTE Training Manual. Available online at: <https://afte.org/resources/afte-training-manual>

⁴⁰ ANSI National Accreditation Board. (2023). AR 3125:2023, Accreditation Requirements for Forensic Testing and Calibration Laboratories. Washington, DC.

⁴¹ Van Kampen, N. G. (2011). Stochastic Processes in Physics and Chemistry. Elsevier. ISBN 9780080475363.

	fundamental premise of the AFTE Theory”	characteristics can be distinguished. ⁴² AFTE as well as training programs, such as the National Firearms Examiner Academy (NFEA) provide training and peer reviewed literature for the profession to educate examiners about subclass characteristics and how to avoid its use for identification in casework.
D2	Pg 34 - Mr. David Faigman testified about his concern because the field is subjective, as well as “(1) the difference in error rates between closed- and open-set tests; (2) potential biases in testing that might skew the results in studies, including (a) the “Hawthorne effect,” which theorizes that participants in a test who know they are being observed will try harder; and (b) a bias toward selecting “inconclusive” responses in testing when examiners know	In a review of the record, it appears Mr. William Tobin was the original expert witness in this case. The majority stipulates their review was limited to the testimony and information that was before the trial court in 2018 in view of the fact their purview is controlled by the abuse of discretion standard (pages 9 and 10, including footnote 6). Nonetheless, the majority’s opinion focuses not on Mr. Tobin’s testimony, but on testimony given after 2018, by Mr. David Faigman, from his declaration during the 2021 hearing where he opined regarding studies performed after 2018 (pages 33 and 34). Mr. Faigman utilizes his same declaration in multiple cases and has received criticism for some of his opinions. Judge McShane stated: “Notably, Dean Faigman, formerly an

⁴² See: Coffman BC. Computer Numerical Control (CNC) Production Tooling and Repeatable Characteristics on Ten Remington Model 870 Production Run Breech Bolts. AFTE Journal. 2003;35(1):49–54; Coody AC. Consecutively Manufactured Ruger P-89 Slides. AFTE Journal. 2003;35(2):157–60; Haag LC. Matching Cast Bullets to the Mould that Made Them and Comparisons of Consecutively Manufactured Bullet Moulds. AFTE Journal. 2007;39(4):313–22; LaPorte D. An Empirical and Validation Study of Breechface Marks on .380 ACP Caliber Cartridge Cases Fired from Ten Consecutively Finished Hi-Point Model C9 Pistols. AFTE Journal. 2011;43(4):303–9; Lightstone L. The Potential for and Persistence of Subclass Characteristics on the Breech Faces of SW40VE Smith & Wesson Sigma Pistols. AFTE Journal. 2010;42(4):308–22; Lomoro VJ. Class Characteristics of 32 SWL, F.I.E. Titanic Revolvers. AFTE Journal. 1974 Apr;6(2):18–21; Lopez LL, Grew S. Consecutively Machined Ruger Bolt Faces. AFTE Journal. 2000;32(1):19–24; Lyons DJ. The Identification of Consecutively Manufactured Extractors. AFTE Journal. 2009;41(3):246–56; Matty W, Johnson TD. A Comparison of Manufacturing Marks on Smith & Wesson Firing Pins. AFTE Journal. 1984;16(3):51–6; Matty W. A Comparison of Three Individual Barrels Produced from One Button Rifled Barrel Blank. AFTE Journal. 1985 Jul;17(3):64–9; Matty W. Raven 25 Automatic Pistol Breech Face Tool Marks. AFTE Journal. 1984;16(3):57–60; Moran B. The Application of Numerical Criteria for Identification in Casework Involving Magazine Marks and Land Impressions. AFTE Journal. 2000;32(4):326–31; Miller J, Beach G. Toolmarks Examining The Possibility of Subclass Characteristics. AFTE Journal. 2005;37(4):296–345; Miller J. An Examination of the Application of the Conservative Criteria for Identification of Striated Toolmarks using Bullets Fired from Ten Consecutively Rifled Barrels. AFTE Journal. 2001;33(2):125–32; Miller J. An Examination of Two Consecutively Rifled Barrels and a Review of the Literature. AFTE Journal. 2000;32(3):259–70; Murdock JE. A General Discussion of Gun Barrel Individuality and an Empirical Assessment of the Individuality. AFTE Journal. 1981;13(3):84–111; Nichols RG. Subclass Characteristics: From Origin to Evaluation. AFTE Journal. 2018;50(2):68–88; Rivera GC. Subclass Characteristics in Smith & Wesson SW40VE Sigma Pistols. AFTE Journal. 2007;39(3):247–53; Tulleners FA, Hamiel J. Sub Class Characteristics of Sequentially Rifled .38 Special S&W Revolver Barrels. AFTE Journal. 1999;31(2):117–22; Van Dijk TM. Steel Marking Stamps. Their Individuality at the Time of Manufacture. Journal of the Forensic Science Society. 1985 Jul;25(4):243–53.

	<p>it will not be counted against them, but that an incorrect “ground truth” response will; (3) an absence of pre-testing and control groups; (4) the “prior probability problem,” in which examiners expect a certain result and so are more likely to find it; and (5) the lack of repeatability and reproducibility effects.”</p>	<p>advisor to PCAST, previously agreed with PCAST’s recommendation that toolmark studies should remove inconclusive results from the calculation. Although Dean Faigman testified he “made a mistake then,” this merely demonstrates that there exist legitimate reasons to not treat inconclusives as wrong answers. Similarly, the Government introduced numerous criticisms, from individuals even the defense experts agree are qualified to opine on the subject, of Dean Faigman and Dr. Scurich’s arguments regarding the treatment of inconclusives. On this record, the vast majority of experts in the field—indeed, seemingly every expert other than Dean Faigman and Dr. Scurich—disagree with the defense experts as to the proper treatment of inconclusives in validation studies”⁴³</p> <p>All applied sciences have some degree of subjectivity (i.e. interpretation of data) to them. This subjectivity should be curbed through strict policies and procedures as well as transparency of documentation (i.e. case notes). In validity tests of firearms identification, participants know they are participating in a study - this potential for bias does not invalidate the study (as acknowledged by PCAST, who accepted the “Ames I” study as being valid). In fact, there has long been a debate over whether the Hawthorne effect is real. The Hawthorne experiments occurred between World War I and the start of the Great Depression where many aspects of daily life were changing. This makes it difficult to interpret the results. Distinguished Professor of social psychology, Richard Nisbett has described the Hawthorne effect as “a glorified anecdote,” saying that “once you have got the anecdote, you can throw away the data.”⁴⁴ Canadian psychologist J. G. Adair discussed major factual inaccuracies in several publications attempting to re-evaluate the Hawthorne data, with many failing to prove it exists.⁴⁵ We ultimately take no stance on whether the Hawthorne effect is real. We point out that there is literature to suggest its effect may not <i>a/ways</i> apply, may not be meaningful, or the effect</p>
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⁴³ United States v. Rhodes, 3:19-cr-00333-IM (D. Or. Jul. 15, 2022), Tr. 388; internal citations omitted.

⁴⁴ <https://www.nytimes.com/1998/12/06/weekinreview/scientific-myths-that-are-too-good-to-die.html>

⁴⁵ Adair, J.G. The Hawthorne Effect: A reconsideration of the methodological artifact. Journal of Applied Psychology. 1984;69(2):334–345.

		<p>may not be what first expects.</p> <p>Through Mr. Faigman, the Court suggests that since examiners know they are being tested (i.e. a “Hawthorne effect”), error rate studies may underestimate the “real” error rate. This is speculation. In error rate studies, answers are typically anonymous. Therefore examiners <i>may</i> be less careful than in casework since there is no personal consequence for wrong answers.⁴⁶ Or it is also possible that examiners realize casework involves the personal liberty of defendants and good performance on a study is also important. Therefore examiners are diligent and professional in both scenarios.</p>
	<p>Pg 34 - “Dean Faigman agreed with PCAST that the Ames I Study ‘generally . . . was the right approach to studying the subject.’ He observed, however, that if inconclusives were counted as errors, the error rate from that study would “balloon” to over 30%.”</p>	<p>Mr. Faigman was a Senior Advisor to PCAST, which defined and then set an arbitrary threshold for what it termed “foundational validity.” The PCAST report recommended the best way to treat inconclusive results was to (simply) remove them from the false positive error rate calculation.⁴⁷ Now that firearm and toolmark examination meets the threshold, the goal posts have been moved. Mr. Faigman’s math treats an inconclusive result as equivalent to a false identification. An inconclusive result is an examiner’s neutral opinion: the markings before her/him do not provide sufficient data to conclude a more definitive result. Lumping “inconclusives”, which are neutral responses, into the same category as results that directly conflict with ground truth is, in our opinion, illogical and irresponsible. Inconclusives may be, in some instances, “missed opportunities” to provide the trier of fact with further information; however, they also allow for examiners to be cautious and only report “identifications” and “exclusions” when the</p>

⁴⁶AAAS Forensic Science Assessments: A Quality and Gap Analysis, Latent Print Examination 2017, American Association for the Advancement of Science, DOI: 10.1126/srhl.aag2874. In discussing fingerprint studies, the AAAS notes decisions thresholds might change depending on whether the comparison is casework vs declared test, but the result is not known: “The participants in these fingerprint studies might have worried that a false identification would be used to impugn their profession, and so they might have set an unusually high threshold for reporting an identification; alternatively, since examiners in many of these tests were anonymous, and knew that any errors would not have personal repercussions, they may have lowered their thresholds.”

⁴⁷ However the PCAST report also states that including inconclusive results, in the denominator of the calculation, has scientific merit. See PCAST report, Appendix A, page 153.

		<p>comparison is convincing and clear.⁴⁸</p> <p>We also take a step back and consider the inherent unfairness of concluding that all inconclusive responses should be “error”, and thus calculate a singular “error rate” from past studies. Examiners participated in these studies with the understanding that their inconclusive conclusions would be interpreted as neutral responses, and not as “error”. If examiners had known that all inconclusive responses would be treated as “error”, then examiners would have been better off taking their best guess, even if their original result would have been inconclusive. At least then they would have had a 50/50 chance of being right. The court’s (and Mr. Faigman’s) inclusion of inconclusive results as an “error” has far-reaching implications which do not improve forensic science, and may have unintended, dangerous consequences.</p>
E	<p>Legal Analysis: Gardner v. United States, 140 A.3d 1172 (D.C. 2016); Commonwealth v. Pytou Heang, 942 N.E.2d 927 (Mass. 2011); United States v. Willock, 696 F. Supp. 2d at 572; United States v. Ashburn, 88 F. Supp. 3d 239 (E.D.N.Y. 2015); Monteiro, 407 F. Supp. 2d; United States v. Taylor, 663 F. Supp. 2d 1170 (D.N.M. 2009); United States v. Glynn, 578 F. Supp. 2d 567 (S.D.N.Y. 2008); United States v. Medley, No. PWG-17-242 (D. Md. Apr. 24, 2018), ECF No. 111; United States v. Shipp, 422 F. Supp. 3d 762 (E.D.N.Y. 2019); Williams v. United States, 210 A.3d 734 (D.C. 2019); United States v. Adams, 444 F. Supp. 3d 1248 (D. Or. 2020)</p>	<p>While AFTE is not an association of legal professionals, we are aware of recent rulings that have not placed any meaningful restrictions on firearms examiner testimony. A partial list is: United States v. Gil, 680 Fed. App'x. 11 (2d Cir. 2017); United States v. Brown, 973 F.3d 667, 702-04 (7th Cir. 2020), cert. denied, 141 S. Ct. 1253 (2021); United States v. Godinez, 7 F.4th 628, 633-36 (7th Cir. 2021); United States v. Stevenson No. 20-2261 CF1 000969 (7th Cir. 2021); United States v. Johnson, 875 F.3d 1265, 1279-80 (9th Cir. 2017); United States v. Hunt, 63 F.4th 1229 (10th Cir. 2023); Merritt v. Arizona, No. CV-17-04540-PHX-DGC, 2021 WL 1541635, at 3 (D. Ariz. Apr. 20, 2021); People v. Therman, No. C091147, 2021 WL 4859299, at *1 (Cal. Ct. App. Oct. 19, 2021); United States v. Chavez, No. 15-CR-00285-LHK-1, 2021 WL 5882466, at 17-18 (N.D. Cal. Dec. 13, 2021); State v. Raynor, 189 A.3d 652, 656 (Conn. App. Ct. 2018); State v. Terrell, No. CR170179563, 2019 WL 2093108, at *1 (Conn. Super. Ct. Mar. 21, 2019); United States v. Harris, 502 F. Supp 3d 28, 33 (D.D.C. 2020); State v. Mobley, ID No. 2002007105, 2021 WL 5411089 at *1-2, (Del. Super. Ct. Nov. 19, 2021); Garrett v.</p>

⁴⁸ Koehler JJ. Fingerprint Error Rates and Proficiency Tests: What They are and Why They Matter. Hastings Law Journal. 2008 May;59(5):101–23;. Dror IE, Langenburg G. “Cannot Decide”: The Fine Line Between Appropriate Inconclusive Determinations Versus Unjustifiably Deciding Not To Decide. Journal of Forensic Sciences. 2019;64(1):10–5.

		<p>Commonwealth, 534 S.W.3d 217, 222 (Ky. 2017); Willie v. State, 274 So. 3d 934, 935 (Miss. Ct. App. 2018); State v. Williams, 814 S.E.2d 925 (N.C. Ct. App. 2018); State v. Griffin, 834 S.E.2d 435, 436 (N.C. Ct. App. 2019); State v. Miller, 852 S.E.2d 704, 706 (N.C. Ct. App. 2020); State v. Lee, 217 So. 3d 1266, 1278 (La. Ct. App. 2017); State v. Magee, 243 So. 3d 151 (La. Ct. App. 2018); State v. Boss, 577 S.W.3d 509, 512 (Mo. Ct. App. 2019); State v. Mills, 623 S.W.3d 717 (Mo. Ct. App. 2021); State v. Wheeler, 956 N.W.2d 708, 719 (Neb. 2021); United States v. Romero-Lobato, 379 F. Supp. 3d 1111, 1114 (D. Nev. 2019); State v. Oliver, No. A-5140-16T1, 2020 WL 773578 (N.J. Super. Ct. App. Div. Feb. 18, 2020); State v. Nowicki, No. S-1-SC-37388, 2020 WL 1910847, at 1 (N.M. Apr. 20, 2020); United States v. Johnson, (S5) 16 Cr. 281 (PGG), 2019 WL 1130258, at 1–2 (S.D.N.Y. Mar. 11, 2019); State v. Smith, No. 109402, 2021 WL 507706, at 3 (Ohio Ct. App. 2021); United States v. Hunt, 464 F. Supp. 3d 1252, 1262 (W.D. Okla. 2020); United States v. Simmons, No. 2:16cr130, 2018 U.S. Dist. LEXIS 18606, at 4 (E.D. Va. 2018); Welsh v. Commonwealth, 890 S.E.2d 845, (Va. Ct. App. 2023); State v. DeJesus, 436 P.3d 834, 837–38 (Wash. Ct. App. 2019); State v. Hatfield, No. 77512-0-I, 2019 WL 6492483, at *8–9 (Wash. Ct. App. Dec. 2, 2019); United States v. Cloud, 576 F. Supp. 3d 827, 845 (E.D. Wash. 2021); United States v. James et al. No. 3:19-cr-00079-MAK-RM, (D.V.I.).</p>
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