FIREARM TOOLMARK EVIDENCE

Michael Oppenheimer
AFPD (D.Md.)
GOALS

FIREARM PRIMER

TOOLMARK COMPARISON

PROBLEMS

WHERE ARE WE NOW
A revolver is a handgun that is loaded using a revolving cylinder, typically with five to 9 chambers that can each be loaded with a cartridge. The main feature to remember is that the chambers are separate from the barrel.
A pistol is a handgun in which the chamber is part of the barrel, and is generally loaded by means of a magazine which is inserted into the grip of the pistol.
FIREARM PRIMER
Many people will erroneously refer to a round of ammunition as a bullet, but a single unit of ammunition is properly called a cartridge. The word ‘bullet’ actually refers only to the projectile loaded in most cartridges. A cartridge is made up of four basic parts:

1. The primer is the ignition component of a cartridge, usually in the form of a metal disk centered in one end of the cartridge case.

2. The propellant or gunpowder is the chemical substance that burns extremely rapidly and provides expanding gases that propel the projectile(s) down the barrel.

3. The cartridge case is usually a metal cylinder that serves as a container for the other components of the cartridge.

4. The bullet or projectile is seated in the other end of the cartridge case. There are many different designs for bullets, but most have a lead core covered by a jacket of harder metal (often a copper alloy). The most common bullet designs are the full metal jacket (FMJ) and jacketed hollow point (JHP). A jacketed hollow point bullet has a cavity in the nose that facilitates expansion or “mushrooming” upon impact. A full metal jacket design has a solid covered bullet nose, which may be round, flat, or pointed depending on the caliber of the cartridge.
(1) **class characteristics** which are akin to design features that the manufacturer intends to create;

(2) **sub-class characteristics** which are impressions common to a smaller group of firearms created during the manufacturing process by a specific tool or instrument; and

(3) **individual characteristics** which are unique to a particular firearm.
TOOLMARK COMPARISON
If there is sufficient agreement between the microscopic marks produced by the firearm and the marks observed on the evidence, then an identification can be made.
PROBLEMS

- SUB-CLASS V, INDIVIDUAL CHARACTERISTICS??
- SUFFICIENT AGREEMENT??
SUB-CLASS V. INDIVIDUAL

- DOES EVERY FIREARM PRODUCE UNIQUE CHARACTERISTICS?

- CAN EXAMINERS IDENTIFY & DISTINGUISH THOSE MARKS?
WHAT'S THE STANDARD?

HOW MANY SUFFICIENT MARKS?
WHY DOES IT MATTER?

- JURORS OVEVALUE FORENSIC EVIDENCE!!!

- Keith A. Findley, Innocents at Risk: Adversary Imbalance, Forensic Science, and the Search for Truth, 38 Seton Hall L. Rev. 893, 948 (2008) (“[R]esearch indicates that jurors often do not understand the fundamentals of scientific evidence, and lack the ability to reason about statistical, probabilistic, and methodological issues effectively.”);

- Mark A. Godsey & Marie Alao, She Blinded Me with Science: Wrongful Convictions and the “Reverse CSI Effect,” 17 Tex. Wesleyan L. Rev. 481, 495 (2011) (noting that “jurors in this country often accept state forensic testimony as if each prosecution expert witness is the NASA scientist who first put man on the moon”);

- Tom R. Tyler, Viewing CSI and the Threshold of Guilt: Managing Truth and Justice in Reality and Fiction, 115 Yale L.J. 1050, 1068 (2006) (“There is widespread evidence indicating that people already overestimate the probative value of scientific evidence.”);

- Richard H. Underwood, Evaluating Scientific and Forensic Evidence, 24 Am. J. Trial Advoc. 149, 166 (2000) (“Given their lack of scientific sophistication and innumeracy, jurors are likely to overestimate the significance of [expert testimony].”).
WHY DOES IT MATTER?


- the expert’s scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;

- the testimony is based on sufficient facts or data;

- the testimony is the product of reliable principles and methods; and

- the expert has reliably applied the principles and methods to the facts of the case.
WHY DOES IT MATTER?

**DAUBERT FACTORS**

- whether the particular scientific theory “can be (and has been) tested”;

- whether the theory “has been subjected to peer review and publication”;

- the “known or potential rate of error”;

- the “existence and maintenance of standards controlling the technique’s operation”; and

- whether the technique has achieved “general acceptance” in the relevant scientific or expert community.
REPORT TO THE PRESIDENT
Forensic Science in Criminal Courts:
Ensuring Scientific Validity
of Feature-Comparison Methods

Executive Office of the President
President's Council of Advisors on
Science and Technology

September 2016
Three recent reports issued in 2008, 2009, and 2016, two by the research arm of the National Academy of Sciences, and one by the President’s Council of Advisors on Science and Technology, have rejected the claim that firearms identification is valid and reliable science.

The most recent report, issued in 2016 following a review of more than 2,000 articles and presentations by members of the forensic community, states unequivocally: firearms identification “falls short of the scientific criteria for foundational validity.” President’s Council of Advisors on Science and Technology, Forensic Science in Criminal Courts: Ensuring Validity of Feature-Comparison Methods, at 11 [hereafter PCAST Report].
In particular, the three authoritative reports found that the techniques used by firearms examiners are, at best, capable of including or excluding a firearm as a possible source of a bullet or casing, but such techniques do not support probabilistic claims, such as that the gun “probably” fired the bullet, much less claims that the firearm in question was the only possible source of the bullet or casing.
HOW DID WE GET HERE?

If there is sufficient agreement between the microscopic marks produced by the firearm and the marks observed on the evidence, then an identification can be made.
HOW DID WE GET HERE?

CIRCULAR THEORY

ASSUMPTIONS

NO EMPIRICAL EVIDENCE

INTERESTED PARTIES
SUFFICIENT AGREEMENT

• The theory of identification as it pertains to the comparison of toolmarks enables opinions of common origin to be made when the unique surface contours of two toolmarks are in “sufficient agreement”.

• This “sufficient agreement” is related to the significant duplication of random toolmarks as evidence by the correspondence of a pattern or combination of patterns of surface contours. Significance is determined by the comparative examination of two or more sets of surface contour patterns comprised of individual peaks, ridges and furrows. Specifically, the relative height or depth, width, curvature and spatial relationship of the individual peaks, ridges and furrows within one set of surface contours are defined and compared to the corresponding features in the second set of surface contours. 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. The statement that “sufficient agreement” exists between two toolmarks means that the agreement of individual characteristics is of a quantity and quality that the likelihood another tool could have made the mark is so remote as to be considered a practical impossibility.

• Currently the interpretation of individualization/identification is subjective in nature, founded on scientific principles and based on the examiner’s training and experience.
SUFFICIENT AGREEMENT

Measurement Uncertainty of 94 per cent

WITHOUT subclass characteristics:

- Height
- Depth
- Width
- Curvature
- Spatial relationship
- Peaks
- Ridges
- Furrows
- Contours
- Rate of twist (distance rifling need to travel down the barrel for it to complete a single revolution)
- Pitch (angle)
- How many micrometer (0.0001mm resolution) sized marks on Bullet?
An examiner may make an identification when there is sufficient agreement, and sufficient agreement is defined as enough agreement for an identification.”

No standard or protocol, however, dictates how many characteristics the examiner must find in agreement to declare a match. Instead, firearms examiners utilize a subjective pattern-matching methodology that allows each examiner to set his or her own criteria based on training and experience.
The “theory” of firearm comparison is a series of unproven assumptions embraced by firearms examiners:

- Assumes that every firearm has unique characteristics resulting from both the manufacturing process and wear and tear, which consistently produce unique marks on bullets and shell casings.

- Assumes that examiners, based on experience and judgment, can identify and distinguish these “unique” accidental marks from subclass marks, which are also accidentally left during the manufacturing process but are not unique.

- Assumes that examiners can accurately determine when two sets of “unique” marks are in “sufficient agreement” to declare a “match.”

There is no standard for what constitutes “sufficient agreement,” nor is there empirical data supporting any particular threshold number of marks that must align. Rather, each examiner refers to his personal recollection of the amount of agreement he has observed in close non-matches encountered throughout his career; in other words, “sufficient agreement” is wholly subjective.
a “valid theory” is a “comprehensive explanation of some aspect of nature that is supported by a vast body of evidence.” PCAST Report at 60; NRC Forensics Report at 154-55 (reaching the same conclusion); Ballistics Imaging Report at 1, 3 (“[T]he validity of the fundamental assumptions of uniqueness and reproducibility of firearms-related toolmarks ha[s] not yet been demonstrated.”).
Table 2: Results From Firearms Studies

<table>
<thead>
<tr>
<th>Study Type</th>
<th>Raw Data</th>
<th>Inconclusives</th>
<th>False positives among conclusive exams</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exclusions/Inconclusives/False positives</td>
<td>Freq. (Confidence Bound)</td>
<td>Estimated Rate</td>
</tr>
<tr>
<td>Set-to-set/closed (four studies)</td>
<td>10,205/23/2</td>
<td>0.2%</td>
<td>0.02% (0.06%)</td>
</tr>
<tr>
<td>Set-to-set/partly open (Miami-Dade study)</td>
<td>188/138/4</td>
<td>41.8%</td>
<td>2.0% (4.7%)</td>
</tr>
<tr>
<td>Black-box study (Ames Laboratory study)</td>
<td>1421/735/22</td>
<td>33.7%</td>
<td>1.5% (2.2%)</td>
</tr>
</tbody>
</table>

*“Inconclusives”: Proportion of total examinations that were called inconclusive. “Raw Data”: Number of false positives divided by number of conclusive examinations involving questioned items without a corresponding known (for set-to-set/slightly open) or non-mated pairs (for independent/open). “Freq. (Confidence Bound)”: Point estimate of false positive frequency, with the upper 95 percent confidence bounds. “Estimated”: The odds of a false positive occurring, based on the observed proportion of false positives. “Bound”: The odds of a false positive occurring, based on the upper bound of the confidence interval—that is, the rate could reasonably be as high as this value.

Conclusions

The early studies indicate that examiners can, under some circumstances, associate ammunition with the gun from which it was fired. 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.

At present, there is only a single study that was appropriately designed to test foundational validity and estimate reliability (Ames Laboratory study). Importantly, the study was conducted by an independent group, unaffiliated with a crime laboratory. Although the report is available on the web, it has not yet been subjected to peer review and publication.
“But my training and experience…” Association of Firearm Toolmark Examiners (AFTE)
INTERESTED PARTIES

1. No applicable background
2. No peer review
3. Confirmation Bias
WHERE ARE WE NOW

PRE-PCAST

- United States v. Willock, 696 F. Supp. 2d 536, 569-70 (D. Md. 2010), toolmark evidence should only, if ever, be admitted when presented by: (1) a qualified examiner, (2) who followed the AFTE theory, and (3) who documented with notes, photographs, or sketches the conclusions reached in sufficient detail to permit, (4) confirmation by a second qualified examiner of how an identification was reached, and (5) the examiner must still be prevented from making outlandish and unsupported pronouncements about the degree of certainty of his identification. Id.


- United States v. Love, No. 2:09-cr-20317-JPM (W.D. Tenn. Feb. 8, 2011) (excluding testimony regarding absolute or practical certainty);

- United States v. Alls, No. 2:08-cr-00223-ALM (S.D. Ohio Dec. 7, 2009) (forbidding any claim of a match to one firearm to the exclusion of all other guns and limiting examiner to descriptions of her methodology and observations of casings);

- United States v. Glynn, 578 F. Supp. 2d 567, 571, 575 (S.D.N.Y. 2008) (noting that, given the lack of data supporting the discipline, “ballistics lacked the rigor of science,” and limiting testimony of match to a conclusion of “more likely than not” instead of even “reasonable ballistics certainty” to ensure that “a conviction in a criminal case may not rest exclusively on ballistics testimony.”);


  Arguably, the biggest obstacle facing any firearms examiner is that there is no such thing as a “perfect match.” Even two bullets known to have been fired consecutively from the same gun will display some differences. Even more problematic, bullets fired from different guns may have significantly similar markings, reflecting class or sub-class, rather than individual characteristics.
WHERE ARE WE NOW

POST-PCAST

- **Williams v. United States**, 130 A.3d 343, 352 (D.C. 2016) (Easterly, J., concurring). It is not enough to simply bar the examiner from using the phrase, “to the exclusion of all others.” “A statement that markings are ‘unique’ to a particular gun is a statement that the probability of finding another gun that can create identical bullet markings is zero. If purportedly unique patterns on bullets are declared to match, that declaration likewise negates the possibility that more than one gun could have fired bullets—it is a statement of unqualified certainty that the bullets were fired from a specific gun to the exclusion of all others.” See, e.g., Williams, 130 A.3d at 352

- **Missouri v. Goodwin-Bey**, No. 1531-CR00555-01 (Cir. Ct. Green County, Mo., Dec. 16, 2016) (limiting testimony “to the point this gun could not be eliminated as the source of the bullet.”).
So -- so we're here clear on what I'm ruling. Mr. McVeigh can testify. Now, his qualifications are subject to being brought out before the jury by the government and challenged or cross-examined by the defense. He can talk about what he did and what he tested and what he looked at. He can put up his pictures. He can show the similarities between one and the other, and he can even express the opinion that the marks from the .45 that he test fired, the marks on the cartridges are consistent with the marks on the other one that were found at the crime scene, but I won't allow him to express the opinion that they were produced by the same gun, and I won't allow him to express a confidence level as to his opinion. That's as far as his opinion can go.
DISCOVERY - CV - proficiency tests - visit the examiner

MOUNTING THE CHALLENGE - experts in statistics, engineering, applied sciences
If there is sufficient agreement between the microscopic marks produced by the firearm and the marks observed on the evidence, then an identification can be made.
four years and my experience, yes.
Q. So you went through the demonstration with the jury and explained the things that you perceived to be similar. Correct?
A. Yes.
Q. And you just testified that sort of you don't use a manual or modules? You didn't at least in this case. Right?
A. I didn't use a text manual, I believe is what you said, a manual?
Q. Right.
A. I just used the totality of all of the other training that I have had, experience that I have had in the field, and also, importantly, the -- the test to test step was really important in this case.
Q. Right. And so -- so one of the things that you didn't do was bring the jury an example, right, an example of where the dissimilarity was too great?
A. I could provide that if -- if I was asked to.
Q. But you didn't?
A. I didn't bring it today, no.
Q. You didn't do that today. Right?
A. No, I didn't.
Q. So you just showed them pictures of bullets and cartridge casings and limited points on those bullets and cartridge casings that you thought were similar. Right?
2019 WL 4306971
Only the Westlaw citation is currently available.
United States District Court, W.D. Virginia,
Danville Division.

UNITED STATES of America
v.
Marcus Jay DAVIS, et al., Defendants.

Case No.: 4:18-cr-00011
Signed 09/11/2019
The court is thus left with the question of what limitations to place on Gibson, Etzel Miller, and McVeigh’s testimony so that they may impart the substance of their work without misleading the jury. Of the recent opinions addressing the field of firearm and toolmark identification, many cited the reports issued in 2008 and 2009 by the NRC, but only one addressed the 2016 report issued by PCAST. Judge Paul Grimm, in United States v. Medley, 312 F. Supp. 3d 493 (D. Md. 2018), thoughtfully addressed similar challenges to this type of testimony (indeed, the expert at issue was McVeigh himself). Judge Grimm observed the difficulty a layman would have in ascertaining just how an expert like McVeigh concludes that “there were enough similarities to be consistent with similarities from [cartridge cases] from the same gun and greater than the number of similarities known to exist in [cartridge cases] from different guns,” and how little explanation is offered of this in reports that followed internal laboratory procedures. Medley, No. PWG 17-242 (D. Md. April 24, 2019), ECF No. 111, at 115.
McVeigh, Gibson, and Etzel Miller **MAY NOT:**

- Opine that certain cartridge cases were fired by the same gun;
- Opine that a cartridge case is a “match” to other cartridge cases or firearms;
- Opine that toolmarks reflect a “signature” permitting the conclusion that certain cartridge cases may be traced to a single firearm; or
- Express confidence in their opinions to any specific level of certainty, including whether the examiners’ observations exclude other firearms or cartridge cases “to a level of practical impossibility.”

Additionally, the court **DIRECTS** the government to supplement the expert reports of Gibson and Etzel Miller to provide a sufficient narrative summary of the bases and reasons for their opinions.
SUPERIOR COURT OF THE DISTRICT OF COLUMBIA
CRIMINAL DIVISION – FELONY BRANCH

UNITED STATES : Case No. 2016 CF1 19431
v. :
MARQUETTE TIBBS :
Judge Todd E. Edelman :

MEMORANDUM OPINION
Accordingly, the Court ruled that the government’s proffered expert, Mr. Coleman, may testify and give general specialized opinion testimony in this case. Mr. Coleman may describe the work he performed and the comparisons he made; he may describe the basis of his conclusion regarding the physical consistency of the toolmarks that he observed; and he may make, as the Defendant concedes, a comparison of the samples based on class characteristics. In sum, Mr. Coleman may conclude that based on his examination and the consistency of the class characteristics and microscopic toolmarks, the recovered firearm cannot be excluded as the source of the cartridge casing found on the scene of the alleged shooting—in other words, that the firearm may have fired the recovered casing. Mr. Coleman may not state an ultimate conclusion in stronger terms. Similarly, Mr. Coleman will be precluded at any point in his
January 3, 2018

By Email and Hand Delivery
Mr. Thomas M. Sullivan
Assistant United States Attorney
District of Maryland
6500 Cherrywood Lane, Suite 200
Greenbelt, MD 20770

Re: Firearm and Toolmark Analysis Discovery Request, United States v. Jovon Medley, PWG-17-242

Dear Mr. Sullivan:


This request applies to all firearm analysis that has been, is currently being, or will be performed in the instant case. The request is ongoing. In the event that new materials responsive to this request are produced, discovered, or otherwise come into the possession of the prosecution or its agents, I ask that such materials be provided without delay. To minimize any burden of duplicating these items, we invite you to provide them in electronic form:

(1) Case Files: Please provide a legible copy of the complete case file with all records pertaining to firearms examination testing in this case. For materials that are represented in any format other than black and white copies, please provide copies that are equivalent in content and quality (e.g., photographic quality copies of photographs, color copies of photographs, and CD-ROM copies of electronic data). The records requested include, but are not limited to, the following, even if located separate from the laboratory “case file.”

   a. Hand written bench notes;
b. Worksheets and other notes;

c. Records of any errors or discrepancies, or trouble-shooting that occurred during the testing in this case, as well as an explanation of actions taken to remedy the problems;

d. Color photographs or copies (if used in testing);

e. Copies of phone and other communication logs reflecting conversations by laboratory personnel internally and externally with other people about testing in this case;

f. Photos of all exemplars of bullets and casings that were used for comparison purposes (or if none used, please inform us of that);

(2) Data files and database information for testing done in this case: Please inform us whether any database of any kind, including but not limited to IBIS and NIBIN, was used in any way in this case. If so, please provide all documentation associated with the database search, including any images used, input commands and output (e.g. search results, candidate match listings, match scores).

- Bullet or casing images: All electronic images of any and all bullet/casing images entered into a computerized database in this case.

- Encoding: Please provide the encoding record, indicating any characteristics marked by laboratory personnel prior to any and all database searches.

- Search results: Hard copy printout or electronic output in easily readable format of the results of any and all database searches run in connection with this case. Information provided should include, but is not limited to:
  
  o Ranked list of “candidate matches”
  o Identification numbers of all images appearing on the “candidate list”
  o “Match scores” of all images appearing on the “candidate list.”
  o Candidate matches: Electronic images of all items appearing on the candidate list.

These files should include all data necessary to, (i) independently reanalyze the raw data and (ii) reconstruct the analysis performed in this case.

(3) Statistical information relied upon to interpret tests: Please inform us whether any statistical method was used to calculate probabilities in the case. If so, please identify the statistical method used to calculate probabilities in this case.
In addition, please provide copies of the materials that were used or relied upon in performing any statistical analyses in this case. These materials should include, but are not limited to, the following:

- The complete database or databases used;

- Copies of all documents describing the source or origin of samples in databases used, including documents regarding the method by which samples were collected, the background and/or characteristics of the tools that were the sources of the samples, the choice of firearms that were sampled, and the nature of the sampling procedure used to collect the samples;

- Copies of all documents generated by computer statistical programs used to aid statistical calculations in this case;

- Any and all information regarding the classes of gun sampled, where the guns were collected geographically, and how many of each type of gun was sampled;

- Computer data files, notes, or other documentation relating to statistical analyses.

(4) Laboratory procedures relied upon when performing tests: Please provide legible copies of all documents that were, or are claimed to have been, followed or relied upon in executing, interpreting, and/or reporting the firearms tests performed in the instant case. These materials should include, but are not limited to, the following: standard operating procedures of the testing laboratory; quality assurance manuals; standard operating procedures of the examiner; the user manuals for all instrumentation used; the error rates of all instrumentation used; and standard operating procedures of examiners in this field.

(5) Documentation of laboratory and analyst expertise: Please provide legible copies documenting how the testing laboratory meets scientific community standards and how laboratory personnel have been trained to conduct firearms testing. These materials should include, but are not limited to, the following:

a. Copies of all licenses or other certificates of accreditation held by the testing laboratory;

b. Copies of all audit reports for the last five years relating to the testing laboratory used in this case;

c. Copies of any error records kept by the laboratory or the examiner;
d. Copies of any proficiency tests that were taken by the persons who performed the testing in this case.

(6) **Laboratory Accreditation:** Please provide copies of all licenses or other certificates of accreditation in firearm analysis held by the laboratory.

(7) **Laboratory Personnel:** Please provide background information about each person involved in conducting or reviewing the firearm testing performed in this case, including:

- Current resume
- Job description
- Copies of all proficiency examinations and their results for the past 5 years
- All Testimony Reviews.

(8) **Validation studies:** Copies of all validation studies conducted by the lab or agency and/or relied on by the lab or agency in connection with firearm/toolmark evaluation or analysis.

(9) **Communications:** All communications regarding the case between firearm examiners, police officers and government attorneys including but not limited to oral communications, reports, letters, and emails.

Thank you very much for your prompt attention to these requests.

Sincerely

/s

Michael S. Oppenheimer
Christian B. Lassiter
Assistant Federal Defenders
Office of the Federal Public Defender
Counsel for Jovon Medley
IN THE UNITED STATES DISTRICT COURT FOR
THE DISTRICT OF MARYLAND

UNITED STATES : 

v. : Case No. PWG-17-242

CHRISTIAN THOMAS : 

Defendant :

MOTION IN LIMINE TO EXCLUDE FIREARM IDENTIFICATION EVIDENCE, OR
IN THE ALTERNATIVE, TO LIMIT SUCH TESTIMONY

Christian Thomas, the Defendant, by and through his attorneys, James Wyda, Federal
Public Defender for the District of Maryland, Michael S. Oppenheimer and Sedira Banan,
Assistant Federal Public Defenders, hereby moves to exclude the Government’s proposed expert
testimony and firearm identification evidence, or in the alternative, to limit the scope of the
expert’s opinion to accurately reflect the discipline. The proposed expert testimony is inadmissible
under Federal Rule of Evidence 702 because the proposed opinion is based on an unvalidated and
unreliable methodology. See Daubert v. Merrell Dow Pharmaceuticals, 509 U.S. 579, 597 (1993);
Kumho Tire Co. v. Carmichael, 526 U.S. 137 (1999); see also Fed. R. Evid. 702. Equally
important, the examiners in this case failed to reliably apply the methodology and the Government
has not provided the bases and reasons for the examiners opinions. See Id.; see also Fed R. Crim.
P. 16.

INTRODUCTION

The debate over whether firearms examiners can link fired ammunition components to a
particular firearm has reached its zenith. Three recent reports issued in 2008, 2009, and 2016, two
by the research arm of the National Academy of Sciences,\(^1\) and one by the President’s Council of Advisors on Science and Technology, have rejected the claim that firearms identification is valid and reliable science. The most recent report, issued in 2016 following a review of more than 2,000 articles and presentations by members of the forensic community, states unequivocally: firearms identification “falls short of the scientific criteria for foundational validity.” President’s Council of Advisors on Science and Technology, *Forensic Science in Criminal Courts: Ensuring Validity of Feature-Comparison Methods*, at 11 (Sept. 20, 2016) [hereafter PCAST Report].

These three reports made several findings central to whether this Court should admit firearms identification testimony. The findings are:


- The theory of firearms examination is “not a scientific theory,” but rather a “claim that examiners applying a subjective approach can accurately individualize the origin of a toolmark.” PCAST Report at 60. *See Exhibit B*, PCAST excerpts.

- The method is subjective, with examiners using their personal judgment to select which features to compare; and the reasoning employed to reach a conclusion is circular—a match can be declared when there is “sufficient agreement” and when there is “sufficient agreement” is based on the personal judgment of each examiner. *Id.* at 47, 60, 104, and 113.

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\(^1\) The National Research Council (NRC) is a component of the National Academy of Sciences, which was created by congressional charter in 1863 to “investigate, examine, experiment, and report upon any subject of science.” Act to Incorporate the National Academy of Sciences, sec. 3, 12 Stat. 806 (1863). [http://www.nasonline.org/about-nas/leadership/governing-documents/act-of-incorporation.html](http://www.nasonline.org/about-nas/leadership/governing-documents/act-of-incorporation.html) (last visited March 19, 2018). The NRC was established in 1916 “to associate the broad community of science and technology with the Academy’s purposes of furthering knowledge and advising the federal government.” National Research Council, Committee to Assess the Feasibility, Accuracy, and Technical Capability of a National Ballistics Database, *Ballistic Imaging* iii (2008).
Because the method is “subjective,” foundational validity and reliability “can only be established through multiple independent black-box studies”\(^2\) and “at present there is only a single study that was appropriately designed.” \textit{Id.} at 106, 111 (emphasis in the original); See \textbf{Exhibit C}, \textit{An Addendum to the PCAST Report on Forensic Science in Criminal Courts}, (Jan. 6, 2017) at 7 [hereafter PCAST Addendum].


In sum, three interdisciplinary reports authored by three separate committees of nationally recognized scientists and professionals found that: the “fundamental assumptions” underlying firearms examination have not been demonstrated; the theory is “not a scientific theory”; the method is “subjective”; and there is “insufficient empirical evidence” establishing validity and estimating reliability.

Because the hallmark of legal admissibility is validity and reliability, this Court should exclude the proposed firearms identification testimony until firearms examiners produce appropriate independent empirical evidence that (1) firearms have unique or individual characteristics, (2) firearms consistently imprint those characteristics on bullets and shell casings, and (3) examiners can identify and evaluate those marks using a reliable and repeatable method, with a known and acceptable error rate.

Law enforcement and laboratory accrediting bodies have created standards to which examiners must adhere. Chief among these standards are the requirement of contemporaneous documentation. This requirement serves two core functions: First, documentation helps to protect

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\(^2\) “Black-box” studies are studies “with many examiners making a series of independent comparison decisions between a questioned sample and one or more known samples that may or may not contain the source.” PCAST Report at 110. Because these studies best replicate case work they are the “only” studies appropriate for assessing scientific validity and estimating reliability. \textit{Id.} at 106. (emphasis in the original).
against bias—the examiner deviating from his initial analysis in order to identify similarities with a comparison. Second, documentation seeks to ensure that an examiner’s work and ultimately subjective conclusions that two items “match” can be reproduced and verified by a third party.

The Government’s experts Edward L. Gesser and Scott C. McVeigh have failed to meet these requirements and ignored the standards that govern the discipline. Mr. Gesser has proposed to testify that after examining cartridge cases recovered on January 2, 2017 and comparing them to a firearm seized on January 13, 2017, he “determined that the casings were fired from that firearm.” See Exhibit E, Government’s Expert Disclosure at 2 (June 15, 2018) (emphasis supplied). Mr. Gesser provided neither contemporaneous documentation of his adherence to any methodology, nor any other documentation of the similarities or differences he purports exist between the items he compared. These failures not only violate the accreditation and licensing standards governing Mr. Gesser’s laboratory but also deprives the defense of any way to test whether he reliably applied any methodology in this case.3 See Exhibit F, Opinion Transcript, United States v. Jovon Medley, Case No. PWG-17-242 (D. Md. Apr. 24, 2018) at 21-23; 51.4

Exclusion is the appropriate remedy in this case, as cross-examination cannot cure the prejudice from the admission of evidence derived from a method that has not been proven valid and that lacks estimates of its reliability. The significance of expert testimony at trial cannot be overstated. Scientific expert testimony carries with it the “aura of special reliability and trustworthiness,” creating a grave risk that jurors will receive it without a critical eye. United

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3 At the time of this filing, the Government has not completed production of discovery material related to the firearms comparison performed in this case. Without Mr. Gesser’s complete file the defense is impaired in its ability to fully challenging the validity of his analysis. The defense requests the right to supplement this pleading once the Government has completed discovery.

4 The Honorable Paul W. Grimm conducted a Daubert hearing in Medley. Judge Grimm expressly intended the attached transcript to serve as “my opinion.” Medley at 57.
States v. Dowling, 753 F.2d 1224, 1236 (3d Cir. 1985); see also United States v. Haines, 803 F.3d 713, 730 (5th Cir. 2015) (recognizing the significance of expert testimony to juries). Cross-examination cannot solve this problem. The Government has not provided any information with which to question its expert regarding his adherence to a methodology or the validity of his subjective conclusion that the firearm is the source of the marks on the recovered cartridge cases. The failure to state the bases and reasons renders the examiner’s opinion inadmissible under Rule 702 and violates Rule 16. If the testimony is admitted, the jury will be left to take the Government’s expert at his word: because he says so, it is true.

At a minimum, the Court should instruct that Mr. Gesser cannot testify that he “identified” the firearm as the source of the casings. This type of source attribution testimony is scientifically indefensible in light of the well-documented limitations of firearm identification. Mr. Gesser should only be permitted to testify to the similarities and differences he observed when comparing two items without any statements of certainty. See Medley at 54. His conclusions, if any, should be limited to including or excluding the firearm as a potential source of the recovered cartridge casings. Finally, Mr. Gesser should be prepared to testify to the error rates from the only appropriately designed validation study. Absent these limitations—even with the benefit of cross-examination—Mr. Thomas will be unfairly prejudiced by misleading testimony that will unquestionably garner significant weight from the jury.

ARGUMENT

I. RULE 702 AND DAUBERT REQUIRE RIGOROUS EVALUATION AND REEVALUATION OF THE RELIABILITY OF PARTICULAR METHODOLOGIES AND HOW THEY ARE APPLIED.

Firearm identification evidence is inadmissible unless it is based on a method that is both “scientifically valid” and that “properly can be applied to the facts in issue” in a particular case.
See Daubert, 509 U.S. at 589; accord Kumho Tire, 526 U.S. at 141 (same analysis applies to matters of a technical, rather than a scientific expertise). Federal Rule of Evidence 702, which codified the Supreme Court’s holding in Daubert and its progeny, governs the admission of expert testimony of a technical or scientific nature. The rule requires the proponent to show:

1. the expert’s scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;
2. the testimony is based on sufficient facts or data;
3. the testimony is the product of reliable principles and methods; and
4. the expert has reliably applied the principles and methods to the facts of the case.

Fed. R. Evid. 702; see also Daubert, 509 U.S. at 592 n.10 (proponent bears the burden); see also Cooper v. Smith & Nephew, Inc., 259 F.3d 194, 199 (4th Cir. 2001)(same). Thus, Daubert requires, as codified in the rules of evidence, both that an expert’s testimony be the “product of reliable principles and methods,” and that the expert “reliably applied” the principles and methods to the facts of the case. Daubert, 509 U.S. at 597. “Nothing in either Daubert or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the ipse dixit of the expert.” Kumho Tire, 526 U.S. at 158 (citing Gen. Elec. Co. v. Joiner, 522 U.S. 136, 146 (1997).

Reliability is thus the touchstone of admissibility under Daubert. Daubert, 509 U.S. at 589. Indeed, because of the power of expert testimony to sway a jury, “it is crucial that the district court conduct a careful analysis into the reliability of the expert’s proposed opinion.” United States v. Fultz, 591 Fed. Appx. 226, 227 (4th Cir. 2015). To guide this inquiry, Daubert and its progeny established five factors for assessing the reliability of an expert’s proffered opinions:

1. whether the particular scientific theory “can be (and has been) tested”; 
2. whether the theory “has been subjected to peer review and publication”;
(3) the “known or potential rate of error”;

(4) the “existence and maintenance of standards controlling the technique's operation”; and

(5) whether the technique has achieved “general acceptance” in the relevant scientific or expert community.

_United States v. Hassan_, 742 F.3d 104, 130 (4th Cir. 2014); see also _Daubert_, 509 U.S. at 593–94.

The list is not exhaustive: the Court retains broad latitude to use other factors to measure reliability. _Kumho Tire_, 526 U.S. at 152.

The reliability of a particular methodology requires constant reevaluation by each court asked to admit expert testimony in a particular case. _Daubert_ explained that “scientific conclusions are subject to perpetual revision.” _Daubert_, at 597. In practice, this means that “[w]hen scientific methodologies once considered sacrosanct are modified or discredited, the judicial system must accommodate the changed scientific landscape.” See _Exhibit G_, Hon. Harry T. Edwards, _The National Academy of Sciences Report on Forensic Sciences: What it Means for the Bench and Bar_, 51 _Jurimetrics_ J. 1 (Summer 2010). For this reason, “past acceptance does not render expert testimony admissible”; rather, “expert testimony long assumed reliable before Rule 702 must nonetheless be subject to the careful examination that _Daubert_ and _Kumho Tire_ require.” See _United States v. Willock_, 696 F. Supp.2d 536 (D. Md. 2010).

II. THE THEORY OF FIREARMS IDENTIFICATION

To conduct firearms identification, examiners look at toolmarks on spent ammunition. Bullets pick up markings from gun barrels. The barrels are rifled, to improve accuracy, with spiral grooves cut into the barrel’s interior to impart spin on the bullet. Cartridge casings, which do not travel down the barrel, may pick up markings from other parts of the weapon, such as the firing pin or breechface. To conduct their analysis in an individual case, the examiner test-fires the suspected firearm and visually compares the pattern of marks on the test-fired ammunition with
that on the ammunition recovered from the scene, using a comparison microscope. If the examiner does not have a suspect weapon, he or she compares the marks on spent bullets or casings to determine if they were fired from the same weapon. See Foundational Overview of Firearm/Toolmark Identification tab available at afte.org/resources/swggun-ark (last accessed July 26, 2018).

Firearms examiners first examine bullets and/or casings for class characteristics. “Class characteristics” are distinctive features shared by many items of the same or similar type—such as the width of a groove cut into the barrel of a firearm, or the shape of a firing pin—and are determined before manufacturing. See NRC Forensics Report at 152. Class characteristics are used to narrow the pool of suspect firearms to one or more makes and models. If the class characteristics between test-fired and evidence ammunition, or between sets of ammunition, are the same, the examiner next evaluates “accidental” marks left on bullets and/or casings by features of a weapon that are accidentally imparted during manufacture. One group of accidental marks, “subclass characteristics,” are defined as features left on multiple items fabricated by the same tool: imperfections on the tool’s cutting surface are imparted on a series of weapons. Examiners may confuse subclass characteristics with individual characteristics, discussed below, in cases where there are limited microscopic marks of value.5 Subclass characteristics are only “present on a group of guns within a certain make or model, such as those manufactured at a particular time and place.” United States v. Monteiro, 407 F. Supp. 2d 351, 360 (D. Mass. 2006).

“Individual” characteristics are the other type of accidental marks sometimes found on guns.6 Like subclass characteristics, firearms examiners believe that individual characteristics

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5 http://projects.nfstc.org/firearms/module11/fir_m11_t04_01.htm (last visited July 26, 2018).

6 Marks left on ammunition by imperfections in the barrel versus deliberate rifling are called “striae.”
result from imperfections on tool cutting surfaces during the firearm manufacturing process, as well as through wear and tear of the firearm. Unlike subclass characteristics, firearms examiners presume that the imperfections that result in individual characteristics are imparted upon, and thus unique to, a particular gun. See NRC Forensics Report at 150-151; PCAST Report at 104.

Because of these individual characteristics, firearm examiners assume that each firearm has a unique set of patterns or marks on bullets or casings that are not shared by any other firearm. See Williams v. United States, 130 A.3d 343, 352 (D.C. 2016) (Easterly, J., concurring). While class characteristics are well-defined, firearms examiners lack standards for distinguishing between “subclass” characteristics, which are shared by firearms, and “individual” characteristics, which are not. Instead, the examiner relies on his or her training and experience.8

If the examiner finds “sufficient agreement” between the individual characteristics seen in the two sets of ammunition, he or she declares a “match” and concludes that the ammunition recovered from the crime scene was fired from the suspected firearm. No standard or protocol, however, dictates how many characteristics the examiner must find in agreement to declare a match. Instead, firearms examiners utilize a subjective pattern-matching methodology that allows each examiner to set his or her own criteria based on training and experience. See Exhibit I, AFTE Theory of Identification; see United States v. Taylor, 663 F.Supp.2d 1170, 1177 (D. N.M. 2009); see also PCAST Report at 104 (Examiners find “sufficient agreement” when they are “convinced that the items are extremely unlikely to have a different origin.”)(citing AFTE Criteria).

7 The assumption that wear and tear creates unique marks on all bullets and shell casings shot by a particular gun is puzzling as this would require “wear and tear” to remain constant over the life/use of a gun. This is contrary to the idea of “wear and tear.”

8 Firearms examiners themselves concede that subclass marks “may be misinterpreted, especially in cases with very limited microscopic marks of value, or in instances in which no firearm is submitted.” See Exhibit H, National Forensic Science Technology Center/AFTE Firearm examiner training module, Physical Characteristics, available at http://projects.nfstc.org/firearms/module11/fir_m11_t04_01.htm.
III. THIS COURT SHOULD EXCLUDE THE FIREARMS IDENTIFICATION TESTIMONY BECAUSE THE GOVERNMENT CANNOT DEMONSTRATE IT IS BASED ON A VALID AND RELIABLE METHODOLOGY

The field of firearms identification lacks the scientific validity that is the predicate for evidentiary admissibility. Indeed, the conclusions of the NRC and PCAST Reports are uniform: there is no scientific theory or technique that is generally accepted by the relevant scientific community, and there is no evidence that examiners regularly reach accurate conclusions. See Daubert, 509 U.S. at 593-95.

Each report found no empirical research proving the “theory of identification.” Instead, this “theory” is nothing more than a series of unproven assumptions embraced by firearms examiners. First, the field assumes that every firearm has unique characteristics resulting from both the manufacturing process and wear and tear, which consistently produce unique marks on bullets and shell casings. It also assumes that examiners, based on experience and judgment, can identify and distinguish these “unique” accidental marks from subclass marks9, which are also accidentally left during the manufacturing process but are not unique. Finally, the field assumes that examiners can accurately determine when two sets of “unique” marks are in “sufficient agreement” to declare a “match.” There is no standard for what constitutes “sufficient agreement,” nor is there empirical data supporting any particular threshold number of marks that must align. Rather, each examiner refers to his personal recollection of the amount of agreement he has

9 The OSAC (Organization of Scientific Area Committees) was unable to find a single study “that assesses the overall firearm discipline’s ability to correctly/consistently categorize evidence by class characteristics, identify subclass marks, and eliminate items using individual characteristics.” PCAST Report at n. 160; see Exhibit J, OSAC Research Needs Assessment Form. The OSAC was established by the National Institute of Standards and Technology (NIST) to develop standards and guidelines to improve the quality and consistency in the forensic science community.
observed in close non-matches encountered throughout his career; in other words, “sufficient agreement” is wholly subjective.

Assumptions and observations do not constitute a valid scientific theory tested through independent empirical research. To the contrary, a “valid theory” is a “comprehensive explanation of some aspect of nature that is supported by a vast body of evidence.” PCAST Report at 60; NRC Forensics Report at 154-55 (reaching the same conclusion); Ballistics Imaging Report at 1, 3 (“[T]he validity of the fundamental assumptions of uniqueness and reproducibility of firearms-related toolmarks has not yet been demonstrated.”).

The NRC and PCAST Reports also uniformly and emphatically conclude that the field of firearms identification has not proved it has a reliable or valid scientific technique for reaching conclusions about individualization, and is therefore not generally accepted in the scientific community. See Daubert, 509 U.S. at 593-95 (courts must consider “the extent to which the underlying scientific theory and technique are accepted as valid by the relevant scientific community.”) As all three reports recognized, to be an accepted scientific method, the field must conduct empirical testing to prove that examiners can reliably and repeatedly reach accurate conclusions. The field lacks any repeatable and consistent procedures for examiners to follow when identifying features within evidence samples, comparing those samples, and then measuring the significances of similarities and differences. Rather, the field allows each examiner to draw his own subjective conclusions about what qualifies as “sufficient agreement” between test-fired samples and found ammunition. See PCAST Report at 111-12; see also NRC Forensics Report p. 155 (concluding that the field of toolmarks relies on the “subjective findings of examiners rather than on the rigorous quantification and analysis of the sources of variability.”); id. at 153-54 (“the
decision of the toolmark examiner [to declare a match] remains a subjective decision based on unarticulated standards and no statistical foundation for estimation of error rates.”).

As these reports also make clear, the field lacks sufficient peer review. *Daubert*, 509 U.S. at 593-95 (requiring courts to evaluate whether peer-reviewed studies exist demonstrating the field’s validity). Only one study, the Ames study, has replicated case-work situations to test the reliability of firearms examiners’ case work. PCAST Report at 108-110. This does not prove scientific validity. *Id.* at 111.

To that end, the field lacks a known error rate, as only one appropriately designed study – the Ames study – has attempted to measure it. *Id.*; *Daubert*, 509 U.S. at 593-95 (emphasizing the importance of a known error rate in assessing a field’s reliability). That study suggests that the field has grossly underestimated its rate of false-positives. *Id.* at 11, 111. Without a known error rate, “an examiner’s statement that two samples are similar – or even indistinguishable – is scientifically meaningless: it has no probative value, and considerable potential for prejudicial impact.” *Id.* at 6.

Here, the firearms examiners will merely rely on their training and experience to reach indefensible claims of individualization and certainty. However, the collective experience of examiners in the field and in courts, no matter how extensive, is not a scientific basis to demonstrate validity and reliability. Claims to the contrary have been soundly rejected by the scientific community. “Nothing – not training, personal experience nor professional practices – can substitute for adequate empirical demonstration of accuracy.” PCAST Report at 46.

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10 The proposed testimony contravenes a 2016 memorandum from the Attorney General directing Department forensic labs to cease using even the lesser expressions “reasonable scientific certainty” or “reasonable [forensic discipline] certainty” in their reports or testimony and directing Department prosecutors to abstain from use of these expressions. *See Exhibit K*, DEPT. OF JUSTICE, Memorandum of Attorney General Loretta Lynch (Sept. 6, 2016)
Defense counsel have made requests to ascertain the scientific foundations and principles upon which the Government’s examiners will rely. See Exhibit L, Firearm & Toolmark Discovery Request (requesting validation studies conducted and/or relied on in connection with firearm analysis in this case). However, the firearms examiners in this case have failed to identify the validation studies that would support their claims and proposed testimony. The defense submits that the NRC and PCAST Reports critiques of the firearms identification discipline are the reason for this silence. The entirely subjective methodology employed here lacks sufficient empirical evidence to establish validity and reliability. The firearms identification evidence is not evidence that a jury can rely on. This Court should exclude it.

IV. THE COURT SHOULD EXCLUDE THE EXPERT TESTIMONY BECAUSE THERE IS NO WAY TO DISCERN WHETHER THE METHODOLOGY HAS BEEN RELIABLY APPLIED

Even if the Court finds that the general methodology underlying the Government’s expert testimony is sufficiently reliable, it must query “whether those principles and methods have been properly applied to the facts of the case.” See Fed. R. Evid. 702 advisory committee’s note; Rule 702(a)(3).

The admissibility of an examiner’s opinion as to the existence of an identification is a subjective determination predicated on the examiner’s experience, and it is “essential that the examiner provide a sufficient explanation for the basis of the opinion.” See Willock, 696 F. Supp.2d at 561. As noted by the Advisory Committee Note to Fed. R. Evid. 702:

If the witness is relying solely or primarily on experience, then the witness must explain how that experience leads to the conclusion reached, why that experience is a sufficient basis for the opinion, and how that experience is reliably applied to the facts. The trial court’s gatekeeping function requires more than simply “taking the expert’s word for it.”
In Willock, the Court emphasized that when applying a subjective methodology like firearm identification, evidence is relevant, reliable, and helpful only if the examiner followed and documented his or her application of the accepted methodology. See Willock, 696 F. Supp.2d at 572 (discussing the importance of adherence to standards in firearms toolmark identification).

To this end, courts have required an expert presenting subjective identification testimony to properly document his analysis such that his conclusions and application of the methodology in question can be verified and reproduced. “The twin requirements of adequate documentation and peer review of the primary examiner’s results are said to ‘ensure the reliability of the expert’s results and the testability of the opinion.’” Willock, F. Supp.2d at 561 (citation omitted); In de Paoli R.R. Yard PCB Litig., 35 F.3d 717, 745 (3d Cir. 1994) (explaining that “any step that renders the analysis unreliable . . . renders the expert’s testimony inadmissible. This is true whether the step completely changes a reliable methodology or merely misapplies that methodology”). Thus, in the context of expert testimony regarding subjective firearm identification, courts have explained that “[r]eproducibility is an essential component of scientific reliability.” United States v. Green, 405 F. Supp. 2d 104, 108 (D. Mass. 2005); see also Monteiro 407 F. Supp. at 368.

For these reasons, courts have excluded subjective firearm expert testimony where the examiner failed to document their analysis in a way that was reproducible and verifiable. Monteiro, 407 F. Supp. at 374 (“Until the basis for the identification is described in such a way that the procedure performed…is reproducible and verifiable, it is inadmissible under Rule 702”); Green, 405 F. Supp.2d at 120 (absence of notes and photographs by firearms examiner “makes it difficult, if not impossible,” for another expert to reproduce what examiner did); Commonwealth v. Pytou Heang, 458 Mass. 827, 847 (2011) (“[B]efore trial, the examiner must adequately document the findings or observations that support the examiner’s ultimate opinion, and this
documentary evidence, whether in the form of measurements, notes, sketches, or photographs, shall be provided in discovery, so that defense counsel will have an adequate and informed basis to cross-examine the forensic ballistics expert at trial.”). In Monteiro, the government sought to admit evidence regarding firearm identification. The court found that subjective firearm methodology required, as a “prevailing and established standard of reliability” that examiners “document identification by notes, sketches, or photographs.” Id. at 373. But the Monteiro examiner failed to do so. His notes “contain[ed] no description of what led [the examiner] to his conclusions. Id. For that reason, the court excluded the identification, explaining that: “Until the basis for the identification is described in such a way that the procedure performed by [the examiner] is reproducible and verifiable, it is inadmissible under Rule 702.” Id. at 374.

By excluding any basis for their assertions, the Government’s examiners failed to conform to either recognized standards of quality laboratory practice, the Forensic Science Division’s own Standards of Policies and Practices, and the requirements of Rule 702. The documentation, or lack thereof, does not divulge the data upon which the conclusions were drawn. While the examiners have turned over photographs they do not document or note anywhere which individual characteristics were relied on to reach their conclusions. See Medley at 116. That the Government’s examiners purport to have followed a process does not provide the needed “facts or data” or demonstrate that they “reliably applied the principles and methods to the facts of the case.” See Fed. R. Evid. 702. The missing “facts and data” are necessary to connect the examiners’ process to their conclusions.11 The examination conducted in this case is not reproducible or verifiable, and thus must be excluded under Rule 702.

11 See, e.g., Exhibit M ¶ 9, DEPT. OF JUSTICE, Code of Professional Responsibility for the Practice of Forensic Science (Forensic science providers must meet 15 requirements including “[M]ake and retain contemporaneous, clear, complete, and accurate records of all examinations, tests, measurements, and
V. THE GOVERNMENT HAS NOT PROVIDED A BASIS FOR ITS EXAMINER’S OPINION

The same defects that render the firearm identification evidence inadmissible under Rule 702 dictate its exclusion under Rule 16(a)(1)(g). The Government’s expert disclosure did not adequately lay out the basis for its expert’s opinions. Initially, the Government’s summary states that it “anticipates that Mr. Gesser will testify concerning his methodology…and the basis for his conclusions in this case.” Government’s Expert Disclosure at 2. However, none of the paperwork describes the basis for the examiner’s conclusions. The defense is entitled to know the basis for Mr. Gesser’s conclusion; not speculate. The Government Disclosure is insufficient under Rule 16.

Equally important, as discussed above, by omitting the data used to reach the examiner’s conclusion, the Government left out the critical link between any methodology and the conclusion. The process is the steps followed in a methodology. The data gathered during each step, however, is what forms the basis of the expert’s opinion. See, e.g., United States v. Saunders, 826 F. 3d 363, 369 (7th Cir. 2016) (finding a Rule 16 violation for failure to provide the basis of the examiner’s opinion where the Government did not disclose the number of points of similarity for a fingerprint identification). Here, the bench notes describe only class characteristics, which cannot limit the potential pool of firearms any further than a particular make and model of firearm. It is that data, striations claimed to be in agreement and disagreement, that serves as the firearm examiner’s “basis” for his ultimate conclusion regarding whether the casings were fired from the firearm. See Medley at 46-52

The key bases of the firearms examiner’s opinion have not been disclosed, and thus the defense has been denied the opportunity to challenge the Government’s evidence.
VI. AT A MINIMUM, THE COURT MUST LIMIT THE TESTIMONY OF THE FIREARMS EXAMINER SO THE JURY IS NOT MISLED

Should this Court refuse to exclude the examiner’s testimony on firearms identification, it should nonetheless limit the examiner’s conclusions to describing the similarities he sees between the two sources, without declaring that the spent ammunition was fired from the same gun or that the spent ammunition was fired from a specific gun. This Court should also insist that firearms examiners present the only documented error rate – between 1 in 46 and 1 and 66 – to the jury. See PCAST Addendum at 7. Failure to limit this testimony will mislead the jury, violating Federal Rules of Evidence 702 and 403, and Mr. Thomas’s Due Process rights. The examiner must not be permitted to overstate the significance of his conclusion by making claims that exceed the empirical evidence and the applications of valid statistical principles to that evidence. Instead, the examiner must “report the overall false-positive rate and sensitivity for the method established in the studies of foundational validity,” and should “demonstrate that the foundational [or black-box] studies are relevant to the facts of the case.” PCAST Report at 6.

Courts must limit the examiner’s testimony if there is a gap between the conclusions supported by existing data and the examiner’s conclusions. Gen. Elec. Co. v. Joiner, 522 U.S. at 146. Permitting the examiner to state conclusions beyond those supported by the data blindsides the jury into giving the examiner’s testimony more significance than is due. For this reason, courts have refused to allow firearms examiners to make conclusions of absolute certainty when declaring a match, as no empirical evidence shows that toolmarks are always unique, or that examiners are generally right. See, e.g. Willock, 696 F.Supp.2d at 549 (requiring the expert to state his opinions and conclusions without any characterization to the degree of certainty); Taylor, 663 F.Supp.2d at 1180 (“[B]ecause of the limitations on the reliability of firearms identification evidence . . . [the
examiner] will not be permitted to testify that his methodology allows him to reach this conclusion as a matter of scientific certainty.”); *Glynn*, 578 F.Supp.2d at 574 (emphasizing that examiners tend to make assertions “that their matches are certain beyond all doubt, that the error rate of the methodology is ‘zero,’ and other such pretensions.”); *Monteiro*, 407 F.Supp.2d at 372.

This Court should therefore preclude the Government from introducing testimony suggesting there is any statistical significance tied to similar toolmarks found on ammunition unless the firearms community presents data showing that certain characteristics are unique. As the three reports discussed throughout demonstrate, there is insufficient empirical evidence suggesting that toolmarks are unique or that examiners can declare a match at the exclusion of all other weapons.12 Instead, this Court should limit the examiner to pointing to the similarities he sees between the ammunition, and any differences identified.13 Recently, after a *Daubert* hearing, Judge Grimm ruled that an examiner from the same laboratory as Mr. Gesser would only be permitted to:

“…put up his pictures. He can show the similarities between one and the other, and he can even express the opinion that the marks from the .45 that he test fired, the marks on the cartridges are consistent with the marks on the other one that were found at the crime scene, but I won’t allow him to express the opinion that they were produced by the same gun, and I won’t allow him to express a confidence level as to his opinion.”

12 It is not enough to simply bar the examiner from using the phrase, “to the exclusion of all others.” “A statement that markings are ‘unique’ to a particular gun is a statement that that the probability of finding another gun that can create identical bullet markings is zero. If purportedly unique patterns on bullets are declared to match, that declaration likewise negates the possibility that more than one gun could have fired bullets—it is a statement of unqualified certainty that the bullets were fired from a specific gun to the exclusion of all others.” *See, e.g.*, *Williams*, 130 A.3d at 352.

13 “[T]he subjective nature of the process, lack of quantitative standards, and limited scope of foundational testing do not demonstrate the scientific principles necessary to establish the origin of the marks with any specific amount of certainty.” *United States v. St. Gerard*, APO AE 09107, at 4 (U.S. Army Tr. Judiciary, 5th Judicial Cir. June 7, 2010).
Medley at 54. As explained supra, no researchers have conducted reliable scientific studies analyzing the frequency of toolmark characteristics. The firearm examiner, therefore, has no more idea than the jury as to the significance of similarities or differences between toolmarks left on ammunition.

Alternatively, this Court should limit the examiner to testifying only that “this gun cannot be eliminated as the source of the bullet/cartridge.” This is the ruling made recently by the circuit judge in State of Missouri v. Scott Goodwin-Bey, No. 1531-CR00555-01 (Dec. 16, 2016). After hearing testimony from both prosecution and defense firearms experts, the trial judge expressed serious concern over the lack of a scientific basis supporting firearms comparison testimony. “As it stands today,” the Court noted, “independent scientists have uniformly concluded that firearm and toolmark analysis has not been scientifically validated. Only current and former law enforcement personnel – who have proverbial skin the game – believe otherwise.” Id. at *4-5.

Finally, this Court must require the examiners to accurately report an error rate. To date, the only available error rate comes from the Ames study. The expert should therefore have to tell the jury that the field has an error rate between 1 in 46 and 1 in 66 and that there is no data on this examiner’s ability.15 “Claims of higher accuracy are not justified at present.” PCAST at 12.

14 The Court emphasized that toolmark evidence is “all subjective,” that there existed no “large scientific studies to determine an error rate,” and that the “peer community is almost exclusively law enforcement.” “Toolmark identification is a very valuable tool,” the Court stated, but “that is where it should stay, in the area of law enforcement, not in the courts.” Id. at 7.

15 The defense requested information with regard to proficiency testing taken by the examiners in this case. To date, the defense has not received any information. It is well-documented that the firearms field lacks the rigorous proficiency testing and controls for minimizing human error and bias that ensure the method is reliably applied. Whereas “[s]cience takes great pains to avoid biases by using strict protocols to minimize their efforts,” NRC Forensics at 122, the field of firearms identification has not taken any steps in that regard. Id. at 8 n.8 (“Unfortunately . . . there is no good evidence to indicate that the forensic science community has made sufficient effort to address the bias issue.”). To the contrary, firearms examiners are often given contextual information about the case and evidence before performing examinations. Id. at 123; see also Taylor, 663 F. Supp.2d at 1178 (quoting Green, 405 F.Supp. 2d at 108. And the field lacks
Without this qualifying information, there is a grave risk that the jury will overvalue the expert’s testimony.

CONCLUSION

For the reasons set forth in this motion, Mr. Thomas respectfully requests that this Court exclude the proposed testimony of the firearms examiner, or in the alternative limit such testimony as described above. Mr. Thomas further requests a hearing on this matter to enable him a meaningful opportunity to demonstrate to the Court the necessity for the relief requested herein.

Respectfully submitted,

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the rigorous proficiency testing showing that specific examiners are capable of conducting accurate evaluations in each case. PCAST Report at 111-12.
CERTIFICATE OF SERVICE

I hereby certify that on July 27, 2018, a copy of the foregoing was served via CM/ECF to parties in this matter.

/s/
Michael S. Oppenheimer
UNITED STATES OF AMERICA
FOR THE DISTRICT OF MARYLAND
SOUTHERN DIVISION

UNITED STATES OF AMERICA,     : Criminal Action No.:
   vs.                      : PWG 17-242
JOVON MEDLEY,             : Greenbelt, Maryland
   Defendant.           : Tuesday, April 24, 2018

______________________________/

TRANSCRIPT OF EXCERPT OF MOTION HEARING PROCEEDINGS
BEFORE THE HONORABLE PAUL W. GRIMM
UNITED STATES DISTRICT JUDGE

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COMPUTER-AIDED TRANSCRIPTION OF STENOTYPE NOTES
EXCERPT

(Whereupon, other proceedings were reported, but are not herein transcribed.)

THE COURT: All right. Are we ready to proceed?

MR. OPPENHEIMER: Yes, Your Honor.

MR. NAUVEL: Yes, Your Honor.

THE COURT: All right. The two operative filings in this case are ECF 68, Defense Motion In Limine to Exclude Firearm Identification Evidence or in the Alternative to Limit it, which was filed on March 21st, 2018. And ECF 78, the government's response to this motion, ECF 78 filed on April 9th, 2018.

Each of the motions contained a significant number of exhibits, the defense exhibits were numbered A through N, and include ballistic imaging report excerpts, excerpts from the PCAST, which is President's Council of Advisors for Science and Technology, excerpts, PCAST addendum, the National Research Committee's forensic report, the disclosure of Mr. McVeigh in this case, the affidavit of Mr. Nixon, who is the defense expert, a article from "Jurimetrics," J-U-R-I-M-E-T-R-I-C-S, 51 "Jurimetrics Journal," summer 2010; the AFTE, which is the Association of Firearms and Tool Mark Examiners, training module; the AFTE, theory of identification; a OSAC research needs assessment form, and -- hold on one second.
THE COURT: Department of Justice memorandum from Attorney General Lynch dated September 2016 regarding forensic evidence disclosures, firearm and tool mark discovery requests submitted by the defense, the government's discovery production letter, and the Department of Justice Code of Professional Responsibility for the Practice of Forensic Science.

In response, the exhibits produced by the government were the Prince George's County police investigator's notes from Mr. McVeigh, witness statements, the crime scene report, various documents associated with the NIBIN, N-I-B-I-N, analysis, which was testified about yesterday. Firearms analysis, the response of the AFTE to the National Academy of Sciences 2008 report addressing feasibility, accuracy and technical capability of national ballistic database. The response to 25 foundational firearm and tool mark examination questions, the 2016 PCAST report, the OSAC response to the PCAST report.

Give me one second. Yes, finally, OSAC, Organization of Scientific Area Committees, the tool marks, the firemarks -- Firearms and Tool Mark Subcommittee dated 14 December 2016, which was submitted to PCAST in response to its December 2016 report. And then various documents with regard to the discovery produced in this case at the hearing. Additional documents were introduced into evidence and received as well.

I want to start with the general evidentiary issue
that we have to address. From there I want to deal with past judicial opinions that have focused on firearms evidence. I then want to focus on the more recent analysis of firearms, tool mark evidence inaugurated by the 2015 PCAST report and subsequently. Then I want to address the specific expert report findings in this particular case and leave you with my ruling.

The challenge as presented by the defense comes from Federal Rule of Evidence 702 that deals with expert testimony. That rule, which was last codified in December of 2000, says that, in essence, when if scientific technical or specialized information will assist the fact-finder in understanding the evidence or making a determination of an issue that is left to the fact-finder, then an expert qualified by virtue of knowledge, training, experience, background, education or skill may testify in the form of an opinion or otherwise. That was the basic formula up until 2000 that had been in existence since the mid-1970s when the Rules of Evidence were first codified.

But in response to the trilogy of cases from the mid-1990s to the end of the 1990s in Daubert versus Merrell Dow, the Kumho Tire, I think it's Kumho Tire versus Carmichael, and the Joiner case, the Advisory Committee for the Rules of Evidence recommended and the Supreme Court and Congress approved changes to Rule 702 that added the new language after the introductory clause I have just paraphrased. That new language required that the expert could testify in a form of an opinion
or otherwise if properly qualified, and if it would be helpful
to the jury. If, one, the expert's opinion was based upon
sufficient facts or data.

    Two, the methods and principles relied upon were
    reliable.

    And three, the methods and principles used would
    reliably apply to the facts of the particular case.

Those final three qualifications were the product of
the Supreme Court's discussions in the Daubert, Joiner and Kumho
Tire, K-U-M-H-O, Tire cases.

    The new area of evidence law that was inaugurated by
Daubert in the mid-1990's thrust upon federal judges a role that
many feel they're ill equipped for. And that is, judges who are
generalists are required to make specific assessments regarding
the validity and reliability of underlying scientific and
technical processes that come into court very frequently.

    Daubert was an interesting case because it was a
method/epidemiological case involving the birth control drug
Bendectin -- not birth control, but the antinausea drug for
pregnant women, Bendectin, and whether it caused birth defects.
And the plaintiff who had very qualified experts had introduced
in response to the defense Motion for Summary Judgment the
affidavits of a number of very qualified experts who expressed
the opinion that based upon chemical analyses in lab testing of
rodents, and the careful analysis of the underlying data in
various published opinions that themselves did not find the
causal connection, that there was a causal connection between
Bendectin and birth defects.

The defendants had received that expert disclosure as
required by Federal Rule of Civil Procedure 26(a)(2), and when
discovery had concluded, they filed a Motion for Summary
Judgment with an affidavit of a medical doctor who was an
epidemiologist who swore in his affidavit that he had reviewed
all 300 plus published articles that dealt with Bendectin, and
that there was no epidemiologically recognized causal connection
between Bendectin and birth defects. And as a result of that,
the District Court excluded the plaintiff's experts and granted
summary judgment in favor of the plaintiffs -- or the defendant,
excuse me.

It went up on appeal and ultimately the Supreme Court
granted cert. And largely the epidemiological affidavit of the
doctor had taken the position that the methodology used by the
plaintiff's doctor in Daubert was flawed because the generally
accepted methodology for determining causation of health,
adverse health effects in the large population of people came
not from clinical medicine, the assessment of individual
patients' health and the treatment thereof, but rather
epidemiological studies of broad populations throughout a
lengthy period of time, and that that methodology used by the
plaintiff's experts was not generally accepted as reliable among
the relevant scientific community, which was epidemiologists.

At the Supreme Court, the plaintiffs and their amici shocked all of the observers because they took the position that this general accepted standard which came from United States versus Frye, a decision of the 1920s by the District of Columbia Court of Appeals that rejected the proposed testimony of a precursor to a lie detector test.

The plaintiffs in their amici argued that that general accepted standard had no place in Evidence Rule 702, which when the Rules of Evidence were codified in the mid-1970s supplanted that common law approach for determining when novel science was admissible.

And what Frye had said was, "In the continuum of science, which marches on for all times, no individual knows," and this is paraphrasing language actually used by the court in that twilight zone of science, and they used the phrase "twilight zone," an idea which has promise crosses the line and becomes generally accepted by the scientific community. But when it does, it's reliable enough to be brought to the attention of juries to be used in deciding cases.

And the Supreme Court was faced with the challenge of whether or not there was any position for the Frye case as a standard when Rule 702 was absolutely silent about whether that standard applied.

The Supreme Court's Daubert decision started from the
broad propositions that they felt were important, and there wereour of them: Relevance, reliability, helpfulness and fit.
Evidence is not relevant under Rule 401, has no tendency to
prove something is important to the case and shouldn't be
admitted.

Reliable evidence is not -- unreliable evidence is not
relevant. If methodology does not produce reliable results, it
has no tendency to prove something important in the case.
Reliability is key.

Helpfulness is key for expert testimonies. We want
the jury to be helped. Unreliable expert testimony, methodology
that's not reliable is not relevant and, therefore, can't help.

And then there's fit, whether or not the methodology
used fits the facts of that particular case. And from these
four overlapping areas of evidentiary concern, the Supreme Court
moved on to say that there would be a non-exclusive five factor
test that federal judges were required to employ under Federal
Rule of Evidence 104(a) that says that the judge makes
preliminary determinations regarding the admissibility of
evidence, the qualification of witnesses and the existence of a
privilege. And in doing so is not required to strictly apply
the Rules of Evidence except for privilege. That, by the way,
is bolstered by Evidence Rule 1101(d)(1), which says that the
facts upon which the court makes a 104(a) ruling are not
strictly bound by the Rules of Evidence with the exception of
And judges, after *Daubert*, were supposed to exercise this gatekeeper function. And to do so there were five non-exclusive tests that were identified.

Number one, has the methodology been tested.

Number two, is there a known error rate.

Number three, has the methodology and the testing of that been subject to peer review evaluation.

And the court put great faith in peer review as it occurs in the scientific community when research findings are published, a board of distinguished peer reviewers evaluates the -- the nature and the design of the experiment ensures that it is appropriate for publication. And then the publication process draws review by other scientists in the field, criticism support, spinoff experiments. And from that process science is supposed to evolve identifying promising reliable methodology and eliminating that which, perhaps, promising but turned out not to have sustainability when subject to subsequent review.

Third -- or fourth was whether or not the methodology had generally been accepted by the relevant community.

And the community here is scientific, technical or specialized. Manifestly not judicial as the Seventh Circuit and the Sixth Circuit in other context, looking at cell tower information, which is our next hearing, have said, the judicial community and the law enforcement community are not the proper
communities for determining whether scientific, technical or
specialized information is reliable. That is a community of
those who practice that particular science, technology or their
technical discipline.

And the mere facts that -- the mere fact that courts
have relied upon a certain methodology and admitted it in the
past does not grandfather that methodology once the Daubert
decision and Rule 702 was changed to require judicial
independent analysis.

The final Daubert factor was whether or not there were
standard tests and protocols that governed the methodology and
whether they had been complied with. So it's testing, error
rate, peer review, general acceptance and compliance with
standard testing protocol.

As I mentioned when counsel were capably arguing, the
judicial community was gobsmacked by this decision. And judges,
as the Chief Justice Rehnquist in his -- in his separate opinion
that he wrote in Daubert said essentially that he had no -- he
stood second to no person in his respect for the federal
judiciary, but how in the world federal judges, who are
generalists, were supposed to apply falsifiability to a myriad
of scientific and technical disciplines in the context of
resolving a specific case was a mystery to him.

Notwithstanding that, the mystery continues, and after
the Daubert case, the Kumho Tire case applied the Daubert
methodology to nonspecifically scientific disciplines. That involved explosion of a tire, and it was more a matter of engineering and manufacturing than it was science. And then the Joiner decision also provided insight.

So the efforts of the judiciary to confine like putting the Jeannie in the bottle, the analysis of Daubert to hard science was dispelled after that trilogy of Supreme Court cases. The changes to Rule 702 were adopted, and since that time courts have been required to allow it. And to follow that procedure.

There's not only associated with Daubert because Daubert was actually intended to liberalize the introduction of scientific, technical and specialized information because previously, the hammerlock of general acceptance meant that there could be very promising and potentially reliable methodology that had not been around long enough to obtain or to attain general acceptance that would be rejected because they weren't generally accepted. And Daubert was actually conceived of as a liberalizing analysis to be used.

Experience has shown it's been used primarily just for the opposite, namely it tried to exclude evidence, but regardless of whether it's used to include or exclude evidence, Daubert puts a substantial burden on the court to exercise that gatekeeping function. And it is not permissible for courts to ignore that gatekeeping function when faced with challenges that
raise into question the various elements of what Daubert requires.

Turning my attention now to the firearms, tool mark evidence. The starting point for my analysis is my report and recommendation, which was adopted by Judge Quarles, when I was a Magistrate Judge, eight years ago in United States versus Willock, W-I-L-L-O-C-K, 696 F.Supp. 2d 536, which dealt with firearms, tool marks analysis. I am not going to verbatim go through every bit of that decision, but I'm going to talk about some of the significant concepts in that opinion that continue to have liability today.

In 2010, as for tool mark evidence, particularly being used primarily in criminal cases to identify whether or not bullet fragments, bullets or cartridge casings were fired from a particular firearm that was involved in a crime, that evidence had been around for probably a hundred years and had been widely accepted without any real challenge or analysis by state and federal courts throughout the country and the world.

And, indeed, as evidence of that, when I asked him this question yesterday, Mr. McVeigh testified that in the 80 times in which he had testified as an expert regarding his discipline, only twice, this case and one other case, had there ever been a real challenge that required the court to exercise its function. And that's a perfect reason to explain why the mere fact that courts in the past have accepted certain
technical or specialized information is absolutely not in itself sufficient for courts to continue to admit it. It's just not allowed. It's not what Daubert requires, although it is easy sometimes just to say, well, those other courts have done it so will I.

As pointed out in Willock, at that particular time, 2010, the National Research Council at the request of the National Academy of Sciences had begun to look at forensic evidence and had published a report that focused on many of the forensic comparative forensic analysis and had reached -- had expressed opinions regarding whether it was reliable.

And in the Willock case, I cited to all of the significant federal court decisions that had been decided as of that date to have looked at the admissibility of tool mark evidence. Obviously in 2010, that was ten years after the changes to Rule 702. Some courts had done what I will call rigorous 702 analysis, others had not, had just simply accepted this evidence because it had always been introduced in the past.

The basic foundation of tool mark forensic evidence was discussed in the Willock case beginning at page 555 of the opinion. Essentially what it says is a tool mark is a mark that's generated when a hard object known as the tool comes into contact with a relatively softer object.

And that, for example, in the context relevant to this case is when a firearm makes contact with -- when it's made,
when you have a hard tool that gouges or carves or removes metal
in order to form the component parts of the firearm; the barrel,
the chamber, the breach face, the firing pin, and if you're
dealing with a semi-automatic as we are here, the extractor, the
ejector. And when the tools that manufacture these manufactured
products, the components of the firearm are softer than the tool
that makes them by definition and the thought is that
microscopic magnification, you can see marks made by the tools
on the item that was manufactured.

Similarly, when a semi-automatic handgun is
discharged, the theory goes, marks are transferred to the
components of the ammunition.

So, for example, when a semi-automatic handgun
advances a cartridge which composed of the -- the cartridge
casing, the bullet, and inside of it is the explosive material
that propels the bullet in the back of which is the firing pin,
it comes up into the chamber. When the -- when the slide of the
handgun is pulled back and advances it into the chamber and goes
forward, the breach face comes into contact with the back of the
cartridge. When the trigger is pulled, the firing pin is
impacted by the hammer, which can leave an impression in the
center of the rim of the back of the cartridge.

The explosion that occurs when the firing pin
detonates the -- ignites the explosive, propels the bullet,
which goes through the rifling in the barrel, which can go from
left to right or right to left, expels in a spinning fashion the bullet, and the bullet then goes to wherever it lands.

The gas that is expelled by the explosion then forces the ejector back, it then grabs with another piece of the mechanism the rim of the cartridge, flips it out, and advances another one up into the chamber, and the process starts again as quickly as the trigger can be pulled.

And the theory is, is that those forces cause the harder metal of the component parts of the semi-automatic handgun to transmit marks on the bullet made by the lands and grooves of the barrel and the cartridge as it is grabbed and pushed and pulled and ejected.

And those characteristics, the theory goes, can be microscopically looked at, and you can compare cartridges fired or bullets fired from the same handgun over a succession of time.

And the theory is that if tool marks are unique and transmitted uniquely by each gun onto the components of the bullet when it is fired, then you would expect to see the same matching set of marks on the components of a bullet if you examined it under high magnification. That's the theory.

The National Research Council's Committee that was charged in 2008 in this report reported on its examination of ballistic tool mark analysis, and one of the things that is associated with it is sort of three definitions that become key
in the way in which the science and technology is supposed to operate.

First of all, you have class characteristics. Those are family resemblances which will be present in all weapons of the same make and model. So we have the .45 caliber as distinct from the .38 caliber or a .32. We have a revolver which operates differently than a semi-automatic. We heard testimony from Mr. McVeigh yesterday that some rifling goes to -- toward, twists toward the right. Other rifling may twist toward the left. There may be different numbers of spirals in the rifling, the longer the barrel, the more the spirals, and those are class characteristics.

So if, for example, you find a .38 caliber shell at a crime scene, then by definition you've eliminated every larger caliber and smaller caliber handgun from the likely candidates that could have fired that gun. The .45 eliminates a .32 and .38 and a 9-millimeter and those are class characteristics.

Class characteristics that can cause impressions on -- on bullets and casings and cartridge casings including the caliber, type of breach face, type of firing pin, and the breach face can be parallel, arched, smooth or granular or circular. The firing pin can leave an impression that's circular or rectangular or elliptical.

Then we have subclass characteristics. Subclass characteristics are defined, and this is at page 58, by the way,
of the Willock case, produce incident to the manufacturer and
can arise from a source when changes over time and therefore may
be present on a group of guns within certain make or model such
as those manufactured at a particular time and place. That's
the Montiero case, the Diaz case and the NRC ballistic imaging
report cited at page 558.

So, the notion would be that an example of subclass
characteristics would include imperfections that are present on
the tool that creates the component parts of a firearm that, for
example, are manufactured in a single manufacturing run. So
we've got the same kind of product that is being used to make
the barrel, for example. We've got the same tools that are used
to make the barrel, and we're going to run all these through in
one run of 200 barrels.

And the theory is, is that those will have subclass
characteristics. So they'll be .45 caliber, they'll be barrel
that has a right groove twist. There'll be seven curves in the
rifling, but each one having been manufactured by the same tools
will bear upon microscopic examination unique marks that were
imprinted on them by that particular manufacturing process.

And the theory is, is that if you were to fire
ammunition through all of those, then you would expect to see
some marks on all of them that were similar because they were
manufactured from products all created by the same tools in the
same individual manufacturing process. That's the theory
anyway. And that's discussed by Mr. Nichols in his 52 "Journal of Forensic Science" article at page 587, 2007.

Finally, we have individual characteristics, which are defined as random imperfections produced either during the manufacture or by accidental damage which are unique to the object and distinguish it from all others.

The -- and this, by the way, is sort of the key, an analytical issue of tool mark analysis in firearms cases. And that is whether or not, when you look at the marks on a shell casing found at a crime scene, whether they were, they bear the identity of individual characteristics unique to them based upon the unique marks on the handgun that fired them or whether they are -- bear the characteristics of marks that they share as subclass characteristics from a number of guns manufactured by the same tool. And that is the whole underlying issue as to whether or not the firearms examiner can state that the marks on the bullet or the cartridge are unique and individual to that particular firearm to the exclusion of other firearms.

Now, how does a firearms examiner get from the examination of a set of cartridges and bullets found at a crime scene to a decision as to whether or not they were fired by one particular individual firearm that has been proven to be connected to the defendant?

They do so through a process that allows them to reach the decision that the marks on the cartridges or the bullet
fragments found at the crime scene are in sufficient agreement with the marks that are found on cartridges and bullet components that have been known to have been produced from the handgun at issue. And page 560 of *Willock*, the definition of sufficient agreement that was used in the *Montiero* case that was quoting from the AFTE, which is the Association of Firearms and Tool Mark Examiners' theory at page 86, and the Nichols' article that I just quoted from before at page 589 is defined as follows:

"Agreement is significant when it exceeds the best agreement demonstrated between tool marks known to have been produced by different tools and is consistent with the agreement demonstrated by tool marks known to have been produced by the same tool."

Now, as pointed out at page 560 of *Willock* and acknowledged by the *Montiero* case in the AFTE theory at page 86, this is inherently subjective, and indeed, as we'll see in just a moment, the PCAST report says it's also circular.

When you say that the agreement is significant when it exceeds the best agreement demonstrated between tool marks known to have produced by two different tools, that necessarily encompasses the proposition that different tools can produce marks that are the same. And therefore, in order to take the first step of a sufficient agreement, the tool mark examiner has to have some ability to differentiate the fact that at some
point the number of agreeing marks between the questioned bullet and the source gun are more than you would expect to find from marks that are the same or similar which were produced by firing from different guns. That's the first step, and yet there is no numerical value that allows us to know whether is it one, is it two, is it four, is it 12, is it 17. How do we know that? Definition doesn't answer that.

The same circularity applies to the second half, which is, is it consistent with the agreement demonstrated by tool marks known to have been produced by the same tool. Now, what does that mean? So that means that by definition it can't be avoided that marks, that when you have -- with a tool as a handgun, and the items are being looked at are the cartridges and the bullet fragments, that the very definition of sufficient agreement acknowledges that there will be different marks on the bullets produced by the same tool. And that you expect there to be differences, but when there are similarities, if they are consistent with, whatever that's supposed to mean, the agreement demonstrated by marks known to have been produced by the same tool, then that plus the first component of the definition allows the examiner to express the opinion that there is sufficient agreement and express the opinion, if allowed by the court, that the gun produced was the gun that discharged that ammunition.

This is a subjective test and nothing since 2010 and
nothing before it and nothing after it has done anything to
change the subjectivity of this test. As pointed out at page
560 of Willock, there is no quantitative standard for how many
striations or marks need to match or line up. It's based upon a
holistic assessment of what the examiner sees.

And as the Glynn case, the Glynn court observed, it's
inherently vague, and they are significantly subjective.
Indeed, Ronald Nichols, who is the -- probably the most
well-known ATF agent and AFTE supporter of the substantial
agreement and firearms analysis methodology, who is assigned to
the ATF bureau in San Francisco, at least was in 2010, as he
said in his article previously quoted in the Willock article at
page 589, there is no universal agreement as to how much
 correspondence exceeds the best known non-matching situation.

So, how do we try to square the circle? Well, as
noted in Willock, the -- the AFTE methodology places a great
deal of premium on documentation of the reasons concluding that
there is a match. And they say that it can include diagrams,
photographs or written descriptions, plus what they refer to as
peer review, which is not peer review. It's not publication in
journals that expose the methodology for others to review and
criticize, but rather it just means verification by some other
tool mark examiner.

The AFTE standard, and I'm quoting now from the
standardization of comparison documentation cited at page 561 of
Willock says: "The case record must contain documentation of
the observations that serve as the basis for a reported
conclusion."

Now, I'm no longer quoting. It goes on to say there's
a lot of latitude, and I now quote, "laboratories are afforded
latitude in establishing how this should be accomplished. At a
minimum, the documentation must include interpretable depictions
or descriptions of the agreement or disagreement of individual
and/or class characteristics to the extent that another
qualified firearm and tool mark examiner, without the benefit of
the evidence itself, can review the case record, understand what
was compared, and evaluate why the examiner arrived at the
reported conclusion. The case record must clearly describe the
label, what items are depicted."

Now, to go back to Rule 702, the -- the essence of
trying to apply 702 methodology after the 2000 changes, what
guidance does the rule or do the advisory notes give us as to
what do you do when the opinion that is to be expressed at trial
rests primarily upon the experience and subjective evaluation of
the expert.

The Advisory Committee notes say as follows: "If the
witness is relying solely or primarily on experience, then the
witness must explain how that experience leads to the conclusion
reached, why that experience is sufficient basis for the opinion
and how that experience is reliably applied to the facts."
The trial court's gatekeeping function requires more than simply taking the expert's word for it and that is critical."

Now, in the Willock case, I looked at a number of decisions, all of them by definition before 2010, that have begun to question what was happening with tool mark evidence. It was the Second Circuit's case in 2007, United States versus Williams. It noted that Daubert did not grandfather or protect from Daubert's scrutiny evidence that had previously been admitted.

And there was the Green case that acknowledged that courts were obliged to critically evaluate tool mark and ballistic evidence even though it had been accepted for years, 405 F.Supp. 2d at 104. And I acknowledge that beginning in 2005, in the National Research Council's Forensic Science Report and thereafter with the National Research, the NRC Forensic Science Report that the scientific community as charged by the National Academies of Science had begun to look at forensic analysis and tried to determine whether or not it met reliability standards after Daubert in 702.

And in the National Research Council's Forensic Science Report in 2005, as quoted at page 565 of Willock, I noted that the NRC Forensic Science Report concluded, "because not enough is known about the variabilities among individual tools and guns, we are not able to specify how many points of
similarity are necessary for a given level of confidence in the result. Sufficient studies have not been done to understand the reliability and repeatability of these methods.

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 where 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."

Now, what the NRC was saying is that the validity of the tool mark analysis methodology depends upon establishing two things. The uniqueness of individual marks and the reproducibility of those unique marks on ammunition when it is fired from the firearm. And unless those two things can be established, then you have not met the requirement of showing that the methods and principles used are reliable.

The point that was also made in the Willock case which is important was that the NRC ballistic imaging report cited an article by a Biasotti, B-I-A-S-O-T-T-I, published in 1959 which said, and I quote now, this is at page 72 of the Willock decision, "The average percent match for bullets from the same gun is low, and the percent match for bullets from different guns is high."

So what that means is, is that when you look at all
the marks on bullets known to have been fired from the same gun, you can focus in on matches that, on marks that match, but there's a large number of marks that don't match. And when you focus on cartridges fired from different guns, there's a large number of similar marks as compared to distinct marks.

So the question is, if you are applying an inherently suggestive approach of sufficient agreement and you know that marks, there are going to be a relatively large number of marks on cartridges fired by different firearms, and when you compare all of the marks on cartridges fired by the same firearm, there will be a lot that don't match. How do you determine sufficient agreement? And there is nothing, at least at that time in the methodology of tool mark examination that gave you the answer to that question, other than just simply, well, this is the experience of the examiner.

Since 2010, the debate on forensic evidence has not abated. It's increased. In September of 2016, the report to the president from the forensic science on forensic science in criminal courts from the President's Advisory Council on Science and Technology came out. This is referred to as the PCAST.

The report indicated that it was provided after the analysis by the National Research Council in 2009 and was designed to bring forward analysis of forensic comparison method analysis. So feature comparison methods included things such as single sourced DNA analysis, complex mixture DNA analysis, bite
mark analysis, latent fingerprint analysis, firearms analysis, footwear analysis, hair analysis, and this report was -- made recommendations to the National Institute for Standards and Technology, NIST, the Department of Commerce, recommendation for the FBI laboratory, recommendations to the attorney general, recommendations to the judiciary.

And I want to refer now to the portions of the PCAST report that focused on firearms analysis which advances five years to the most immediate past. And before doing that, I want to make one further point on Daubert that I didn't make earlier. The result of Daubert analysis in theory, anyway, is not to analyze the correctness of the decision reached, but rather to analyze the reliability and methodology and sufficiency of the factual data.

So, what do we know from the 2016 PCAST report? And I might add also that the PCAST folks that were -- the co-chairs were the assistance of the president of the United States from science and technology, Professor Eric Lander, president of the broad institute of Harvard and MIT. The vice chairs included professors from computer science and integrated biology from the University of Texas. Members included the president of large corporations, professors from astrophysical science and international affairs from Princeton, physics professors from the University of Maryland, professors from the school of Natural Resources and Environment from the University of
Michigan. Natural economics, University of Maryland, the Kaiser Permanente School of Medicine, the planning dean and professors from various fields of science and technology across the group. The PCAST working group, the president was Professor Lander, Professor Gates from the Center for String and Particle Theory, Professor of Physics, University of Maryland, Professor Chin, distinguished professor emeritus and electrical engineering and computer science from Berkeley.

The Professor Press from the Computer Science and Integrated Biology Department at the University of Texas, Austin. Professor Schrag, professor of environmental science and director of Harvard University Center for the Environment. The staff included Diana Pankedich P-A-N-K-E-D-I-C-H, from the American Association for the Advancement of Science and Technology, and Tianna Simoncelli, S-I-M-O-N-C-E-C-L-L-I, senior advisor to the director of the Broad Institute at Harvard, and Kristin Sorelli, advisor to public policy and special projects at Harvard and MIT. And they had a number of judges and academics who also were on the panel.

Beginning at page 104 of the PCAST report it began its analysis of the methodology for firearms analysis. And it started with the notion that, "Firearms analysis," quote, "is based on the idea that tool marks produced by different firearms very substantially enough owing to variations in manufacture and use to allow components of fired cartridges to be identified
with particular firearms.

"For example, examiners may compare questioned cartridge cases from a gun recovered from a crime scene to test fires from the suspected gun." Talks about class characteristics and individual characteristics, and it made the following comment at page 104.

"PCAST expressed concerns about certain foundational documents underlying the scientific discipline of firearm and tool mark examination. In particular, we observed AFTE's theory of identification as it relates to tool marks which defines criteria for making an identification is circular. The theory states that an examiner may conclude that two items have a common origin if their marks are in sufficient agreement, where sufficient agreement is defined as the examiner being convinced that the items are extremely unlikely to have a different origin. In addition, the theory explicitly states the conclusions are subjective."

The report continues at page 105 and noted that there had been a lot of testimony -- a lot of attention in the recent past to try and to prove the theory that every gun produces unique tool marks. It made reference to the 2008 NRC report, and that report found, and I quote from page 105 of the PCAST report, "The validity of the fundamental assumptions of uniqueness and reproducibility of firearms related tool marks had not yet been demonstrated, and given current comparison
methods, a database search would likely return too large a subset of candidate matches to be practically useful for investigative purposes."

The report went on to say that, of course, it's not necessary that tool marks be unique for them to provide useful information about whether a bullet may have been fired from a particular gun, but, quote, "However, it is essential that the accuracy of the method for comparing them to be known to be based upon empirical studies."

They then cited from the 2009 NRC report, they concluded that there had not been sufficient studies done yet, and the footnotes to this analysis make reference to many of the studies that they looked at.

We heard a lot during the hearing yesterday and today about various studies that were attached to the exhibits that had been submitted to me and that I have reviewed. These various studies are discussed at the PCAST report beginning at page 106, and they differentiated between non-black box studies, which are referred to as set based analyses. And set based analyses essentially means that the examiners are aware that they have within the sample bullets, portions known to have been fired by the gun in question when in real life situations, crime scene analysts don't know that. They're seeking to determine whether that's the case, at least oftentimes.

It went on to say that, "Because firearms analysis is
at present a subjective feature comparison method, its foundational validity can only be established through multiple independent black box studies."

They concluded that, "Although firearms analysis has been used for many decades, only relatively recently has its validity been subject to meaningful empirical testing. Over the last 15 years the field has undertaken a number of studies to establish the accuracy."

It goes on to say that, "While the results demonstrated that the examiners can under some circumstances identify the source of fired ammunition, many of the studies were not appropriate for assessing scientific validity and estimating the reliability because they employed artificial designs that differ in important ways from problems faced in casework."

The analysis continued: "Specifically, many of the studies employed," quote, "set based analyses in which the examiners are asked to perform all peer-wise comparison within or between small sample sets."

They go on to say that, "The study design in some of these tests had serious flaws because the comparisons are not independent of one another, but rather involve internal dependencies that inform the examiners' answers and sometimes can allow the examiners to make inferences about the study design."
They conclude that, "Set based studies are not appropriately designed. Black box studies from which you may determine empirical studies of validity."

They went on to talk about certain types of set based comparisons that they referred to as within set comparisons and set-to-set comparisons and concluded that when they studied four specific such cases to include the Fadul, F-A-D-U-L, study, which is referred to here, that dealt with ten consecutively manufactured firearm slides, "examiners were given a collection of questioned bullets and/or cartridge cases fired from a small number of consecutively manufactured firearms of the same make. A collection of bullets or casings known to have been fired from these same guns. They were asked to perform matching exercises."

It says, "This closed set design is simpler than the problem encountered in casework because the correct answer is always present in the collection. In such studies examiners can perform perfectly if they simply match each bullet to the standard that's the closest. By contrast in an open set study, as in casework, there's no guarantee that the correct source is present. Closed set comparisons would thus be expected to underestimate the false positive rate."

They concluded on page 109, "In short, the closed set design is problematic in principal and appears to underestimate the false positive rate in practice. The design is not
appropriate for assessing scientific validity and measuring reliability."

They then at page 109 talked about the set-to-set comparison in a partially open set, the Miami/Dade study and then talked about recent black box study analysis that had taken place, referring to the Ames Laboratory study, which was introduced in this hearing.

And that actually did employ a design that had black box configuration, and in that particular study they found that when 218 examiners did their examination, one of whom was Mr. McVeigh, that they -- that there were 2,178 different source comparisons. There were 1,421 eliminations, 735 inconclusives and 22 false positives. The conclusive rate was 33.7 percent, and the false positive among conclusive examinations was 1.5 percent with a confidence interval of 2.2 percent.

The false positive rate corresponds to an estimated error rate of one in 66, so the false positive corresponds to an error rate of one in 66. This is the best test done so far. Every 66 cases, there will be one error with an upper bound being one in 46; that would be the highest error rate, so that's the range.

The PCAST report concluded, "The results for the various studies are shown in table two. The table show a striking difference between the closed set studies where a matching standard is always present by design, and the
non-closed studies where there is no guarantee that any of the known standards match.

Specifically the closed set studies show a dramatically lower rate of inclusive examination and false positives. With this unusual design, the closed set studies that have been criticized, in other words, examiners succeeded in answering all the questions and achieved essentially perfect scores. In more realistic open designs, these rates of false positives are much higher."

The conclusions they reached, "The early studies indicate that examiners can under some circumstances associate ammunition with the gun from which it was fired. However, as described above, most of these studies involve designs that are not appropriate for assessing scientific validity or estimating the reliability of a method as practiced. Indeed, comparison of the study suggests that because of their design, many frequently cited studies seriously underestimate the false positive rate."

The conclusion continues at page 111. "At present there is only a single study that was appropriately designed to test foundational validity and estimate reliability, the Ames study. Importantly, the study was conducted by an independent group unaffiliated with a crime laboratory."

It goes to say that, "The scientific criteria for foundation of validity require appropriate design studies by more than one group to ensure reproducibility. Because there
has only been a single appropriate design study, the current
evidence falls short of the scientific criteria for foundation
of validity," and concluded that there was a need for additional
analysis."

So, they summed it up in a chart on page 112.

Foundational validity, quote, "PCAST finds that firearms
analysis currently falls short of the criteria for foundational
validity because there's only a single appropriate design study
to measure validity and estimate reliability. Scientific
criteria for a foundation of validity require more than one such
study to demonstrate reproducibility.

Whether firearms analysis should be deemed admissible
based on current evidence is a decision that belongs to the
courts. If firearms analysis is allowed in court, the
scientific criteria for validity as applied should be understood
to require clearly reporting the error rates as seen in
appropriately designed black box studies estimated to be at one
in 66 with a 95 percent confidence limit of one in 46 in the one
such study to date."

Now, as the government has properly pointed out, not
everybody accepts the PCAST report. Indeed, there was a rather
significant unfavorable response by a number of organizations to
include the Department of Justice.

I'm going to turn to some of those in a moment, but
first I want to cite from Defense Exhibit 1, the Ames study.
And the Ames study, again, the essence of that is found on page 3 of the study, and it was summarized as follows.

First of all, it's done by Ames Laboratory associated with Iowa State University, so it was a -- an independent laboratory. It was not associated with the Association of Firearm and Tool Marks Examiners, which is the association of these folks who come into court and testify about firearms.

Here's the summary. "Responses were received from 218 participating examiners. The rate of false negatives was quite low with the error distributed across examiners with various backgrounds, state, federal, local, private. The overall rate of false positives estimated as 1.01 percent from comparisons known to be from different firearms, but reported as identifications was significantly higher.

"However, most of the error rates were reported by a small number of examiners, that is, individual examiners have varying error rates. For most examiners this is quite low while for some it is relatively high. Hence, the overall rate is best interpreted as an average of widely varying individual rates. Inconclusive results were not recorded as errors. Rates of poor quality marked production for these handguns varied. False positive and false negative error rates for individual examiner performance were measured. The rates were not uniform across the sample population with a few examiners providing most of the false positives."
Now, the significance of that report is that with 218 examiners, the actual false positive rates found were not uniformly disbursed among all those examiners. Some were very good and some were not. So how do we decide those that are good and those that are not?

Well, one way requires strict adherence to the methodology and documentation of how the methodology was applied in that particular case so that looking at just the records and the documentation without looking at the evidence itself, you can determine whether or not the conclusion reached was a proper conclusion.

Now, there were a number of other organizations including OSAC, the Department of Justice, individual tool mark practitioners, that went back to PCAST and said, you got it wrong. There are studies you didn't look at. You blew off these other studies that meet the criteria that you say we should have done, and you've, you know, cast aspersions on us that were not justified.

So PCAST considered those and came out with an addendum that they authorized just a little more than a year ago, January 6th, 2017, found at Exhibit C to the defense motion. It sort of summarized where PCAST left off to explain what it did in response to the criticism from many sources as to what it had done.

It said at page 1, "In this report, PCAST noted that
the only way to establish scientific validity and degree of reliability of a subjective forensic feature comparison method, that is, one involving significant human judgment, is to test it empirically by seeing how often examiners actually get the right answer. Such an empirical test of a subjective forensic feature comparison method is referred to as a black box test. The point reflects the central tenant underlying all science. An empirical claim cannot be considered scientifically valid until it has been empirically tested."

It goes on to say that, "Practitioners of a subjective forensic feature comparison method claim that through a procedure involving substantial human judgment they can determine with reasonable accuracy whether a particular type of evidence came from a particular source, the claim cannot be considered scientifically valid and reliable until one has tested it by, one, providing adequate number of examiners with an adequate number of test problems that resemble those found in forensic practice; and two, determined whether they get the right answer with acceptable frequency for the intended applications.

"While scientists may debate the precise design of the study, there is no room for debate, but the absolute requirement for empirical testing."

Now, having said that, we stated what their ground was from before, they summarized the responses that they had gotten.
The following reports released, "PCAST received input from stakeholders expressing a wide range of opinions. Some of the commentators raised the question as to whether empirical evidence is truly needed. The Federal Bureau of Investigation, which clearly recognizes the need for empirical evidence and has been a leader in performing empirical studies in latent print examination, raised a different issue. Specifically, although PCAST has received detailed input on forensic methods from forensic scientists at the FBI laboratory, the agency suggested that PCAST may have failed to take account of some relevant empirical studies.

A statement issued by the Department of Justice on September 20th, 2016, the same day the reports released opined that, quote, "The report does not mention numerous published research studies which seem to meet PCAST criteria for appropriately designed studies providing support for a foundation of validity. That omission discredits the PCAST report as a thorough evaluation of scientific validity."

So, what was the response of PCAST? They say, quote, "Given its respect for the FBI, PCAST undertook a further review of the scientific literature and invited a variety of stakeholders, including the DOJ, to identify any published appropriately designed studies that had not been considered by PCAST that established the validity and reliability of any of"
the forensic featured comparison methods that PCAST report found to lack such support. As noted below, DOJ ultimately concluded that it had no additional studies for PCAST to consider.

"However, PCAST did receive written responses from 26 parties, including federal agencies, forensic science and law enforcement organizations, individual forensic science practitioners, a testing service provider, and others in the United States and abroad. It noted that many of the responses were extensive, detailed, thoughtful, and covered a wide range of topics."

It acknowledged its gratefulness for the time that those folks took who opined on this important topic.

So based upon what they had received, they provided the following analysis: "While forensic science organizations agreed with the value of empirical tests of suggested forensic feature comparison methods, that is, black box test, many suggested the validity and reliability of such a method could be established without actually empirically testing the method in an appropriate setting. However, PCAST noted notably, however, none of these respondents identified any alternative approach that could establish the validity and reliability of a subjective forensic feature comparison method."

It went on to say that after reviewing what they had received, quote, "There remains confusion as to whether these elements can suffice to establish validity and degree of
Subparagraph 1: "Forensic science literature contains many papers describing variation among features. In some cases the papers argue patterns are unique." It goes on, "Such studies can provide a valuable starting point for a discipline because they suggest that it may be worthwhile to attempt to develop reliable methods to identify the source of the sample based on feature comparison. However, such studies, no matter how extensive, can never establish the validity or degree of reliability of any particular method. Only empirical testing can do so.

Conclusion two: "Forensic scientists rightly cite examiners' experience and judgment as important elements in their disciplines. PCAST has great respect for the value of examiners' experience and judgment. They are critical factors in ensuring that a scientific eval and a reliable method is practiced correctly. However, experience and judgment alone, no matter how great, can never establish validity or degree of reliability of any particular method, only empirical testing can do so."

It then responded to input it received from the Organization of Scientific Area Committee's Friction Subcommittee, that's the OSAC, we heard testimony about that yesterday. The report at page 4 says: "In its response to PCAST's call for further input, the Organization of Scientific
Area Committee's Friction Ridge Subcommittee, whose purview includes latent fingerprints, raised some very important issues."

They said, "While the OSAC FRS agrees with the need for black box studies to evaluate overall validity, they expressed concern that that view could unintentionally stifle future research aimed at dissecting components of the black box to transition it from subjective to objective method. As for the friction ridge discipline, which is different from the tool marks discipline, PCAST concluded that it applauds the works of friction ridge discipline which has set an excellent example by undertaking both, one, path breaking black box studies to establish validity and equally of reliability of latent fingerprint analysis; and two, insightful like box studies that shed light on how latent print analysts carry out their examination, including forthrightly identifying problems and needs for improvements."

It goes on to say, however, the situation is different for subjective methods whose validity and degree of reliability has not been established by appropriate empirical studies. If a discipline wishes to offer testimony based on the subjective method, it must first establish the method's validity and degree of reliability which can only be done through empirical studies."

They then analyzed the challenges to the completeness
of PCAST evaluation, page 5, and they said the following:

"Finally, we considered the important question raised by the DOJ in September of whether a PCAST failed to consider numerous published research studies which seemed to meet PCAST criteria."

The analysis goes on: "PCAST reexamined the five methods evaluated in its report for which the validity and degree of reliability had not been fully established. We considered the more than 400 papers cited by the 26 respondents, the vast majority had already been reviewed by PCAST in the course of the previous study at the suggestion of John Butler at the National Institute of Standards and Technology, NIST. We also consulted Interpol's extensive summary of the forensic literature to identify additional potentially relevant papers. Although our inquiry was undertaken in response to the DOJ's concern, DOJ informed PCAST in late December that it had no additional studies for PCAST to consider. It then applied its ultimate amended conclusions to various disciplines."

Page 6, it talks about firearms analysis, and it concluded in its amended report -- addendum to its report. "In its report PCAST reviewed a substantial set of empirical studies that had been published over the past 15 years and discussed a representative subset in detail. We focus on the ability to associate ammunition not with a class of guns, but with the specific gun within the class. Firearms discipline clearly recognizes the importance of empirical studies. However, most
"As described in the PCAST report, set based approaches can inflate examiners' performance by allowing them to take advantage of internal dependencies in the data. The most extreme example is the closed set design in which the correct source of each question sample is always present. Studies using the closed set design have underestimated the false positive and inclusive rates by more than one hundredfold. This striking discrepancy seriously undermines the validity of the results and underscores the need to test methods under appropriate conditions.

"Other set based designs also involve internal dependencies that provide hints to examiners, although not the same extent as closed set designs. To date, there has been only one appropriate designed black box study, a 2014 study commissioned by the Defense Forensic Science Center and conducted by the Ames Laboratory, which reported upper 95 percent confidence bound on the false positive rate of 2.2 percent.

"Several respondents wrote to PCAST concerning firearms analysis. None cited additional appropriate designed black box studies similar to the Ames Laboratory study."

Went on to conclude, "The Organization of Scientific Area Committee's Firearms and Tool Mark Subcommittee took the more extreme position that all set based designs are appropriate
and that they reflected actual casework because examiners often start their examinations by sorting sets of ammunition from a crime scene.

"OSAC's FTS argument is unconvincing because, one, it fails to recognize that the results from certain set based designs are wildly inconsistent with those from appropriately designed black box studies; and two, the key conclusions presented in court do not concern the ability to sort collections of ammunition as tested by a set based designs, but rather the ability to accurately associate ammunition of a specific gun as tested by appropriately designed black box studies."

It went on to say as follows: "Courts deciding on the admissibility of firearms analysis should consider the following scientific issues: One, there's only a single appropriate black box study employing a design that cannot provide hints to examiners. The upper confidence bound on the false positive rate is equivalent to an error rate of one in 46.

"Two: A number of older studies involved the seriously flawed closed set design, which has dramatically underestimated the error rates. These studies did not provide useful information about the actual reliability of firearms analysis.

"Three: There are several studies involving other kinds of set based designs. These designs also include," I'm
sorry. "These designs also involve internal dependencies that can provide hints to examiners, although not to the same extent the closed set designs do. The large Miami/Dade study cited in the PCAST report and the small study cited by Bunch fall into those categories.

These two studies have upper confidence bounds corresponding to error rates in the range of one in 20 from a scientific standpoint, scientific validity should require at least two proper design studies to ensure reproducibility. The issue for judges is whether one poorly designed study together with ancillary evidence from imperfect studies adequately satisfies the legal criteria for scientific validity. Whatever the courts decide, it's essential the information about error rates is properly reported."

So that's the -- that's the PCAST in its wake.

Now let's turn to this particular case because that general background is important in terms of my cast under Rule 104(a) when deciding whether or not Mr. McVeigh can testify, and if so, as to what.

First of all, as to his qualifications. There has really not been much challenge to his qualifications. I will say again on this record that I've been a judge for 21 years, and I've been a trial lawyer for almost 50. And I have seldom seen an expert as candid, forthright, acting without a shred of being defensive, trying his hardest to understand questions,
respond without being argumentative.

It appears as though Prince George's County and the people of Maryland are lucky to have a person of his integrity and dedication working for the crime lab in Prince George's County. There is no challenge to his qualifications. Although he's not a member of the AFTE, he took their instruction, he's been qualified by his lab, and he has done the examination in this case based upon what he has identified in terms of his training and experience. So I find easily that he has the knowledge, training, experience, background, education and skill to testify in the form of an opinion or otherwise.

The next thing I have to talk about is whether he has sufficient data to base his test. The challenge really hasn't been to the sufficiency of the data, but rather to the reliability or the methodology and whether it was reliably applied.

In doing that, I want to start with his examination report. This is Exhibit 5 to ECF number 78. It's a series of documents, the report itself, that begin at Bates number JLM 00773 through really 782, are the guts of it, and I'm going to go through those briefly now.

Page 773 reports the result of examination. He says there are five fired cartridges. I'm leaving portions of it out. They were microscopically intercompared to test fire exemplars from the Rock Island Armory pistol recovered from the
incident.

Quote: "The referenced items from incident A were identified as having been fired in from the referenced pistol from incident B." And there are no further grafts or anything else, that's what I would call face sheet of the conclusion sheet.

Page 774 is a result of the examination. He says there are five fired cartridge cases, PW 1 through PW 5, and two bullet items, PW 6 and PW 7, recovered in incident A that were microscopically intercompared to test fire exemplars from the Rock Island Armory brand pistol. And there's some more non-opinion information, and it then concludes the referenced items from incident A were identified as having been fired in from reference pistol from B.

And below it there's a series of initials. It says, FCC's, which he testified were fired cartridge cases. BFI, breach face impression, which he testified were marks on the rim, and marks at the rim. And he just identifies those. So presumably you can infer from that that that's what he looked at when he was reaching his conclusion. Bullets, and then it says, L-I-M-P-S, which stands for land impressions.

Now, significantly, although this does explain what his opinion is, gun -- incident B gun produced was the gun from which incident A bullet portions were fired from. What he doesn't do is provide the analysis of how he reasoned from the
look at the bullet fragments to these conclusions. We know that he looked at fired cartridge cases. But that doesn't tell us a lot. He looked at the breach face impressions, that narrows it down, and marks on the rim, which further narrows it down.

But there are marks not only on the rim, but on the cylinder part of the cartridge, and we know, as I quoted from Willock, that from publications going back to the 1950's, there is a large number of similar marks on items known to have been produced by different firearms. And a equally large number of marks on bullet components fired from the same firearm that are not similar.

And what we don't know is from this face sheet or from the photographs is when you line up a portion of the firearm component looked at, and you look to see lines that seem to come together and lines that don't, which ones were the ones that he relied upon in reaching his conclusion that there was sufficient agreement. Take a look at 775.

First of all, the one on the left is at 36 magnification. It's at the rear of the cartridge, and it is a portion that looks like about 25 percent of what the actual cartridge, a back look like. If you take a look at it, there are lines that sort of seem to go from -- and there's about a 40 percent portion of the left-hand side of the picture that's from the one sample, and on the other side about 60 percent from the other. And collectively put together they look to be about
roughly 25 or so percent of the back of a bullet that you would look at if you were holding it up and looking at where the firing pin connects the rim.

Some lines start from the one sample and go all the way through to the other, but others start on one and don't go all the way through so it's possible to look at this and say, well, those are ones that don't match up, but these are ones that do match up, and some of the ones that match up are at the top and at the bottom and sort of in the middle part a little bit here and there, but others that do not.

Now, how do I know that the numbers that match are consistent with the numbers that match on cartridges known to be fired from the same gun, and that the numbers that don't match are less than the numbers that are known not to match from those fired by different guns.

If you look to the picture on the right, it's even a smaller portion of the cartridge. It's a very small part of the circular rim. In fact, it doesn't even look circular. It looks sort of like an almond shaped component that is obviously just a very small portion. It's also at a much higher -- it's at 56 level of magnification. Again, if you look at the part on the left, there's some parts that seem to go clear through to the one part on the right, but there's some other parts that don't seem to do that.

And then there's some parts below that are dark and
you can't really tell what they show. Again, how do I know how
you find that there were enough similarities to be consistent
with similarities from bullets fired from the same gun and
greater than the number of similarities known to exist in
bullets fired from different guns? There's no way I know that,
nor does the report explain that to me.

The same can be said at page 776. At 777, there are
conclusions. The same one fired from the same unknown firearm.
There's no photographs here. It does talk about what items were
looked at, but again, it doesn't provide any explanation.

You have on page 778 the fired cartridge case
worksheet. That, of course, provides data regarding the kind of
ammunition. And it says notes, the micro shows it was
identified as having been fired by the same unknown firearm, but
it doesn't explain how this data supports that conclusion. Same
with 779, same with 780, same with 781.

On 782, we had certain measurements that were taken
that were fed into the NIBIN system, and it resulted in a
reporting of the other types of firearms that could produce
those same characteristics. And there were a total of 33
manufacturers listed that did not include the one that we know
manufactured the firearm.

Now, I'm not -- it appears as though what Mr. McVeigh
did is consistent with the internal procedures from his lab, and
indeed, when his lab has been audited by others who do this kind
of lab work, they've said that your paperwork is sufficient.

It was interesting that he testified that when he was reviewed, what the reviewer did was he would frequently just have the microscope up and say, hey, Bill or Mary or whatever, come on over and take a look at this. They would look at the same microscope at the actual evidence, make their own determination and say thumbs up or thumbs down.

But that's not what the standard from the AFTE says, and that's not what the advisory note to Rule 702 says. It says that, "When you're basing it upon a subjective analysis and experience, the actual notes have to tell you how you applied the methodology to the facts and made that result," and simply saying, well, I don't tell out the one, the number of marks on there because there were so many, I just line them up and I can look at them, in my mind that does not meet what the Advisory Committee required, it does not provide enough information to show how the methodology was applied in this particular case.

Similarly, the peer review, so to speak, is reviewed by another examiner from the same office. There was also one from, I think the District of Columbia, whose initials were put on there. We don't have any separate reports from them, and what it appears as though is that they didn't look at just the report itself and go back to see whether they agreed with the results, they rather looked at the ammunition. And that, that is in my mind the concern that I have about the methodology and
the application of the methodology to the facts.

So where does this leave me? The one thing that I said in the Willock decision, my recommendation to Judge Quarles and what I repeat now is that as PCAST sort of recognizes, they're looking at this area through the lens of science, and it's pretty clear that they say that for this kind of subjective analysis, you must have empirical research, it's got to be black box, you got to have the right error rates, the design has got to be such that it mirrors real life. That makes all the sense in the world to me for science, but they drew the line by not telling judges, this is what you should do, and they made that very clear throughout.

So what I'm left with is, with what I have from an admittedly qualified and dedicated examiner in a case, is there anything about this evidence that will pass muster from a point of view of 702. And here I come back to one of the questions I asked Mr. Oppenheimer because if we didn't have any expert at all, but we knew that there was a .45 that was the caliber of the handgun, and a .45 is found with the defendant, and if we knew that the cartridges found at the crime scene were Winchester and that the cartridges found in the handgun were Winchester, and if we knew that there were other similarities, juries have throughout the history of this country been able to independently determine the authenticity under Rule 901(b)(3) by looking at known samples and unknown samples and deciding for
themselves whether or not they were from the same source.

That's an accepted way of authentication.

And certainly would it be helpful for the jury to know that I've already ruled that the .45 comes in as being something taken from the possession of the defendant, he pleaded guilty to having it in D.C. Superior Court, and the search was a valid search, I found. That was objected to, but I overruled that objection.

So we know that the gun was found with the defendant, and we know that we have bullets that were found from the crime scene, we know we have bullets that were found from the gun. And I don't see any reason why it would not be helpful to the jury for Mr. McVeigh to testify with his photographs and matching up the marks that he saw that were similar and pointing out the characteristics that were similar between the firearm cartridges fired at the scene and what was test fired, subject to cross-examination, subject to Evidence Rule 803(18), the learned treatise hearsay exception, where certainly a defense can read into the record, and 803(18) says, "To the extent relied upon by an expert during direct examination or called to the attention on cross-examination, learned treatises," which I find the PCAST reports would be, "can be read into the record."

And whether or not Mr. McVeigh acknowledged them or not, that's evidence that comes in and can be read to the jury so they can understand.
In addition, certainly Mr. Nixon can testify at trial, if that's what the defense wants him to do. In addition, I believe that it would be appropriate for Mr. McVeigh to be able to express an opinion that the marks that were produced by the -- that were found on the crime scene cartridges are consistent with the marks that were found on the test fire from the .45 known to be associated with the defendant, but I will not permit him to express the opinion that they were fired by the same gun, and I will not permit him to express any confidence level as to it.

So -- so we're here clear on what I'm ruling. Mr. McVeigh can testify. Now, his qualifications are subject to being brought out before the jury by the government and challenged or cross-examined by the defense. He can talk about what he did and what he tested and what he looked at. He can put up his pictures. He can show the similarities between one and the other, and he can even express the opinion that the marks from the .45 that he test fired, the marks on the cartridges are consistent with the marks on the other one that were found at the crime scene, but I won't allow him to express the opinion that they were produced by the same gun, and I won't allow him to express a confidence level as to his opinion. That's as far as his opinion can go.

The defense will be able to cross-examine, offer under 803(18) information as learned treatises. On rebuttal, the
government may offer any of the studies that they thought were 
helpful under 803(18) if they want to do that. Be aware, 
counsel, that when you're doing that, the jury doesn't get to 
see them.

    Probably you've been -- you either have appeared to 
stay awake or have resisted the sopopheric [ph] soporific, 
excuse me, effect of my language, reading to you from all these 
different studies, but be aware that the jury may not have the 
same intestinal fortitude, so I would keep my readings focused, 
but that is what I believe is appropriate. And why do I say 
that?

    While I am informed by the PCAST analysis, and I think 
that from the perspective of science they raise legitimate 
issues, I'm not prepared to say that you got to throw the baby 
out with the bath water, particularly when you have a dedicated 
and honest broker like Mr. McVeigh, who is straightforward in 
what he did and can point out why he drew the observations that 
he did from the test samples and from the firearm exemplars and 
properly restrict it in terms of the scope of what he can tell 
the jury, that that would be helpful to the jury because the 
jury itself can look at known and unknown samples and decide 
whether it came from the same gun under Rule 901(b)(3). And so 
that's something that's been allowed by the Rules of Evidence 
individually of Rule 702.

    Secondly, I have to note that not every court in the
United States has followed what PCAST said. Government cited a
case from the Northern District of California that said, well,
we don't care what PCAST said, we're going to let it in because
it's always been let in. Respectfully, I disagree. The judge's
job would be easy if all we could do is say courts have always
done, I'm going to do it again. That's where I was in 2010, I'm
not there anymore.

2010, I observed that despite growing concern by the
courts, no American court that I was aware of had totally
excluded the evidence, at most they had restricted what the
expert can testify, which is consistent with my ruling today,
but you can't ignore what the issues were that were raised by
PCAST, and I can say that it takes some time sometimes for the
courts to come to bear and to take knowledge of what's going on,
and the mere fact that twice out of 80 times Mr. McVeigh has had
to go through this exercise is evidence of the fact that most
courts do not do it. They don't have the circumstance where
they have defense counsel that have the resources and the
dedication to bring the issues, and they can't find an expert to
testify and provide them with help, and so the evidence rolls
in.

The PCAST report is not the end of the story, but it
does show that there are issues associated with the validity of
the underlying subjective assumption that this science rests on.
I'm convinced that the similarities of the characteristics and
the scope of what I've allowed Mr. McVeigh to testify to is sufficiently helpful, does pass muster under, not only 702, but other rules as well, and that with experienced and focused cross-examination from lawyers who have clearly prepared themselves for the task, that the weight that can be given to the evidence I permit will be a point for argument with the jury.

Now, Mr. Oppenheimer, if you want to propose a jury instruction, I'll take a look at it. Whether this is appropriately handled by a jury instruction or by a limiting instruction when the evidence comes in, we can deal with later, but for right now I understand that you've suggested that. I haven't seen it, and we'll have plenty of time during the trial to deal with post-jury instructions. So that's by ruling on this motion.

I had hoped to be able to write an opinion, but with the other work that I have and the other work that we have in this case, I'm likely not to get to it so this transcript will be my opinion. I may come up with a very brief one pager that says for the reasons I stated on the record which are adopted and incorporated by reference, this is my ruling, but my ruling should be fairly clear, I hope, to both the United States and Mr. Oppenheimer. Are there any questions about what my ruling is?

(Pause.)
MS. KAPLAN: No, Your Honor, we're just taking a moment to make sure we --

THE COURT: No, that's all right, take whatever time you want. You got to live by it, you might as well make sure you understand what it is.

(Pause.)

THE COURT: While the government is looking at its notes, are there any questions from defense in terms of my ruling?

MR. OPPENHEIMER: If I could have one more moment here, Your Honor. I just want to make sure I --

THE COURT: Yes.

(Pause.)

(Brief recess.)

THE COURT: All right. Any questions from the United States regarding my opinion?

MR. NAUVEL: Yes, Your Honor. A couple brief questions. I think you've gotten to know just a little bit, Mr. McVeigh, over the past couple of days, and he's very concerned with respecting your order and following it to the letter. But he's also raised concerns also which I'll relay to you, which is that he is concerned with his ethical obligations outside of the testifying piece, outside of the courtroom, and more specifically, AFTE provides a range of conditions, a range of conclusions, and three conclusions I think you heard him testify
to were identified, eliminated, inclusive. And he's also concerned about his protocols, which make similar type of points, so all this to say, the question is, is it consistent with your ruling to say --

THE COURT: Well, let me see if I can -- he can certainly say he did not eliminate this gun. He can certainly say that his -- his views are not -- well, I would say this: He is -- he has not eliminated his gun as having made it. I think if he says that he did reach a position that it was not inconclusive, then I don't want to get close to what I said he can't go beyond. And he can certainly say that he did not eliminate this gun as being a possible source to it, but that the best he can say is that, you know, and if you want him to say that I, you know, something to the effect of that the Court has instructed him to, you know, that he can say that it's consistent with or you can frame the question so that he is responding directly to your question.

I don't want to -- I certainly understand that he made different opinions I'm not letting him put in, and if he is faithful to my ruling, it's not because he's done anything wrong, it's because I've ordered it, and he's complying with the Court Order. I think the way it can be handled is, is that, you know, it can be done in a question, do you have an opinion that you can express to the jury as to whether the marks on the bullets fired by the gun are consistent with the marks found on
the other one. And then he can say obviously he thinks it's consistent, that's part of what his opinion was, it's just not expressed in the terminology that he's accustomed to using.

So he's nodding his head, I think he understands that. I think the best way to handle it is by a question posed by the government to allow him to make that specific response.

MR. NAUVEL: Could he say that they are -- the -- that the marks have been identified, have been identified as being consistent with the marks on the test fire?

THE COURT: In his opinion, the marks on the test fire are consistent with the marks he found -- with these marks that he found on the exemplars.

Now, the defense can say, well, it's not consistent with this one, that one and the other one, but you can say it that way, yes. He just can't say it's from the same gun, and he can't say his confidence level.

MS. KAPLAN: So, to the extent the word "identify" has particular meaning within his field, and, Mr. McVeigh, if you would come right up here in case I lose it, you can whack me on the shoulder.

So I think what he asked us is can he say that in his opinion the marks on the bullets fired from the gun have been identified as being consistent with the marks on the bullets recovered from the crime scene. I don't know that that is meaningfully different from what Your Honor has suggested, it
just includes that would identify, which I think is important for your working with.

    THE COURT: Yeah, explain what your concern is, sir.

    MR. McVEIGH: Oh, just the points between the two points, what counsel just said regarding identified as having consistent with or is sufficient to replace the word "identified" with the phrase "consistent with" to honor your ruling.

    THE COURT: Yeah, for my ruling I'm substituting the word "identify," which is a word of art that you -- when you say identify, it's the same thing as saying in my opinion it's the same gun, right? That's what it means. I'm not going to allow you to say that, but you can say that -- and you can point to the marks and say these marks here, here, here, here, here, are consistent with marks made from the gun.

    MR. McVEIGH: That's the clarification.

    THE COURT: And that's what I'll allow you to do, and you can point out however many of them. You can say there's so many of them, there's just this, this and this, but he gets to cross-examine on the ones that don't match, and he can cross-examine and read into the record the, you know, all the studies and everything else that he wants, and he can call his own expert to say no, it's not. So that's what I'm going to allow to have happen.

    MR. McVEIGH: Thank you, Your Honor.
THE COURT: Anything further from the government?

MS. KAPLAN: And so for him to say the marks on the bullets recovered from the crime scene are consistent with the marks made from the gun would be an appropriate way for him to --

THE COURT: Are consistent with these marks, particular marks. I'm going to allow him to identify which marks he says are consistent, not just a general thing that are consistent with the same one. Because that's seems to be the ultimate conclusion, I'm not going to allow him to say.

MS. KAPLAN: Okay.

THE COURT: And what he will then do is have the opportunity to point out to the jury what his mind is saying to him when he looks at it and why those are to him marks that are consistent marks, the same marks, consistent means the same. This mark here is consistent with the mark here, you can see it starts over here, runs all the way over there, it kind of gets scrambled here. This is a dark zone in here, we don't see it going over, but look down here we see it, all that is just comparison, known to unknown. And the jury can draw whatever inferences. And he gets the benefit of being able to explain -- I mean, he gets to talk about, he can talk about class characteristics and subclass characteristics and individual characteristics and the phraseology. He can talk about, you know, the microscope and how he got them and test fired, and
explain how he got these two things and how the comparison microscope works and the different powers and everything, and take the laser thing.

I don't know how we're going to get that precision on the screen with high def, but I leave that up to you. Maybe you'll have to bring in a HD TV in here or something, I don't know.

You can laser print and go through that, and the defense can move wherever it needs to move to see it, and he can spend whatever time is reasonable identifying how this mark connects with that mark, and we're looking over here, and you can see right here, and these, the marks are consistent. These are the marks that we know came from a cartridge fired from the gun that was recovered, and these are consistent with those, see how it goes there, there, there, that's what I'm allowing him to do.

MR. NAUVEL: Okay. And then, Your Honor, I honestly don't know whether this is required or not, but to the extent that the government needs to object to preserve any kind of --

THE COURT: Let me make it clear. My ruling is a Federal Rule of Evidence 103 pretrial definitive ruling on the record which preserves your ability to be able to say I'm completely wrong in the event that there's an appeal taken from this case by the government, and those who are smart and wiser than me down in Richmond can decide whether I made a mistake or
not. But by making it a pretrial definitive ruling on the
record in accordance with Rule 103, it prevents you from having
to offer the evidence, get an objection, and having me rule at
trial.

MR. NAUVEL: Thank you, Your Honor.

THE COURT: And if you have any question about that,
take a look at Rule 103 and you'll see it's not one of those,
oh, I'm kind of leaning this way, but let's see what happens at
trial. This is definitive in pretrial. The whole purpose of
that change which came in in, I think 2000, or one of the 1990
changes was to preserve the record so that you now know it's a
definitive ruling, not a "I'm inclined to" ruling.

MR. NAUVEL: Okay, thank you, Your Honor.

THE COURT: And it is important to preserve it, so I
think you've done that.

Mr. Oppenheimer.

MR. OPPENHEIMER: I think you addressed it, Judge, the
use of the word "identified" is what made me stand.

THE COURT: We've identified that as a word that's not
going to be used.

MR. OPPENHEIMER: And then I guess I just want to be
sure that the opinion is couched in terms of an opinion. The
language we've been using is that the marks are consistent,
insinuating are, in fact, consistent with as opposed to his
opinion.
THE COURT: Well, I think that the way to queue it up is for counsel to say, do you have an opinion whether the marks that you've identified as having been made by the test fire of the gun are consistent with the marks that you described to the jury on the bullets recovered at the scene?

Yes, I have an opinion.

What is your opinion?

It's consistent.

Do you wish to explain?

And by then he would have gone through it all again. And he's not going to repeat it all, but that's the way to phrase it so that the question is a specific response to a question posed by counsel, and I think that should address your issue.

MR. OPPENHEIMER: I have nothing further.

THE COURT: So, on the Rule 61 was the defendant's prior convictions. We've agreed that we're not --

Mr. McVeigh, thank you very much, sir.

MR. McVEIGH: Thank you, Your Honor.

THE COURT: I appreciate, you had a long couple of days, and I appreciate your perseverance, sir.

MR. McVEIGH: Thank you.

THE COURT: We've agreed that the homicide conviction is not going to be brought in for 404(b) purposes, right?

MR. NAUVEL: Yes, Your Honor.
THE COURT: And we've agreed that we're not going to mention parole status.

MR. NAUVEL: Yes, Your Honor.

THE COURT: But we do have to get the felony conviction in for the felony in possession, and I thought that the only open issue was, are you working on a stipulation of that?

MR. NAUVEL: Yes, we're working on stipulations, and we apologize, Your Honor, we actually have not, all four of us had an opportunity --

THE COURT: I understand that.

MR. NAUVEL: But we do, having discussed with the defense, we do anticipate having these issues resolved before the time --

THE COURT: I just don't want to miss it between now and -- we have one more hearing that we have to get through.

MR. NAUVEL: Right.

THE COURT: And I am planning on writing an opinion on that one.

MR. NAUVEL: Okay.

THE COURT: Now, Ms. Kaplan, are you here just as a guest appearance or are you -- I understand Mr. Sullivan has been chased out to the Senate Judiciary Committee.

MS. KAPLAN: I am in this for the long haul, Your Honor, and I'm attempting to get up to speed as quickly as
possible.

    THE COURT: Well, you have -- there's an old expression that you'd be blessed with an interesting case. This is an interesting case. You have very skillful, but very professional opposing counsel, and you have a very skillful and very articulate co-counsel, so I have no doubt that in the time that we have remaining that everyone will be able to continue in that vein with the excellent work that both sides have been doing.

    Mr. Lassiter.

    MR. LASSITER: I was only standing in regards to the stipulation question. I didn't know whether you wanted to hear from my side or not. I don't have anything to add at all.

    THE COURT: You're working on the issue.

    MR. LASSITER: Yes.

    THE COURT: Okay. Anything further, folks? I think I've taken enough of your time the last couple of days.

    Thank you all very much for your hard work. This is exhausting, and both of you have done fabulous -- all of you have done fabulous work on this, so thank you.

    (Court recessed at 3:57 p.m.)

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CERTIFICATE OF COURT REPORTER

I, Linda C. Marshall, certify that the foregoing is a correct transcript from the record of proceedings in the above-entitled matter.

/s/

Linda C. Marshall, RPR
Official Court Reporter
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THE COURT: All right. Good.

Well, let's bring the jury in. We have our -- we have our weekly bench meeting at one, so I am going to try and see if we can maybe take the lunch break at one. That should give a good amount of time for the next witness on direct and then enough time to finish cross hopefully today.

MR. OPPENHEIMER: Yeah.

THE COURT: We will see where we are.

Let's bring the jury in and we can get started.

MR. OPPENHEIMER: One issue, Your Honor, and I'm sorry to raise it so late. It occurred to me, when I reread the ruling, we never revisited the issue of potential jury instruction versus limiting instruction.

THE COURT: I'm sorry?

MR. OPPENHEIMER: Limiting instruction versus jury instruction. Your Honor references it in the ruling. The pace at which we are moving, I had meant to raise it, I forgot, but here we are now, and he is about to take the stand. I wonder if the Court had thought about a potential limiting instruction.

THE COURT: With regard to the --

MR. OPPENHEIMER: The admission of testimony regarding firearms comparison.

THE COURT: Yeah. I would consult with you before I
gave it. I would do it -- I would want to do it after the
examination, after the evidence was completed, direct and the
cross, but I would bring you up to the bench and would make
sure we agreed upon the contours of it, but I don't want to add
a written -- I feel that limiting instructions that deal
directly with specific evidence should be after they have heard
that evidence.

So I will talk to you about that, and we will craft it at
a conference, bench conference before I actually give it to the
jury.

MR. OPPENHEIMER: Okay. Thank you.

THE COURT: I prefer that to an actual jury
instruction.

MR. NAUVEL: Your Honor, one other issue before we
bring the jury in. I wanted to -- I guess I wanted to run a --
let me find it -- because we are concerned with staying within
the contours of your ruling, I just wanted to run one
particular line of questioning by you to get your ruling ahead
of time so we don't have to do it --

THE COURT: No. That's fine.

MR. NAUVEL: So, one of the things I'd like to ask is
-- is Mr. McVeigh here? Scott, can you step out for a second?
(Whereupon Mr. McVeight exits the courtroom.)

MR. NAUVEL: One of the things I'd like to ask is
whether he's had a chance, in his career, to compare ammunition
that he knows comes from different firearms, right? And he's
going to say yes because he's had to do it for training
purposes, so two -- two sets that he knows do not match, for
whatever purposes, he's done that in the past, training,
academic purpose, and he's done that, you know, he's done it
before. And I will ask him when might you have done that?

And then the question that I'd like to ask is whether, in
the course of his career, comparing things that he knows are
not related, whether, in the course of his career, he's ever
seen this level of consistency -- "this" being what I am going
to show -- this level of consistency between two bullets or two
shell casings that were not fired by the same gun?

So it's a retrospective question based on things he's
analyzed in his career, but I just wanted to put that to Your
Honor so you have time to think about it, and, you know, know
whether I should get into that or not.

THE COURT: Let me just hear from the defense, and
then I will tell you what my ruling is.

Mr. Oppenheimer, will you be cross-examining?

MR. OPPENHEIMER: Yes. My feeling is this, Your
Honor: I think that Mr. McVeigh really should stick to the
strictures of the ruling. In identifying class
characteristics, he can look at -- he can point to the
individual marks and show -- show to the jury sort of why he
thinks they are consistent.
THE COURT: Consistent between the bullets that he actually looked at?

MR. OPPENHEIMER: Yes, between the -- right. The problem, I think, becomes with that line of questioning. I also think there is another line of questioning, that is sort of part and parcel with that, is his -- his identification sort of standard call for sort of three different conclusions, right: identification, inconclusive, or elimination?

So I think when you start asking him -- if they ask him, okay, well, did you eliminate -- could you eliminate this?, and he would say no because of all of these similarities in the marks, and so he's just back door ing his way back to identification. And I think that's, again, back door ing his way back to identification, which is not what the ruling was intended for.

THE COURT: Here is my thoughts on this: The lesson that has been learned from both of the major studies of toolmark identification evidence, the PCAST, the President's Council of Advisors on Science and Technology, that came out in 2015, and the earlier one, the National Research's Council's Analysis in 2008 or '09, is that the methodology employed to compare toolmark impressions on bullet components is a -- an inherently subjective method of analysis. And that the standard used by practitioners of this forensic field to determine whether they rule in it as made by the same one, same
firearm, is that circular standard of substantial similarity
where it shows a -- that there were -- the number of similar
marks on the two samples exceed the number of similar marks on
cartridges fired from known different firearms and are
consistent with the number of similar marks fired from
cartridges known to be fired from the same firearm, that is
both circular and inherently subjective. There is no standard
cutoff as to how many similarities are necessary before you can
put it in that definition.

And, so, it necessarily asks for the subjective views of
the examiner as to whether he or she feels it is enough to rule
in as opposed to rule out.

That is the essence of what was found to be, not
demonstrated to be reproducible and reliable.

So I appreciate you're asking to have me read it
beforehand. I will not allow that. I will limit his testimony
to the comparison, you know, to talk about the training and
what they do and what they look for, the class, the subclass,
and all of that, and then to do the comparison as to what he
did, show it side-by-side, and to point out the similarities.

MR. NAUVEL: Okay.

THE COURT: And the jury will then draw their own
inferences as to whether they think -- you know, you got a lot
of arguments you can make: What's the likelihood of a .45 and
a this and a that and other thing? All that is fair game for
you to argue and for them to argue. But I think that that
question gets into the essence of what all of the surveys by
the scientists have found to be problematic with the -- with
the methodology, and so I think it is objectionable and beyond
the scope of what I would allow.

MR. NAUVEL: I will do that, Your Honor.

Just to be clear, I absolutely -- because Mr. Oppenheimer
mentioned something else while he was saying -- he said it was
related, and I don't think it's related at all, I absolutely
will ask: Did you exclude this?

THE COURT: No. I think that's fair. He can say he
didn't exclude it, just not saying it's from the same gun.

MR. NAUVEL: I absolutely will ask was it
inconclusive as well.

THE COURT: No, you can't ask that because he would
say, no, it wasn't conclusive -- inconclusive because he wants
to say it was a match.

MR. NAUVEL: What we can't say is we can't go to the
third category, which was -- you remember the categories were
excluded, inconclusive, and match. So what we were instructed
to do was you can't get to that match, you got to replace that
with consistent with, is it consistent with. So we are not
going to go to, Did you I.D. that? We are going to say, Is it
consistent?

THE COURT: Is what consistent with what?
MR. NAUVEL: Is the test fired -- let's take bullets, for example. Is the test-fired bullet -- are the markings on the test-fired bullet consistent with the markings on --

THE COURT: But he can't say that, and the reason why he can't say that is they are similar and they are dissimilar. He can say --

MR. NAUVEL: These specific markings, sorry. I am going to put it up there --

THE COURT: All he can say is the markings that are similar are consistent with those two, but there are also markings which are not consistent, so you can't ask the general question which lopes the entire analysis of the firearms cartridges as, Are these consistent with the marks being made by the -- by the known firearm that was found with the defendant?

You can ask him: Do these firearms -- do these cartridges, that were known to be fired from the gun recovered from the defendant, have markings that are consistent with the markings of the ones that were found there? That's fine.


THE COURT: But to imply that it's consistent with -- the most he can say is it has markings that are consistent with the ones that were known to be fired by the defendant's gun. And the defense can say, And it has markings that are not consistent. You can line up the ones that don't match. And
that's the best that we can do. And the jury is going to have to draw their inferences from it. Okay?

MR. OPPENHEIMER: And just so we are clear, my concern, though, is the situation that Mr. Nauvel posed in that when he lays out the framework for how he reports a conclusion, identification, inconclusive, elimination, once he says, Well, is it an elimination? No. Is it inconclusive? No. And it's process of elimination --

THE COURT: We can't go down that path because once we start doing that, first of all, he can't -- he wants -- using his three-part classification system, he would not be able to say -- you know, say, Did you rule it out?, that's fine. Left alone, rule it out, that's fine because it does have -- there are consistent marks. But rule it in, he would say yes, he's not going to be allowed to express that. And if you ask him, Was it inconclusive?, then he says, No, it wasn't inconclusive, well, the jury is going to speculate as to whether it is. I won't allow that.

He can say he couldn't rule it out and he can say that there are marks on the firing samples known to come from the gun that bear -- that are the same, that appear to be the same type of marks, include marks that appear to be consistent with the ones found on the crime scene, but not whether or not the bullets, in toto, fired from the gun known to be the defendant's, are consistent with bullets known to have been
fired because they have marks that are similar and marks that
are not similar, and that's as far as we can go with it.

Okay?

MR. NAUVEL: Okay.

THE COURT: All right. Let's bring the witness in
and get started, and the jury first.

MR. OPPENHEIMER: I just suggested maybe they should
let the witness know.

THE COURT: If you want to do that while we are
bringing the jury in, that would be fine.

(The jury panel enter the courtroom at 11:37 a.m.)

THE COURT: Well, we got the air working so it's
probably about 15 degrees cooler in here than it was. Not only
was it not cool, but there was no air moving at all, so I think
we are back in business here.

Ladies and gentlemen, just administratively -- have a
seat and be comfortable -- we are going to try and break for
lunch -- we have a witness starting now that may take a bit of
time, and I am thinking of breaking for lunch at one so we
don't have to break -- and giving you your lunch break from one
to two. We are still making good time in our progress in the
case. That will allow me to go to our weekly bench meeting
which is from one to two.

So can you -- are you able to withstand it and have lunch
at one? Can you make it that long? Did you have enough
caffeine or sugar or whatever you had back there to get you to here? Okay. Great.

So perhaps, Ms. Kaplan, we can get -- or Agent Wilson -- never mind. They are ahead of me as usual.

Sir, come on forward, if you don't mind, please, and stand in front of the chair to the jury -- or the witness box and raise your right hand to receive the oath.

SCOTT MCVEIGH, GOVERNMENT'S WITNESS, SWORN

THE DEPUTY CLERK: Please be seated.

Please speak directly into the microphone. Please say your first and last name and please spell your last name.

THE WITNESS: Thank you. Good after -- good morning. My name is Scott McVeigh, spelled S-C-O-T-T, M-C-V-E-I-G-H.

THE COURT: All right. Mr. McVeigh, I just want to briefly go over the rules of the road with you, sir, as I do with every witness.

Number one, first and foremost, is please listen carefully to each question that the lawyers ask you. For each question, if it's not -- if it is not a clear question or one that you don't understand, let me know so I can make sure it's a clear question before you have to answer it.

Number two, if it is clear, please answer it directly. Don't guess, volunteer, or speculate. And don't volunteer information that the question, itself, doesn't ask you for.

If you are asked to look at a document or a photograph or
something else so that you can be questioned about it, you can
take however long you think you need to look at it so that you
are comfortable that your answer is accurate.

If you have to look at a report or a document that, for
example, you prepared back in the past in order to be specific
about your testimony, you are allowed to remember better by
looking at that document, but then, when you finish looking at
it, you have to testify from memory and not from reading the
document unless I have already independently allowed that
document to be admitted.

So, with those instructions in mind, there is a pitcher
of water there and you can put water in a cup if you need it.

Please keep your voice up. Try to remember to, when you
answer a question, face the jury, and then you will, by doing
that, be facing the microphone as well, and please speak slowly
and distinctly.

Sir.

DIRECT EXAMINATION

BY MR. NAUVEL:

Q. Good morning, Mr. McVeigh.

A. Good morning.

Q. Where are you currently employed?

A. I am currently employed with the Prince George's County
Police Department in the forensic services division in a unit
that is called the firearms examination unit, or FEU. You may
hear me refer to the abbreviation "FEU."

Q. And how long have you been employed there?
A. I have worked at -- I have worked with the County Police Department since 1990, but I had an 11-month service break when I retired my law enforcement commission. I went to Annapolis Police Department, where I worked for 11 months, but I returned in 2009 as a civilian employee in the firearms exam unit, and I have been there ever since.

Q. And what is your current position?
A. My current position is as the unit's senior examiner. I am assigned to the unit with two other county examiners, an examiner from Anne Arundel County, a supervisor, and a couple of technicians.

Q. And very briefly, what are your current duties?
A. I, as a senior examiner, I help the lab manager with some basic sort of supervision tasks, but, primarily, I am a case or a bench examiner. I do case work. I also help manage the case work, and I am the unit's training coordinator, so I look for training opportunities for the career development of people in the unit.

Q. Since you have been working at the FEU, you said the name is called, since you have been working at the FEU, approximately how many -- how many cases have you been involved with involving firearms analysis?
A. Since I was first allowed to be an examiner, do
examinations in my own name in 2008, I have done, to date,
1,213 examinations; however, that number doesn't really include
certain types of sort of supplement reports and it doesn't
include file reviews or reviews of someone else's work which
would conservatively take the number to over 2,000.

Q. We will get into this in a little more detail later on,
but just so you can kind of set the stage, very briefly, what
is firearms analysis?

A. Oh, firearms analysis or firearms examination, as it's
done in the laboratory, the work that I do, is interested
entities, detectives, officers, the courts sometimes will
submit items that are related to firearms or ammunition
components to our laboratory for an examination.

In its most simple concept, we are trying to assess the
firearm in -- with the characteristics of the firearm and the
evidence, and we will do and analyze those components using a
process of comparative analysis, which is a sort of fancy word
of saying we look at the class characteristics, the caliber,
things like that. And then, if warranted, we will use a
comparative microscopy. That's the second of the two-part
phase. So the comparative microscopy is a comparison
microscope used by a trained examiner looking at two items at
one time and assessing the characteristics on those items, and
we generate reports and we work the cases in turn.

Q. And in a similar brief fashion, could you please explain
for the jury what the concept of toolmark analysis means?
A. So toolmark is the -- is the parent discipline of firearms examination. Excuse me. Toolmark is -- the most simple way to think of a toolmark is if a screwdriver slides across a zinc lock hasp, it will leave a mark, so a harder tool creates a mark on a softer substrate or a softer surface. It's often called the work piece.

So it's the analysis of the mark left by the tool that is of interest in the pursuit of the firearm examiner and the toolmark examiner, which firearm examination is a subset of toolmarks, the principles are all the same, but the -- the toolmark section is very small, and in the United States, the firearms section below it is very, very big.

Q. And have you received any training in this field, either firearm or toolmark examination or analysis?
A. I have received extensive training through a protocol manual that was administered to me upon my selection as an examiner candidate, or trainee is -- it's sometimes used, that is the AFTE, the Association of Firearm and Toolmark Examiners training module.

The module is an extensive -- it's a minimum two year; most people cannot complete it in the two years -- a protocol. It has a lot of training assignments, practical exercises. It requires the examiner to attend -- to go to factories and tour firearms factories to see how firearms are made, ammunition
component factories, to see that as well. And along the -- along the line, there are a lot of quizzes and tests on the material as you pass through the syllabus. There is a midterm, and it all culminates with a written final, a practical final, and then, normally, a period of supervised case work before you are deemed to be certified to work in your own name.

So, I completed that in 2008, and we do continuing education opportunities as we -- as we move through -- throughout each calendar year.

Q. And as -- throughout your career, have you obtained certifications in the field of firearms examination?

A. So, I mentioned AFTE, A-F-T-E, before. I am a regular member in good standing of AFTE. I am one point shy of distinguished status. And I am certified through our -- our laboratory to conduct these types of analysis.

Q. Are you also certified by the state of Maryland?

A. I don't -- I think the word -- I am a license --

Q. License?

A. I am on a licensee, or it's a licensure through the state of Maryland, so I am on the license.

Q. Are there any tests that you had to take in order to be certified as a firearms examiner?

A. Could you repeat the question? There was one key word I missed.

Q. Sorry. Are there any tests you had to take to be
certified as a firearms examiner?

A. It was the word "test." The testing that we have to do is proficiency testing. When you are in training and you remain at the lab where you were trained, that takes the place of your -- if you move from one lab to another, so we have that type of testing. That hasn't occurred in my situation. But I am regularly proficiency tested throughout the course of the year in accordance with our accreditation standards.

Q. Have you ever taught on the topic of firearm or toolmark analysis?

A. I have taught and lectured; specifically teaching in Beltsville, a couple miles from here, there is the national laboratory center, which is the ATF's facility.

Q. What does "ATF" stand for?

A. Sorry. The Bureau of Alcohol, Tobacco, Firearms, and Explosives. It is BATF, but everyone says "ATF." That is where the, yearly, they have a National Firearms Examiner Academy, which is the only type of academy of its kind. Most examiners in the United States are trained in their own laboratories, but a few, ten to 12 people are selected throughout the year to attend an expedited course that's taught by the ATF, and I have, between 2002 and 2017, I was an instructor in the bullet module, an adjunct instructor, so I was invited to teach there for a period of five years.

Q. Have you ever been published, Mr. McVeigh?
A. I have been published, yes.
Q. Have you testified before in a court of law on the topic of firearm or toolmark analysis?
A. Yes, I have.
Q. Approximately how many times?
A. To date, 92 times.
Q. Before we get to the subject of -- actually, momentary indulgence, Your Honor.
(Pause.)
MR. NAUVEL: Your Honor, at this point, we'd like to tender Mr. McVeigh as an expert witness in the field of firearm and toolmark analysis.
THE COURT: Do you wish to question on the qualifications, sir?
MR. OPPENHEIMER: Just briefly.
THE COURT: Go ahead.
VOIR DIRE EXAMINATION
BY MR. OPPENHEIMER:
Q. Good morning, Mr. McVeigh.
A. Good morning, sir.
Q. This is not the first time you and I have met. Right?
A. That's correct.
Q. I have seen you on a couple other occasions?
A. Yes.
Q. Once here in court. Right?
A. Yes.

Q. That was about a month and a half ago?

A. I will take you at your word.

Q. Give or take?

A. Yes.

Q. And once at your lab?

A. Yes. At the laboratory in Landover.

Q. So, Mr. Nauvel was just talking to you about some of your professional experience?

A. Yes.

Q. I wanted to take a step back and talk a little bit about your educational experience.

A. Certainly.

Q. To begin with, when we are talking about a firearm comparison, we are talking about bullet and cartridge being sort of forced through the barrel of a firearm. Right?

A. Sure. Yes.

Q. And that process of the bullet, of the cartridge being forced through the barrel happens because of an explosion?

A. Yes. Controlled explosion, yes.

Q. And we are talking about, I think, like you said, we are talking about tools, right, hard metals?

A. Harder metals marking softer metals, yes.

Q. So, in this instance, the bullet being the softer metal that is going to take on the marks of the harder metal?
A. Correct.

Q. And so that employs different scientific principles. Right?

A. It does, yes.

Q. And so let me ask you: Do you have any background in statistics?

A. I do not.

Q. Do you have any background in tribology?

A. Tribology, no.

Q. And what is tribology?

A. The -- the study of metals moving against one another.

Q. And friction?

A. And friction. And it's in a basic sense, yes.

Q. How about metallurgy?

A. No.

Q. And what is metallurgy?

A. Metallurgy is the component study of metal.

Q. And you would agree with me that sort of all of these scientific disciplines come to bear in the work that you do?

A. Yes. But it's not -- it's not critical nor is it a requirement in my position to have studied those fields extensively, and we are thankful for the people who are tribologists and metallurgists who have done research because we do rely on that, but I, personally, do not have that background.
Q. And just to answer my question --
A. Sure.
Q. -- so, yes, you would agree with me that those are relevant?
A. Yes.
Q. I just wanted to be clear.
A. Sorry. I thought I did.
Q. You have a high school diploma?
A. Yes.
Q. Any college?
A. Some college, yes.
Q. How much?
A. I believe 39 credits through two different schools.
Q. Do you have any degrees, Associate's or Bachelor's?
A. I have a certificate through one of the schools, Chesapeake College, for a law enforcement related endeavor.
Q. I'm sorry?
A. It's a certificate, it's a year -- I think it's a -- one of it is at a year from Chesapeake College, so it's a certificate.
Q. A certificate in what?
A. Law enforcement. Natural Resources Law Enforcement, specifically.
Q. And that doesn't have anything to do with firearm comparison?
A. No, not directly.

Q. In getting that certificate, that criminal justice certificate, did you -- did you take courses on any of the sort of scientific disciplines that I just talked about?

A. You tax me to think that if there were, it wouldn't be any more than a basic, basic overview relating to crime scene, so nothing -- nothing in those three fields that you mentioned.

MR. OPPENHEIMER: That's actually all for now, Your Honor. I have no objection.

THE COURT: All right. So, pursuant to Federal Rule of Evidence 104(a) and 702, I am satisfied that Mr. McVeigh has the training, knowledge, and experience to provide testimony in the area of firearms analysis and toolmark analysis as it relates to firearms.

And Mr. Nauvel, you may proceed, sir.

MR. NAUVEL: Thank you, Your Honor.

DIRECT EXAMINATION

BY MR. NAUVEL:

Q. Mr. McVeigh, before we get to the subject of firearms analysis itself, maybe you could explain to the jury some of the basics of how a gun actually works.

And in order to assist you in doing so, did you bring an object with you today that you have used as a teaching aid in the past before?

A. I provided it to you earlier today, yes. It's a plastic
teaching aid that's meant to look like a cartridge, a gun -- a firearm gunpowder cartridge.

MR. NAUVEL: Your Honor, I'd like to show the witness what's been marked, for identification purposes only, as Government Exhibits 17F and G just because it breaks apart.

THE COURT: So these will be demonstrative aids for his testimony?

MR. NAUVEL: Correct, Your Honor.

THE COURT: So, ladies and gentlemen, again, like the charts that are just demonstrative, these are -- this item that will be used by Mr. McVeigh, itself, is not evidence. It is illustrating the evidence that he will provide by testimony. And, so, you may see it as he uses it to explain his testimony, but it will not be sent back into the jury room with you when you deliberate.

So, with that in mind, we may proceed.

MR. NAUVEL: Thank you, Your Honor.

May I approach the witness, Your Honor?

THE COURT: Yes.

BY MR. NAUVEL:

Q. Mr. McVeigh, could the objects I just handed you help you explain the concepts of firearm and toolmark analysis to the jury?

A. Yes. Both -- both firearm function, and, also, there is a portion or two with regarding the things that we look at when
we do our analysis, yes.

Q. Thank you. And this is the point where Mr. McVeigh might need to get miked.

THE COURT: Okay.

BY MR. NAUVEL:

Q. Mr. McVeigh, what I'd like you to do is identify those objects for the jury, and just because of the distance, I wonder if you might be able to approach them and show them as you explain to them what the models actually represent?

A. I can do that. I should put the microphone a little higher.

THE COURT: Say your name, please.

THE WITNESS: Scott McVeigh.

(Witness exits the witness stand.)

THE COURT: Please proceed, sir. Mr. Oppenheimer, you may position yourself so you can see as well, sir.

MR. OPPENHEIMER: Thank you.

THE COURT: Take a couple steps back. I need to see as well, sir. There you go.

BY MR. NAUVEL:

Q. Mr. McVeigh, if you might explain to the jury what this represents and what the components are and what you use it for?

A. We use this device, which is a plastic teaching aid, for instruction, but also have used it in courtrooms prior to today. It's meant to look roughly like a cartridge, which is a
component of ammunition that goes into a firearm, subsequently
fired through a firearm.

The cartridge is plastic. The real thing is metal, usually a brass color or copper color or aluminum color, but apart from that, some of the features that I will point out are similar.

The cartridge or rounds of ammunition is the -- is the unit prior to being fired through the firearm. So we -- we prefer the terminology "cartridge," but sometimes you will hear people say "round." It has four primary parts, the first part being the cartridge case. The cartridge case is a cup-like device that holds all the parts together, the three other parts together.

And the second part, which is in the cartridge case that I am indicating with my right index finger, which is not here but would be here in a real cartridge, is propellant powder. That's a loose base of powder that is ignited by a burn in the bottom of the cup that comes through what's called the flash hole which is in this device. It's the little hole in the bottom. And that occurs when the firing pin or the striker of the firearm impinges the pressure sensitive gunpowder in the third part, which is called the primer.

So, going backwards from what I just said, the firing pin and striker strikes the primer, igniting the pressure sensitive small amount of powder inside the primer. That, in turn,
ignites the -- the fire and the propellant powder in the base of the -- in the cup of the cartridge.

And force is finally part four, which is the bullet down the barrel at a high rate of speed.

So these are the four primary parts, and, in a very general sense, how a gunpowder cartridge works.

Q. And what I wanted you to explain, and you can decide whether it will be useful to use this model or not, is how a gun works. So --

A. So, traditional gunpowder cartridge is -- firearm has a chamber, which is where the cartridge or the round of ammunition gets inserted into.

Q. Mr. McVeigh, sorry to interrupt you.

A. Sure.

Q. As an additional aid, I thought that maybe we could put up what's already previously been admitted as Government's Exhibit 3K, just put that on the screen for your reference. And this is a photograph of the relevant gun to this case, 3K.

So, to the extent that the image is useful for you to explain how a gun works, please use that as well.

THE COURT: We are going to get you a laser pointer. Can everyone on the jury -- are you able to see that screen without causing discomfort to your necks? Because we will have him -- he can't use a laser pointer on each one of your individual screens, but he can use it on the big screen up
there that I think you should be able to see.

THE WITNESS: So the question is using perhaps this
-- I can segue using the photograph and explain how that
firearm may function. Is that correct?

BY MR. NAUVEL:

Q. Yes. Yes.

A. I shall do that.

If you can just refer to the plastic demonstrative
cartridge, I can set this down on the ground because real
cartridges appear in the picture one, two, three, four, five,
six, and then a seventh above the ejection port of the pistol.
That's what this is meant to look like. So in a -- with
students and things and courthouses, we use this instead. So I
will set that down.

That cartridge -- those cartridges -- to load this
firearm to have -- so that the user can use the firearm by
pulling the trigger and igniting a cartridge and sending a
bullet down range as intended is to load those cartridges into
the stick-like magazine, sometimes referred to as a "clip," but
in our terminology, we prefer "magazine." It's -- it's like a
Pez dispenser. So those cartridges go into the magazine.
There is a spring inside the -- and there is also lips which
capture the cartridge as its seeded so you can put one
cartridge in after the other.

The magazine, when the desired amount of cartridges are
placed into it, is inserted into the bottom of the pistol, which is the, referred to as the magazine well. Then, in order to charge the firearm, to place it into a condition called battery, the user would have to get one cartridge in that silver-like device, which is the chamber. The chamber is the portion of the barrel in a semiautomatic pistol which holds the cartridge.

Once a cartridge, by moving that slide back, and the cartridge is either manually inserted or stripped from the top of the magazine and -- and goes into the -- the barrel and chamber, and that action closes because the recoil spring demands that the slide close on itself, that is a position called battery. That means that the user can use the firearm, it's ready to go.

With a semiautomatic pistol, by the name of "semiautomatic," is that for one pull of the trigger, one shot is fired. Through the process of the way that this firearm works, and others like it, cartridge case, that is now referred to by us as a fired cartridge case. Those are indications that it has been cycled through a firearm, are extracted by a little piece called the extractor, which usually sits at that position where my laser is pointed right now, and then ejected by a counter-opposed ejector, which is an internal part of the firearm, and the cartridge case -- now the fired cartridge case ends up in the immediate area of the user, and the exact slide
movement picks up the next cartridge and puts it into the chamber.

So that's a very long -- a lot of words to describe one shot fired. Cartridge case or shell casing comes out, the next shell goes in the chamber, and the user can pull the trigger until there are no more cartridges in there, but it's one shot per pull of the trigger.

Q. And if you could please explain maybe the significance of -- of the barrel and the length of the barrel?

A. So, the barrel is mostly shrouded by the slide. It's kind of a semi-internal part. But the reason that you can see part of it is because that's the area that the cartridge case has to come through.

This particular model pistol is what they call a compact model, has a shorter barrel than some others. The barrel length is just user preference. Barrels can be very short, one inch, two inches, and they can -- there are other revolvers that have 10- or 12- or 14-inch barrels, so that's just a user preference for concealability and other concerns that the user would have.

Q. How does a bullet get projected through the barrel, and how does it then, if you could describe the way that it moves through the barrel, too?

A. So now I will pick up my plastic cartridge again, and we will talk just about, from that point where that buildup of
pressure from the burning of the propellant powder now pushes
the barrel, the, the bullet and engages what's called rifling
inside the barrel, those are land and groove spirals.

Q. Just quickly, what did you mean by "land and groove"?
A. Land and grooves are the high and low spot in the barrel,
which have a twist. They are cut or swaged into the barrel
during the manufacturing process. So those land and groove
impressions, in part, spin to every bullet that passes through
that barrel. Some twist left and some twist right.

How those -- how those land and grooves, those high spots
and low spots are put into the barrel is, there can be
different ways to do that, but what they found was when they
put those spiral grooves -- or spiral lands and grooves in the
barrel, then part of the spin to the bullet, as it came through
from the barrel, and that spin gave stability. It cut down on
the yawl [ph] and the different things that we are seeing that
made early smooth firearms not reliably accurate.

So the main reason that firearms are rifled is, with the
exception of shotguns, is to increase stability and accuracy.

Q. And how does a gun leave a mark on a bullet or shell
casing?
A. So, the -- the idea of toolmarks, and that question is
predicated on the idea that, in the factory, the tools that
create the firearm are harder than the firearm themselves. The
tools, carbide, a lot of -- a lot of high steel is used to make
the tools, the drills, the reams, the buttons, the broaches, and all the different manufacturing techniques that are used to take a piece of metal and make it into a firearm, those tools create marks in the firearm. And then the firearm becomes complete, it goes out into the world, and now the firearm is the tool, and the softer brass, lead, copper, nickle coated, nickle-plated copper, things like that, that's much softer than the steel that come into contact with the firearms, so sometimes there can be associations with regard to the marks.

Q. I think you are safe to return to your seat just for now.

A. Thanks.

(Witness retakes the witness stand.)

BY MR. NAUVEL:

Q. Can you explain to the jury, from the comfort of your seat, what class characteristics are?

A. I'm -- I discussed earlier a comparative analysis phase as part of sort of a two-step process that we use. Class characteristics are super important to the first part. So, for an for example, if you have a 12-guage gun and someone gives you evidence that is a .38, we can look at those two class characteristics, the 12-guage, or whatever the size of -- of A is and the size of B, and if they are not in agreement, we can say pretty safely that that's not the right firearm.

So it was -- but class characteristics is not simply just caliber. There is caliber, twist. There is features that we
use during our process that have to do with weight of the
objects, that have to do with measurements of specific areas,
such as land and groove impression dimensions. So those are
class characteristics we use during that phase.

And if all of the class characteristics are in agreement,
tiny measurements, weights, gross appearance on low
magnification of patterns and things and caliber, and all of
those things agreed, then we go to the next phase and look at
the other characteristics.

Q. And what are individual characteristics?

A. So, individual characteristics are the smallest
microscopic marks, the ones that we need real higher -- higher
end magnification to assess that are particularly -- normally
associated with a particular firearm.

Q. Sorry. I just let you sit down. But are there -- are
there any kind of characteristics, let's say, on your model
bullet that you might be able to show the jury?

(Witness exits witness stand.)

THE WITNESS: Sure. The class and individual?

BY MR. NAUVEL:

Q. Yes, those characteristics, sure.

A. So, again, this is just a -- a teaching aid. It doesn't
really look like the real evidence that I look at, but for the
purposes of just explaining what we do, the class
characteristics would be, for example, the diameter, the
diameter of the -- of the bullet. Do they -- are they in
agreement if you are trying to compare two things? If so, you
move on.

The weight of this projectile, if there is not
depreciable amount of material that's missing, you can weigh
the two things and say, Oh, they are, you know, close in
weight. The land impression and groove impressions, of which,
on this teaching aid, there are six of each --

Q. Mr. McVeigh, do you want to try and come use this -- or
whichever is easier for you, either with trying to use the ELMO
or showing them closer?

A. I don't know that anyone can see the lines unless we use
that. So the lines are -- where I am headed was the individual
markings.

Q. Sure. You can proceed.

A. So come there?

Q. Sure.

A. Ask me a question.

Q. Would you please explain what individual characteristics
are using this model that you have here?

A. So, grossly exaggerated and on this plastic model, just,
again, for demonstration purposes, the -- the lines and the --
the three-dimensional lines in this model all are a little bit
different in each land impression. So the area where we focus
our -- our work is in the land impressions. Traditionally, we
don't work much with the groove impressions for a number of reasons.

The land impressions have, in this teaching aid, have lines which travel the length of the bearing surface, which is the part that comes into contact with the actual barrel. Those lines are meant to, again, roughly demonstrate where the firearm examiner looks when they are doing their comparison of the individual characteristics.

Q. Thank you, sir. You may return to your seat.

(Witness retakes the witness stand.)

BY MR. LASSITER:

Q. So, now, I know I asked you to briefly describe this earlier, but now that the jury has all of this context in mind, can you give a more fulsome explanation of what firearm analysis or examination entails?

A. The elements of -- of a questioned case, somebody wants answers for a comparison, is this the gun related to these items, it's all brought to the laboratory that's in Landover. The firearm examiner will either self assign, or be assigned by myself with the unit supervisor, a case to work. They retrieve the evidence from a secure evidence vault and begin the process of conducting the examination. And by doing that, they pull the items to their workstation, open the items, separate them, classify them, and begin that comparative analysis phase.

Each item, evidence is marked both on the packaging and
the actual items themselves. A case -- a case jacket is made
on a management system, which is a virtual case jacket on a
computer screen, but it ultimately produces a -- an actual
paper jacket with pen -- with ink signatures in the end.

So the worksheets have pull-down options where the
examiner can use descriptors to, during that comparative
analysis phase, enter things such as weights and measurements
from calibrated scales and stage micrometers that we use during
our work.

And then if the case warrants the comparative microscopy
phase, which is sort of the second part of the examination,
then we use comparison microscopes, which have a pretty high --
pretty significant range of magnifications, to do the
comparison of the -- the -- the real marks, not like the
plastic bullet that we saw, but what they really look like in
the real work that we do, and we assess those characteristics
by looking at the -- at two things against one another, if it's
two unknowns or if it's a known and an unknown, and that's an
important part of what we do in terms of the -- the source.

A known refers to something that I know came from there.
If I shoot a firearm in a water tank and I pick up the bullets
from the water tank and pick up the cartridge cases from the
adjacent tile flooring, those are knowns.

Unknowns would come in from -- as evidence marked that we
wouldn't know what the source of those was.
Q. So what type of things -- what type of evidence do you actually examine?
A. So, we examine everything that's related to gunpowder firearms, and that would be firearms, themselves, magazines, cartridges. Usually that stuff doesn't have too much to do with the microscope. The microscopy work that we do is, using this one more time or referring to it, fired cartridge cases and fired bullets, those items that have indications that they have been fired through a firearm and are waiting in a vault for an examiner to look at the class characteristics and the characteristics and make an examination -- an examination and an assessment about -- about them.
Q. And jumping back for -- for a second -- I apologize for jumping around a little bit -- but earlier you talked about class characteristics and you explained what those were. You talked about individual characteristics and what -- and you showed the jury what those were.
What is referred to as subclass characteristics?
A. Yes. That's -- that's an important part of what we do, too. Subclass characteristics are those characteristics that are associated with a certain tool in a factory. So subclass characteristics are -- the easiest way to think about subclass characteristics are what we call toolmark carryover. That -- that means that there is a large mark or a series of large marks, a lot of times from broken tools but not necessarily so,
that are trans. -- that are present or persistent in a group, an undetermined group of firearms. So if a broken tool creates a certain mark in a certain firearm, that mark may be present in some form in a run of firearms. We have policies in place to address and consider the subclass characteristics as a portion of our examination.

Q. Okay. How do you, after conducting your analysis, how do you ultimately reach a conclusion, if at all?

A. We -- we make those two part -- that two-part conclusion -- sorry, the two-part analysis. We -- there is a process that we do called review. It's where a peer, another examiner in the lab, verifies the scientific -- forensic scientific validity of the examination that we have conducted, and then, also, there is an administrative review which looks for typographical errors and to make sure that the correct language is used and things like that.

So at the conclusion of the two processes that I -- I spoke extensively about, the review process, the verification process, we generate a report based on all the things that I am saying with our findings, which sort of represents, I think your question was conclusion, that would represent my conclusion.

Q. After conducting your analysis, are you able to eliminate evidence?

A. Frequently, yes. I mean, we are able to eliminate,
sometimes easily -- individual elimination on individual characteristics can be difficult, but on class characteristics, it's very easy.

Q. Have you personally eliminated firearms that police officers think might have been the crime weapon or might have been relevant in some way?

A. Yes, many times.

Q. Mr. McVeigh, does your lab have any procedures or protocols about how to perform firearms examination or analysis?

A. Yes, we do. We have several sources of -- of rules and procedures for that. The department -- the police department that we work for has rules, the general order manual, personnel rules. But then to still down, we also have requirements from our accreditation body which is A -- sorry, I always mess this up -- ANAB -- we are not supposed to say "ANAB," but that flows better -- and that's the international accreditation body that we are accredited by. There are rules for the accreditation standards, and they are very closely linked with our standard operating procedures and the various manuals that we have in the laboratories both for how we conduct our work and also safety considerations, material data safety sheets, and things of that nature, hazardous material plans and things. So, yes, there is a lot of rules to what we do.

Q. And is your lab audited on compliance with all these
rules and procedures and protocols that you described?
A. We are audited according to the ANAB lab schedule. We are subject to spot audits at any time, and when I left work yesterday, we were having -- we were going through an internal audit.

Q. Has your lab, excluding the one from yesterday -- maybe including, if it's complete -- but has your lab passed its audits?
A. The laboratory that I work at has never had -- has never failed an audit.

Q. Mr. McVeigh, I am going to hand you what's previously been admitted into evidence as Government's Exhibits 12A through 12G.

Can you please describe for the jury what these are? And please take your time.

A. If I could take a second to look at each item?

Q. Yes. Please take your time.

A. Thank you.

I do recognize the items.

Sorry. Was there another question?

Q. If you could please describe, as a group, kind of, what these -- what these items are?

A. As a group, they are seven evidence bags containing either fired cartridge cases or bullets. These are all portions of -- this is the evidence that I began an examination
on January 16th, 2017, and I recognize the items because of my
initials both on the items where I opened them on the morning
of the 16th and also where they were subsequently sealed later
-- later in the day.

There are five bags of the seven, A through E, I believe,
12A through E, Government --
Q. 12A through G?
A. -- A through E, the first five, which have police
identifiers, numbers PW1 through PW5, each contain one fired
cartridge case --
Q. Okay.
A. -- one single fired cartridge case, Winchester brand, and
the caliber is .45 auto.

And in Government's F and G, each one of those bags
contains one fired bullet, .45 caliber, and my lab number that
I analyzed these, all these items on back in January, 2017, is
17-0034-KCM, which are my initials.
Q. You mentioned January 16. So, using the evidence that
you now have in front of you, can you please walk the jury step
by step through what you did on January 16, which was I believe
your first contact with this evidence?
A. I looked at the -- I recovered the items from the vault,
much in the manner I described, created a case jacket, marked
the items, each item separately, separate -- separated them
into cartridge cases and bullets because you look at those
things separately. There is a different worksheet for
cartridge cases and a different worksheet for fired bullets.
But another reason for doing that is because they touch
completely different parts of the firearm, so there is normally
not any association made one bullet back to a certain cartridge
case. So it's looking at the cartridge cases together and the
bullets together.

I looked at the class characteristics, I saw that they
were in complete agreement, so I did adjourn to the comparison
microscope, at which time I did side-by-side comparisons of
like evidence to each other, so, in other words, the bullets
against one another and the cartridge cases against each other,
and I captured some digital photo micrographs of some
consistent marks that I saw.

And ultimately, after review, after the report was being
generated, the evidence was resealed and sent -- I don't recall
if I sent it to the lab or whether I kept it there, but that --
that -- that -- that concluded my business with the analysis,
the first thing, basically just looking at the things against
themselves and reporting out my findings.

Q. Okay. And you mentioned one thing that I want to unpack
for the jury.

You mentioned you can't compare bullets to casings. Is
that correct?

A. We -- we normally don't. There have been some very rare
instances in documented research where they have been able to make associations between certain marks which would tie a cartridge case back to a shell.

Can I use this to demonstrate?

Q. Sure. Yes. Of course.

A. But ordinarily, we don't look at those, those instances were fairly rare. Because once the bullet comes into contact with the internal -- inside of the barrel, it touches different portions of the firearm than this impacted -- impacting the fired cartridge case during the firing process. So the bullets touch the land and grooves of the barrel, the bearing surface, and the cartridge case comes in contact with the breech, firing pin, extractor, ejector, and the walls of the chamber.

So, we don't normally put those two things back together. It would be an unusual circumstances and it would be something that would jump out to the examiner during the examination.

Q. So, is it fair to say that your analysis of shell casings is completely separate from your analysis of the bullets?

A. In this case, it was. I saw nothing to indicate that there was an unusual element afoot, so -- but it all goes on the same report. It's just a different category.

Q. And so have you -- is it possible for you to reach conclusions using only one of those categories of evidence?

So, for example, if you were to only have bullets and no shell casings, would you be able to do your analysis?
A. Well, that's speaking hypothetically, but I would say yes, it's possible, yes.

Q. And how about the inverse, if you only had casings and no bullets, would you still be able to conduct an examination or an analysis?

A. Yes. We conduct an investigation -- we can conduct it when there is only one item. We just say that there are marks or there are not. But when there is a comparison that can be made, we do make that.

Q. So, moving now to January 25, 2017, was this the approximate date when the FEU was asked to -- to assist on this case again?

A. I believe my first direct touching involvement was on January 27th.

Q. 27th?

A. But there had been some correspondences, emails and such, prior to that.

Q. And can you explain what happened at that point?

A. An examiner, a peer from the Washington, D.C. Police Department, and he is an officer but he works at the laboratory which is called D.C. DFS, which I may refer to, so I will explain what that is. D.C. Division of Forensic Services or Sciences, I am not sure what the "S" is, but anyway, he brought a firearm, Rock Island 1911 firearm from his property division and his laboratory in his custody, brought it to our lab so
that I could fire it into the water tank and then compare
knowns to the evidence that I have been speaking about earlier
today.

Q. And what did you do then after you had fired the knowns?
Actually, if you could walk the jury through that process, too.
I apologize.

A. It would probably make more sense to do it that way.
Officer Chase brought the firearm, the firearm is now in
constructive joint custody between he and I. I made some notes
about the firearm, which, again, he was with me, go down to the
shooting room which is a little, it's a hallway, a little bit
of a walk down from our microscope room, fire two shots into
the water tank, thus, creating my knowns, and gives a baseline
of what the firearm marks like when I look at it later.

I returned the firearm pistol, the Rock Island 1911-A1CS
pistol in this case, to Chase, and he stayed there while I did
the first portion, while I compared marked and compared
ultimately my cartridge case from this case to one of the test
fires. That was after having marked my test fires and also
doing a baseline examination of my test fire to my test fire.

So I want I see what the marks look like during that
process before I mount any unknown against it to look at on the
comparisons microscope.

Q. Can you tell us, Mr. McVeigh, some of the things you
documented while you were going along and engaging in this
process?

A. So, documentation occurs both on January 16th and January 27th, but I am looking at the -- the -- the character -- the characterization of the marks. Are they parallel in nature? Are they arced? Are they granular patterns? There is different things. And those are all part of the things that I noted primarily on the 16th.

So, on the 27th, when Chase brought the firearm, the goal -- those things had already been documented, and they are important to assess the class characteristics, but in looking at the knowns from, that I fired from, I am looking to see if those knowns -- what the class characteristics and the gross appearance of those marks on the knowns are in relation to the request that I compare test fires from that Rock Island pistol to the previous -- previously discussed PW evidence items.

So, really, the documentation was -- was -- was in the case where I was to just look at the class characteristics and really go immediately to the comparative microscopy, and in doing so, I am looking all over at different magnifications.

Q. Well, before you go to the microscopy, I want to ask one question that kind of fits in between there.

How did you choose which bullet and which casing get -- was compared to the test fires?

A. So --

Q. And if it assists you, if you could actually take them
out of the -- of the bag and show them to the jury if it assists you in explaining why you chose what.

A. The -- sure. I just have to dig it out.

Q. Sure.

A. So I took representative samples from the evidence that I had looked at earlier, and those representative samples were for the bulk of my comparative microscopy on the 27th of January. And those were Government 12E, which is PW5, a fired cartridge case, and 12G, which is PW7, which is a fired bullet. And you asked me for a reason. The selection of P5 was fairly arbitrary. It was just one of five and it didn't have any detectable damage.

Q. And was the quality of the other cartridge casings pretty comparable to that one?

A. Yes, it was.

Q. Please continue.

A. P7 states -- sorry. Government's 12G was significantly less damaged than the other bullet items, so I elected to open that one and utilize that one.

Q. If you are able to compare the two as well using the ELMO maybe?

A. Did you say come to the ELMO?

Q. Yeah, if you could.

A. Sure.

(Witness exits the witness stand.)
BY MR. NAUVEL:

Q. Just so everyone can -- just so everyone can see -- I don't know if the jury can see these properly. Let's look at one at a time and then maybe stick them both together. There we go.

Which one is this?

A. This is Government's Exhibit 12G, which is a police item that I referred to primarily throughout my examination as PW7, which is the initials of the recovering officer. And in evaluating which one to use, the land and groove impressions are present in their entirety without significantly substantial damage to the bullet itself, so I viewed that one to be less damaged than the other option that I had in this case, which was Government Exhibit 12F, PW6, which had a noticeable tear in the jacketing material and a little distortion of the bullet diameter.

Q. Is it correct to say that it's kind of been flattened?

A. Only on one side. The land and groove impressions on the other side are pretty well intact. At most, I would say this is moderately damaged compared to some other bullets.

Q. So you could still perform an analysis on that one?

A. I did and I could.

Q. And you did. Okay. That's right.

And -- but it was your determination that PW7 was probably the better one to go with in this instance?
A. Yes.
Q. Thank you.

Okay. So I believe the point where I so rudely interrupted you was you were about to get into the microscopic inner comparison portion of your examination.

So, at this time, I am going to show you what's been marked as Government's Exhibits 17A, 17B, 17C, 17D, 17E, and 17F.

If you would please identify these first for the jury.

If you would identify for the jury what the -- what this group of items are.

A. Thank you.

Government's 17A through 17E are five digital -- they are images of the digital photo micrographs that I took from the spot camera on the Leeds microscope on the day of January 27th that I looked at both the fired bullet evidence in comparison to test fires from that Rock Island pistol that Officer Chase brought me and the fired cartridge case -- cases, which are, again, sometimes referred to as shell casings, which was PW5, which was the one I arbitrarily selected from my group and test fires from the -- my knowns that I recovered myself from the water tank or adjacent to the water tank on the 27th of January.

So these -- these are the -- we are required to take a minimum of two pictures so the -- the pictures, the photo
micrographs that we take comprise sort of a visual note, if you like, of our examination. It's not solely intended to look at our examination because we look at much more, but the -- the threshold of -- of -- of the work that we are supposed to do requires us to take, in this case, would have been four, but I took five.

Q. And are these images that you have in your hand, are they fair and accurate representations of the photographs you took on that day?

A. Yes, they are.

MR. NAUVEL: Your Honor, we'd like to offer Exhibits 17A through 17E into evidence.

THE COURT: Any objection?

MR. OPPENHEIMER: Can I just briefly voir dire on these pictures?

THE COURT: Pardon me? No. I'll let you do it during cross-examination.

Is there an objection?

MR. OPPENHEIMER: No. I don't have an objection.

THE COURT: Admitted.

MR. NAUVEL: Your Honor, for demonstrative purposes only and to help Mr. McVeigh explain his analysis, we are going to put these images that have been admitted on the screen so the jurors can see them. But to help Mr. McVeigh, we also have large versions of these that we have identified as 17A -- is it
McVeigh - Direct

1 17A2, 17B2, 17C2, through 17E2, and we'd like the Court's
2 permission to show the jury these demonstratives.
3
4 THE COURT: All right. Those are demonstrative aids.
5 The photographs that I have admitted, you will get to look at.
6 The blowups are to be looked at in conjunction with the
7 testimony here in the courtroom, but they will not be brought
8 back.
9
10 And, again, a reminder, just keep an eye on the clock.
11 1:00, we are breaking for lunch.
12
13 MR. NAUVEL: I wonder, Your Honor, whether this might
14 be a good time to break.
15
16 THE COURT: I'm thinking it might be a good time to
17 break now and come back at quarter of two, so if we get
18 started, we have just got it all set up and then we stop in 15
19 minutes and come back, I don't think it makes much sense.
20
21 So, ladies and gentlemen, let's break now. It's quarter
22 to one. We will come back at quarter to two. And please be
23 prepared so that we can actually start the testimony once again
24 at quarter to two. Thank you again for your time and
25 attention. And we are now in recess.

26 (The jury panel exit the courtroom at 12:44 p.m.)
27
28 THE COURT: Okay, folks. One hour lunch break. Back
29 at -- be ready to start at quarter to two on the dot. Thank
30 you.
31
32 MS. KAPLAN: And, Your Honor, just to be clear,
because Mr. McVeigh is still in the middle of his direct examination, we can talk to him during lunch?

THE COURT: Yes. It's only when he's been tendered for cross that you can't do that.

MS. KAPLAN: Thank you, Your Honor.

(Recess taken from 12:46 p.m. until 1:46 p.m.)

THE COURT: Please be seated, everybody.

Shall we bring the jury in?

MR. NAUVEL: Yes, Your Honor.

THE COURT: Thank you.

We can have the witness resume the stand. You can just have a seat there, Mr. McVeigh. Stand when the jury comes in.

(The jury panel enter the courtroom at 1:48 p.m.)

THE COURT: All right. Everybody have a seat and be comfortable, please. We will resume now.

Mr. McVeigh, I remind you that you are still under oath, sir.

THE WITNESS: Yes, Your Honor.

BY MR. NAUVEL:

Q. All right. Mr. McVeigh --

A. Yes, sir.

Q. -- so I think where we were is we were at the spot where we were about to talk about your microscopic inner comparisons, and we were going to use, for that purpose, we were going to put the images up on the screen but also have -- have you look
at some boards, which are just blown-up versions of those same images, and we were going to kind of talk through those images if you wouldn't mind.

A. No problem.

Q. What I'd like, and I believe these were admitted into evidence, so I'd like to start with Exhibit -- Government's Exhibit 17E.

THE COURT: So, Mr. Oppenheimer, I am going to position myself over there, too. You should feel free to do the same.

MR. OPPENHEIMER: Thank you, Your Honor.

THE COURT: Ladies and gentlemen, I hope you don't mind if I stand right here.

(Witness exits the witness stand.)

THE COURT: You may have to be miked as well. We can only hear Mr. McVeigh.

BY MR. NAUVEL:

Q. And Mr. McVeigh, I am also going to have you grab your plastic -- your plastic aid.

A. This is an enlarged --

THE COURT: You may have to be miked as well. We can only hear Mr. McVeigh.

BY MR. NAUVEL:

Q. So, Mr. McVeigh -- sorry. Are you able to explain to the
jury what they are looking at maybe using your -- your teaching aid there?

A. This is an enlargement of one of the five photo micrographs that I took on the microscope on January 27th, 2017, with regard to the inner comparison of evidence that I spoke previously about, PW5, which is a fired cartridge case or shell casing. It was the one that I arbitrarily selected to compare to the knowns.

So if you look at the image, there is a black line that runs the entire -- from top to bottom, the entire length of the image. That image is the center line, and that image is visible through the microscope when you are viewing it. And it's important because it signifies that you are looking at two different objects, those two different objects being on your and now my left-hand side of the image, a portion of the fired cartridge case that is PW5 at 56 times magnification, 56 times what you can normally see with the naked eye.

On the right half of the black line, the cross line, is what is the test fires from the DFS 17-00207, which is the D.C. designate -- case designation for the recovery of the Rock Island 1911-A1CS pistol that Mr. Chase brought to me on the 27th, Officer Chase brought to me on the 27th, and it was subsequently fired that day prior to making this photo micrograph.

So that sort of describes what is the annotation in the
image that you see.

Q. Mr. McVeigh, just before you get into that, is it always
consistent -- is the test fire always on the right and the
evidence on the left, or does that vary?
A. In the images that I took in this case, yes, and, as a
rule, it -- it is that the test fire of the known is on the
right. Right is right. It's kind of a thing that we say to
keep that straight.

Q. Okay. Please continue. Sorry.
A. So -- so that sort of accounts for the annotations that
you see at the top in the green -- in the green print. That's
a layered annotation that I place immediately after taking the
image, or thereabouts, contemporaneously right -- right as I am
doing the exam.

In the heart of the image, in the center of the image on
the center line, what is depicted is a portion of the -- the
examination of one area that I saw on the cartridge case during
my microscopic evaluation of the PW5 fired cartridge case to
the same area on the knowns of -- of the Item 1, which was
later discovered to be Item 2. I received an email from Chase
that said I mislabelled the photo. But this is the test fire
again and the evidence.

So, on the center line, this image is meant to depict
the, using the pattern matching technique that we use when we
evaluate these marks, the -- the -- the matching or consistent
-- the pattern match or the areas of consistency along that center line from an area which, using my laser pointer, starts about right there (indicating) and goes down here (indicating) where the pattern sort of abruptly breaks apart and it's not the same.

The reason for that is the bunter mark appears in an area on the mark of the rim. And a bunter mark is a mark -- that is the reason that this part is not important to the image is because that's -- that's either a letter or a number, and that's viewed at a very high microscopic level so you actually see the toolmark from the tool, which is called a bunter, which makes the letter or number and stamps it in the cartridge case.

So, using my plastic model -- one, I wanted this to be a little bit more agreeable for our purposes today. It might say W-I-N or Winchester or .45 or some variation of that. My model doesn't have that, but this is the area where that would occur (indicating).

And what you are seeing in almost a large third of the right-hand side is the -- is the toolmark, the bunter mark that -- that is either a letter or a number. So that's not a part of the area that I was concentrating on, that 56 times.

Q. So, let me ask you this: Is this a mark that was made by a firearm?
A. No.

Q. Okay. What was it made by again, one more time?
A. The tool is called a bunter, and it's made when the
cartridge case is produced and stamped with the manufacturer's
either name or the caliber of the firearm.

Q. Okay. And how about these marks here (indicating), can
you walk us through these?

A. So these marks are viewed at 56, which is the high --
mid- to high-level range of microscopic magnification that's
available to me during the analysis. And what -- by taking
this photo micrograph during my inspection and examination and
evaluation of this evidence was to show the correspondence, the
consistency between the marks on the left side and the right
side of the black line, and that is the area which falls out of
focus, above where the light is now, is the edge of the
cartridge which falls into where it's -- where it's black is
where I put the annotation.

So, really, we are using this cartridge, what you are
seeing is very small marks that were made at the rim of both
sets at 56 times, with the area of concentration as a note for
me in my analysis and examination of the pattern -- consistency
in the patterns pretty much between here, and then on this big
piece, about six or seven inches below there where there is a
significant consistent agreement of the patterns in that area.

Q. And was that the only place on the -- I forget what you
call the back there?

A. The head.
Q. -- the head where -- where certain toolmarks were consistent?
A. There was another area that was captured in the breech face area on the primer.
Q. Were there -- and this is a general question because we are going to look at maybe five images --
A. Yes.
Q. -- were there any other areas with such markings that you did not capture?
A. So the entire -- the entire piece is looked at under magnification, and it's a variety or spectrum of magnification, low and high. We usually choose to take the images at mid to high level because that shows the -- the type of marks that we are interested in preserving for memory recall.
The cartridge cases, themselves, overall, were evaluated against each other. And --
Q. What did you find from that evaluation?
A. Well, the class characteristics were in complete agreement.
Q. Okay.
A. So, gross appearance, the types of markings, it was -- it was -- it was the smaller marks, viewed at very high magnification, is where we choose to do the -- the -- the capture of the -- the images for the -- for the note purposes. The worksheets and the observation of the agreement indicate
that the class characteristics are in agreement.

Q. Okay. And if you allow me to do so, I see some -- some marks that are consistent and some that are not entirely consistent or not consistent.

Can you explain why that might be or what your thoughts are about those?

A. To my -- to my eye, this is -- this is a fairly consistent pattern agreement. There is -- we do not, however, say the word "perfect." We don't say the word "match" because the firing of a gunpowder cartridge in a chamber in a firearm and a bullet through a barrel are very dynamic events. So we refrain from the using the words "perfect" and "match" because there are instances where, due to how much powder is loaded in there, due to the metallic construction, the relative hardness of the cartridge or the primer and different considerations, where, some marks, there will be differences, dissimilarities. It's the question of how much dissimilarity becomes too much when you have consistent agreement and consistency such as depicted here and some of the other photos I took.

Q. And, so, in the process of firing, what is it actually that would have made these marks on the -- on the back of the casing there?

A. So, for the -- with regard to the cartridge cases, the area that we are -- that we are most -- most in agreement and captured for, memorialized in images, for me, is the breech
face of the firearm.

Q. What is that?

A. That's the area -- the breech face of the firearm is the area where the firing pin comes through a little hole called an aperture. And the breech face, when the cartridge case is fired, there is a lot of pressure, and the pressure builds and builds and builds and it pushes against all -- all the surfaces. One of the main surfaces that it pushes against is the breech face, the breech face being the piece that moves and locks that unit into space during that firing process.

So the cartridge, when the powder ignites, wants to push back against the breech face, action/reaction. So the bullet takes the path of least resistance, so that goes off. There is a lot of engineering that goes on to make it all work together, breaking it down into aspects, but for the purpose of the image, and I think of an image that I took of the cartridge case and another image, the area is the breech face of the firearm.

Q. Is there anything you want to point out to the jury on this one before we move on to the next one?

A. I think I have accounted for the things that were important to me.

Q. So if we could now move to 17D. Let me just stick this here behind you.

What are we looking at here, Mr. McVeigh?
A. With all of the discussion about the annotation, being a little bit more succinct than I went through the first time, the difference in this is that the items are still the same. A test fire from the pistol on the right side, an image capture of part of the primer, breech face impression on PW5, on the left side of the black line, is still the same. It's fairly centered.

And the -- the difference between this one and the last one is that the magnification is a little bit lower. It's at 36. I did this for two reasons. The pattern in this case was a little bit more -- a little larger of an area for me to work with, so I wanted to capture an image of the pattern basically from top to bottom of what -- what I deemed to be significant or consistent. And, also, it -- it gave a -- a relative -- a relatively good view of, a little bit out of focus, but still a good view of the firing pin impression, which is a good note for me that reminded me that the firing pin impression in this particular firearm lacked a lot of significant detail on the surface of it, and that's -- so it's mostly smooth. Even though it's a little bit out of focus, it helps my memory recall for that.

But regarding the consistency of the pattern --

Q. Before you get into that, I just want to ask you about exactly what you just said, consistency of patterns.

So, you mentioned this technique, I believe, which is
called pattern matching.

What is that?

A. So, pattern matching is -- it's -- it's the optical -- it's a human being optically looking through a comparison microscope and assessing two patterns to see if they are more dissimilar -- more similar than dissimilar or similar in their entirety. It's the technique that every firearms examiner in the United States and internationally uses to assess the characteristics of the items that they are looking at, even those that use supplementary techniques, such as 3-D imaging or a quantitative finding where they count those aspects, they all -- every one starts with pattern matching. You see it, recognize it, and then maybe there is some variation in the way that labs choose to annotate that or -- or house that -- that information. But that's the technique that we use looking for a pattern.

Q. And would you say that some of this is subjective depending on the examiner, or let's -- and let's go to this specific example to kind of take it out of the abstract?

A. There is a degree of subjectivity to be sure, and there is -- there is a -- a process, which is why I earlier stated an examiner can't do case work for a minimum of two years. This is most of where the time that the examiner spends is learning the significance of the marks and capturing them using the equipment and -- and then the meaning of -- of the marks.
So, the -- the subjectivity, I would have to agree, is an aspect of it, but I would -- I would compare it to if I looked at an X-ray of my own broken arm, it may not mean as much to me as it meant to someone who is supposed to look at X-rays, so that's -- I think that's the subjectivity aspect you are talking about.

Q. So, I interrupted you right as you were about to start looking at some of these specific toolmarks, so please go ahead.

A. So these are fine impressed lines that, pretty much from the bottom of the annotation of words 27, or a little bit below there, is where the pattern starts to come into alignment and agreement. There are breaks in the pattern. There are places where a line may not meet another line that has the same three-dimensional aspect. That's normal. There -- and for the reasons that I described. Very dynamic event.

When this primer was made in the factory, perhaps this primer was made four or five years later and there was a -- a little bit of a hardness difference, maybe this one had more gunpowder in it, so to have some dissimilarity is normal.

What you are looking for is the significant agreement or sufficient agreement. Where is that? And this digital photo micrograph was taken to capture what I believe to be agreement. And it continues down the line.

Q. Okay. And why -- why is it that this area is -- is of
more interest to you than, let's say, the sides?
A. Well --
Q. By "sides," I mean top and bottom.
A. Of the image?
Q. Yeah, of the image.
A. Of the image, it falls out of focus for one thing, so that area, I can only focus on one point at a time. But then there is also -- this is what's called the primer pocket. The primer pocket, or where the cartridge case and the primer, there is a little bit of a gap, so, normally, the impressions can't get in there because it's -- the space will not allow the impressions to sink that deep into that little bit of a gap. So, in the primer pocket, I don't expect ever to see toolmarks of any kind.
What I do expect to see is when this primer reaches the heel of the primer and flattens out, that's when the toolmarks, the impression toolmarks that are created during the firing process are visible. Then I have to figure out where along that line I can have some congruence.
Q. I do want you to explain a little more detail what this focus thing you were talking about before, what the focus means, what the relevance of focus is? Sorry.
A. So in order -- taking digital photo micrographs on a comparison microscope requires a lot of light. These objects are dark. The room is dark. The light is focused. So, the
more light you pour on, you lose a little bit of depth of
field, so it's -- when taking these images, there is a balance
of depth of field and then an illumination that is --
represented what we saw.
The -- when you increase the light, one of the techniques
to do is to -- is to -- it's a side lighting technique, a
fluorescent lighting, and if we move the item that's under the
microscope slightly, our depth of field changes and also our
focal range changes. So, all of those things I have to account
for when I am -- when I am taking an image, and what I am
trying to do is, given the space that I have and the pixels
that I have, take something that best represents what I saw
when I did my analysis. But, again, this is only just a
portion of that.
Q. And you mentioned something about -- and I didn't stop
you because you were talking about something else --
A. Sorry.
Q. -- you mentioned something about a 3-D versus looking at
it -- if you look at it in 3-D, it might look slightly
differently, or can you please explain what you mean by that?
A. Well, the question that you asked me earlier was about
pattern matching, but being very involved in my community, I do
know that there are other techniques that are either currently
being used, currently being validated, in the validation stage,
and one of those is 3-D.
Q. Oh, I meant --
A. We don't utilize that. That's not available to us, and, for the most part, it hasn't been validated for general case work.

Is that what you were talking about?

Q. It is. And I have -- it reminded me of another point that I think I will raise on a different image unless you have more to say on this one?

A. This is just a digital photo micrograph. It's a 2-D rendering of what I saw in three dimensions when I looked at the evidence of PW5 against the test fires that I took on the 27th. This is one of two of the cartridge cases.

Q. So, are you able to show the jury your model? Does the model illustrate some of the -- some of the three-dimensional things that you were trying to take a picture of?

MR. NAUVEL: Your Honor, may we publish this to the jury, Your Honor, the model?

THE COURT: I think he already is.

MR. NAUVEL: Yeah. Sorry.

THE WITNESS: With regard to the three-dimensional versus two-dimensional, the easiest analogy I can draw is -- I hope that everyone is quiet enough if I do that (indicating). I have the impressed marks on this plastic. Those are in three dimensions, and you can move it around and articulate it to see that there is depth, there is spacial relationship between
those, and they are -- you can touch them and feel that they
are three dimensions.

This was much the same when I looked at it. But when I
captured the digital photo micrograph, it generates a flattened
image which now is more two dimensional than it is smooth.
That's the best analogy I can think of.

Q. So, essentially, what I am trying to get to, were there
certain lines that -- certain toolmarks that appeared more
consistent when you tilted it a slightly different way and were
there some that appeared slightly less consistent when you
tilted it a different way?

A. There were dissimilarities at other areas and there are
dissimilarities here. It's whether the dissimilarities
outweigh the similarities. And the overall estimation is that
the similarities outweigh the dissimilarities with regard to
this and other areas that were viewed.

Q. Should we move to the next one, Mr. McVeigh?

A. I am supposed to answer a question with a question, so
yes.

Q. So this is 17 -- 17C.

A. This and the next couple of images are photo micrographs
that were taken in roughly the same time period, on the 27th of
January, 2017, in the lab on the same microscope using some of
the same magnifications. I think one is a little bit higher.
These are of the bullets. So these are the land impressions, which are indicated in my annotation of the pictures. This one is L-I-M-P, which is an -- it's an accepted abbreviation in our field for land impression. So this is one at 56 times, which I think we saw one previously at 56 times. Land impressions are the areas I mentioned before that we concentrate our analysis in. That's the preferred toolmarks for the firing process of -- of this type of firearm and most firearms, is the land impressions.

This area depicts some toolmarks that are in agreement primarily in the center, the light copper-colored area where the laser pointer is focused right now with a coarse line agreement for indexing purposes about four inches below that, and then there are an area that's a little bit out of focus on the groove impression, which is what I chose to plant my annotation. Again, that's an area that I was less concerned about and an area that was out of focus, so I put my annotation there.

Then in the land impression area below that, there is one area, I guess about a little under a half of that, where there is not as -- they are pronounced lines in a red marker, which is consistent with my annotation that I arbitrarily named this land impression the red land impression. That's how we do the indexing, is we utilize Sharpie colors which are sort of semipermanent, and we indicate that, we will mark that, and
that way, we can come back to it. Because looking at these in very high magnification can be taxing and draining, and once you find your index point, you don't want to lose it. Plus, it also gives a naming reference. So there is red mark, red marker.

There is some lines that are in the bottom half on the left-hand side that are not necessarily very -- there is not necessarily as many corresponding lines on the right half, the test fire half. Again, that dynamic or that land impression apex is, it's a rounded surface. So that's not uncommon and that was not alarming to me.

What was more --

Q. Show to the jury, if you would approach a little bit, or it's up to you if you think the ELMO is better or showing them.

A. Well, I mentioned indexing, and I don't know if I am clear on that point.

Q. I don't think you have explained what indexing is.

A. Okay.

Q. Please go ahead.

A. Should I go over there?

Q. Yeah. I will just zoom in.

A. That's good.

So these are two land impressions, and this is, again, the -- this is -- to -- to be clear, this is the plastic demonstrative thing, but the indexing principle is pretty
important.

Q. Tell me again, what is the -- is the -- the land is
the -- if I were doing peaks and valleys, the land is the peek?
A. The groove is the peek -- the groove impression is the
peek, but it's the -- it's the -- the -- it's the deeper point
in the rifling because they are -- the deeper produces the land
impression. The land and the barrel -- now you have me
confused. The land and the barrel produces the deeper
impression in the bullet, the land impression.

Q. Got it.
A. So, but the indexing point is that when you are looking
at comparing the two fired bullets, either as your baseline,
your test to test fire, there -- there will be a little bit of
correspondence, so you will have one line or two lines that
will match up. This is, again, the plastic training aid, so
what you will do is you will check, and when you have six land
impressions, you have six possible candidate land impressions
for your comparison, so you look at each one, and, again, you
may have -- you may have coincidental marks that line up, but
when you get to one that looks like it's -- it's a better
candidate, as you go through your six options, you will find
one that has a better look. Then you can lock those two down
in an indexed setting, mark them, and check other areas to see
if the patterns are matching the way that you would expect them
to.
So that's the indexing process, and that's why the red index mark appears on there.

Q. And is that, in fact, what you did in practice with these bullets? Once you found some lines that were potentially consistent, did you then rotate and see if that was repeated on the other surfaces of the bullet?

A. Yes, I did.

Q. Okay. Thank you. So maybe we can head back over there and take a look at this image.

So, if you could walk us through.

A. Sure.

Q. You mentioned that the area you were most concerned with was this central area. And just to recap, you had mentioned the top was out of focus a little bit.

Remind me about the bottom again.

A. That's what I forgot to show you on the ELMO. If I can run back over there and answer that question?

Q. Go ahead. Go ahead, Mr. McVeigh.

A. As you are looking at that image, there is a portion of the land impression that is -- it's a curved -- it's a curved surface, a curved area. So this is what I referred to as the apex, it's the highest point of the curve.

And then I am going to refer to the edge, here and here (indicating), the edge of the land impression. That's the leading edge or trailing edge depending on the rifling twist.
So, with that knowledge, I can clarify.

Q. Yeah. If --

A. Should I leave it up?

Q. Yeah. Leave it up, and then we will just look at you so people can look at both at the same time.

A. So that view is looking down, but now I am again looking at the items flat on comparison microscopes. And where the area that is the greatest engagement of rifling touched piece to piece, because there does have to be room for the bullet to pass through the barrel, but the engagement is greatest in the -- in the -- in the edges, so that's where this and that pattern is significant to my work.

To have some dissimilarity closer to the apex of the land impression does not -- it does not flag to me, in my experience of having done over 1,000 of these cases, as significantly dissimilar. It's just that sometimes they will mark and sometimes that mark won't be there. This, to me, is more significant, which is why I captured the image.

Q. Okay.

A. And that's your pen back.

Q. Thank you. And anything else on this specific image that you would like the jury to know about?

A. I have hopefully accounted for everything.

Q. Let's move on to the next one, which I believe is 17B. So, what are we looking at here, Mr. McVeigh? You can
take your other bullet back.

A. This is also an edge. This is at almost twice the magnification of the last image. And probably most importantly, this is of a different edge of a different land impression. So, this is where the puzzle piece starts to fit in terms of consistency of -- of pattern. This is at 102. It's the most -- it's the most magnification we have available to us with the microscope that we have, and while it's darker, and the higher you go in magnification, the more difficult technique is needed to -- to light this, so my apologies for the darkness of the one on the left, but the pattern is significantly consistent in the middle, in the same area, middle of the image as I intended when I took the image.

So you have focus fallout above the annotation on groove impression and a little bit of focus fallout particularly on the bottom right area. That's to be expected at this high level of magnification.

Then you also have an area in the, closer to the apex of the bullet where the one on PW7 marked a little, with a little bit more gusto than my test fire did, but what was key here in this image, which was also key in the previous image, and that's that in that edge, those patterns, in my view, were consistent.

Q. And explain to me what is the significance of the magnification again, the high magnification?
Why is that important?

A. The individual marks, the individual characteristics that we are looking for to -- to make sure that it's not just something you are seeing from far away that you think looks similar, but at -- this is the magnification that the industry has found to be -- to -- deemed to be appropriate to determine, not just guess or think, but determine that agreement at that level for this -- these types of articles. And -- and, by that, is it -- it makes you sure of your -- of your pattern, the congruence of your pattern agreements that -- that you see at a lower magnification, and it also helps cut down on the possibility of subclass interference.

Subclass interference is those toolmarks that might be associated to a group of firearms. Subclass characteristics are not seen in agreement at this level on these size of marks in the -- in my training.

Q. So, at this level of magnification, are you confident that those marks that are consistent from the test fire to the evidence were not the result of subclass characteristics?

MR. OPPENHEIMER: Objection.

THE COURT: Sustained.

BY MR. NAUVEL:

Q. Let me ask you this way: At this level of magnification, did you have concerns about subclass characteristics?

MR. OPPENHEIMER: Objection.
THE COURT: Sustained.

MR. NAUVEL: May I approach, Your Honor?

THE COURT: I think we need to move on with the examination, please.

MR. NAUVEL: Okay.

BY MR. NAUVEL:

Q. I see an area down here on the test fire -- is this still the test fire side --

A. Yes.

Q. -- that does not seem to have consistent toolmarks corresponding on the -- on the evidence.

Can you please explain why that might be or what you saw?

A. Why it might be would be speculation on my part other than just to generally say each bullet, each cartridge case does not, they are not identical. They are not literally, in every facet, identical. There is variation. It can be down to a couple factors that I cited.

My consideration and my examination is to whether the dissimilarity is significant, and then, if so, to document it with regard to that -- the dissimilarity.

I mentioned, with regard to this image, that that dissimilarity is not concerning to me, that the focus of my capturing this is this area in my finger spread right now (indicating).

Q. All right. So why don't we move on to the next one,
which is, I believe, 17A.

What are we looking at here, Mr. McVeigh?

A. In 17A, we are looking at a very similarly annotated image of yet another of the land impressions that were available to me upon viewing. This is different because it's of a different area than in the middle without any other reference points, but it still is of an edge of a land impression. This one, however --

Q. Are you able to illustrate, using your models, where this might be?

A. I can. While this is still in an edge of -- of what I arbitrarily determined to be the brown land impression, this one is at the heel of the bullet, which is most of the time where we do -- it's where we do a fair amount of our -- of our analysis and our comparisons because this is the last part to touch is the muzzle of the firearm before it leaves.

So there is a little bit of a focus fallout primarily here and also some discoloration on the evidence, PW7, which is normal. There is no good cleaning thing to color that carbon that occurs. There is a lot of heat and friction that occurred during the -- during the firing. Again, a very dynamic event.

Q. So where it appears darker here (indicating), are you saying that the evidence, itself, was darker due to carbon deposit?

A. I'm saying they don't mark -- I'm using that to be
illustrative to the point that they are not identical.

Q. Got it.

A. That smoke and powder buildup, it's probably never going to be the same, but that's not the crux of what it is that we do.

We focus on those toolmarks that we can see where the patterns emerge and where we can make an assessment about that.

So at the heel of the bullet explains the reason why there is significant image drop off on pretty much the entire three-quarters of the -- of the -- of the right side of the image. That's because you are looking in space there. This is the heel of the test fire bullet, the heel of the evidence bullet, PW7, on the brown land impression in an area along the edge at the heel, with the agreement and the interest of -- of my taking this image for my analysis was -- was just that, that area in my finger spread where those patterns are consistent at that line.

Q. All right. So why don't you walk us through some of the specific toolmarks because I see some that are consistent and some that are not consistent, and if you could walk us through some of these specific ones?

A. Using the laser pointer, in an overall pattern matching philosophy, the agreement is from a place where actually the test fire markings fall off because they are at the edge of the bullet, so it's an -- it's an eight, approximately eight-inch
area where the marks are in consistent pattern matching and
style agreement, which is the area where I am showing these
marks going across the center line, one piece to the other, and
it stops about there (indicating).

There are a few out of focus marks there, but I am not
claiming any agreement there because it does start to fall a
little bit out of focus. In this eight-inch approximate oval
circle that I am indicating is -- is the reason that I took
this. That's the significant agreement or consistent agreement
that I saw.

Q. Anything else on this particular image?
A. That is the third of three land impressions. I also
looked at three others, but I only captured images of these
three.

Q. I think you can probably retake your seat.
A. Okay.

Q. Thank you, Mr. McVeigh.
(Witness retakes the witness stand.)

THE COURT: I need to have the stand moved. Thank
you very much. Let's turn the exhibits around so that we are
not having them face the jury if they are not actually looking
at them. You can just put the one on the front and turn them
around. That's good.

Thank you so much.

BY MR. NAUVEL:
Q. So, Mr. McVeigh, one thing I forgot to do earlier was ask -- I will show you, first of all, what's been entered into evidence as Government's Exhibit 4.

This is already entered into evidence, but if you can still identify this for the jury.

A. I recognize Government's Exhibit -- is it on the bag?

Q. Exhibit 4?

A. Four?

Q. Mm-hmm.

A. -- as the Rock Island Armory 1911-A1CS pistol that I fired in the presence of Mr. Chase on January 27th, 2016 -- 2017, sorry, at -- January 27th, 2017, at our laboratory at 7600 Barlowe Road in Landover, and I recognize the firearm and the serial number is what matches in my recollection of my notes, Robert Ida Adam, which is the "RIA," it's the police phonetic alphabet that we use, 5785 -- or 8527, and I recall specifically the 527.

Q. Okay. Thank you, Mr. McVeigh. I will take that back from you.

MR. NAUVEL: One moment, Your Honor.

No more questions, Your Honor.

THE COURT: Cross-examination, sir?

MR. OPPENHEIMER: Yes, Your Honor.

CROSS-EXAMINATION

BY MR. OPPENHEIMER:
Q. Mr. McVeigh, I want to try to touch on some of the general concepts you have talked about as you were going through the demonstrative.

A. Sure.

Q. The first being, your analysis and the micro comparison is subjective. Right?

A. It is, yes.

Q. You -- you are looking at two items under a microscope. Right?

A. Yes.

Q. And you are looking back and forth between the items. Right?

A. No. The -- the whole purpose of the comparison microscope is that you can see them both at the same time, so your eyes, both eyes can see both things at the same time.

Q. Okay.

A. They have to -- as long as your diopters are set correctly.

Q. So you are looking at them at the same time and looking for patterns?

A. Correct.

Q. And there is no set number of patterns that you need to see to find something consistent. Right?

A. No. It's -- it's an overall assessment, and it would be disingenuous to say there is one and there is consistency. So
it is a pattern, there are -- it is a plural number and it's -- and it's an assessment of -- of all of the evidence, but, no, there is no number defined.

Q. So, for example, as the government was going through the pictures and pointing to things that were -- that seemed dissimilar in the pictures, your answer would be that you would expect to see some dissimilarity?

A. The government asked me about dissimilarity and similarity, and both -- I think both were present in all the pictures, and I would expect to see that, to answer your question in the affirmative, yes, some dissimilarity.

Q. So -- so, for instance, you talked about situations where you have knowns. Right?

A. Yes.

Q. So you have two items that you know to be fired from the same weapon. Right?

A. Yes, test --

Q. Test fired?

A. Test fires, yes.

Q. Knowing those two items are fired from the same weapon, you would expect to see things that were dissimilar between them. Right?

A. I would, yes.

Q. And having two items that you know are fired from different weapons, right, you would expect to find things that
are the same between them, areas of similarity?

A. You lost me. If you could just repeat that -- that one more time. I think I understand. I just want to make sure I give you the --

Q. Two items fired from different weapons are going to have some patterns that seem similar?

A. Yes. There -- there are -- there can be patterns of similarity and dissimilarity. It's -- it's a little bit of a -- there are some thresholds involved and there is some baseline -- there is some baseline comparisons to your knowns or to patterns that -- similar patterns that you have seen in the past, which is why the training period is so long. But yes, there is -- that is -- that is consideration in both directions.

Q. You talked about, when examining the markings, the striations, the depth and the spacial relationships between the marks?

A. Yes.

Q. But you don't use an instrument to measure the depth of the marks. Right?

A. No. We don't use an -- an instrument for that.

Q. You just look at them?

A. We look at them, and by moving them, we can -- we can gauge their -- with the shadows and the things, you can recognize -- like I see you now standing before me, I can see
the background behind you. I know you are in three dimensions. It's much the same looking at a bullet in a microscope.

Q. But you don't know the exact measurement --
A. No.

Q. -- between the distance between you and I?
A. No. We don't currently have a device for doing that.

Q. And the same thing with the spacial relationship between the lines. Right?
A. The spacial relationship is a little bit easier because they are -- they are -- to assess, but we don't measure that, per se.

Q. You look at them to see if, essentially, they line up?
A. Correct.

Q. I think you -- you mentioned to Mr. Nauvel that you don't engage in a quantitative analysis. Right?
A. We don't render quantitative findings in our laboratory, or many laboratories, actually, in the United States right now.

Q. So, sort of going back to the number of similarities that you would need to find something consistent, there is no percentage of similarity that you need to see?
A. No, not currently. That's -- that's not something that we are able to do, but that is something that's being looked at on a research level outside of a working laboratory such as mine.

Q. Right. But in the laboratory that you work in right now,
where you conducted the examination in this case, you don't do that?
A. No, we don't.
Q. Now, there is -- there have been a number of criticisms of firearm comparison in the last ten years. Is that fair to say?
A. Well, there have been three primary documents that had elements that were critical about elements of firearm examination, but not -- not wholesale, no.
Q. Okay. Okay. So, before I talk about reports, I just want to talk about some of the individual criticisms. Right?
A. Sure.
Q. One of them, one of the criticisms being that this is wholly subjective. Right?
A. Yes. That's one of the things that -- that is -- that has been brought up by people outside of the field, yes.
Q. That there are no standards to determine when there is enough agreement to declare something to be consistent?
A. Well, see, there you touch on an important point because we are going to talk about claims that I have not made today that are being criticized by these reports. Most of the criticisms have to do with the distillation of results in terms of -- and their significance, not so much the practice of what I have talked about primarily today, the techniques that I have done today, if that makes sense.
Q. So when you are looking at two items, the test fire and the recovered item, and you are doing your analysis as to whether the marks are consistent, what you are doing is using your training and experience. Right?
A. Yes.

Q. And your training and experience consists of the examinations that you have done in the past. Right?
A. Well, the training, the ongoing training, the tests that I take, and then also instructing in -- in -- in course. All of it in total, yes.

Q. So, is it fair to say that what you are doing is looking at these items under the microscope and sort of searching your mind's eye to think back to another comparable examination that you have done?
A. Well, that can be -- that can be -- absolutely can be an element of it, but there is also references that we can use for -- for those types of things.

Q. So do you, for instance, when you did this examination, did you have a manual of comparisons to reference to the test fires and cartridge cases in this case?
A. No, just the -- not a manual, per se. That doesn't really exist. There is -- there is images and textbooks that we could use, but I didn't use them in this case.

Q. You just used based on --
A. -- having taught the bullet module for, at that point,
four years and my experience, yes.

Q. So you went through the demonstration with the jury and explained the things that you perceived to be similar. Correct?

A. Yes.

Q. And you just testified that sort of you don't use a manual or modules? You didn't at least in this case. Right?

A. I didn't use a text manual, I believe is what you said, a manual?

Q. Right.

A. I just used the totality of all of the other training that I have had, experience that I have had in the field, and also, importantly, the -- the test to test step was really important in this case.

Q. Right. And so -- so one of the things that you didn't do was bring the jury an example, right, an example of where the dissimilarity was too great?

A. I could provide that if -- if I was asked to.

Q. But you didn't?

A. I didn't bring it today, no.

Q. You didn't do that today. Right?

A. No, I didn't.

Q. So you just showed them pictures of bullets and cartridge casings and limited points on those bullets and cartridge casings that you thought were similar. Right?
A. Yes.

Q. And so they have no way of evaluating whether or not that's better or worse than anything else that you have seen. Right?

A. Yes. I guess so.

Q. How could they. Right?

A. How could they?

Q. How could they know that?

A. I -- I don't know. I -- I have tried to faithfully answer the questions today. That one, I am not sure about how could they. I don't know how to answer that. I didn't provide something that you described. I was not asked to look into that.

Q. So, essentially, the point of that demonstration was to take your word for it. Right?

MR. NAUVEL: Objection.


BY MR. OPPENHEIMER:

Q. You mentioned reports over the last ten years. Now, these reports have looked at the way forensic science is used in criminal courts. Is that correct?

A. Yes. That's -- that's an element, yes.

Q. There was a report by the National Academy of Sciences in 2009. Right?

A. Yes.
Q. And that report looked at a number of forensic disciplines. Right?
A. Yes. That's correct.
Q. Firearms comparison being one of them. Right?
A. That is correct.
Q. And the 2009 NAS report, in part, as it related to firearms comparison, found that the discipline had not reached scientific validity. Right?
A. There was some questions and concerns about the -- about the foundational validity of the -- again, more to the point in just me answering yes or no is the yield, the ability to be able to do sole source attribution and things of that nature. That's where those criticisms are fundamentally important. Again, that's not been offered here today.
Q. When we are talking about something being scientifically valid, that's demonstrated through research. Right?
A. Yes. I mean, that's -- that's a key part of the -- the process of validating these scientific things, yes.
Q. I mean, you just talked about the 3-D imaging project.
Right?
A. Yes.
Q. And that's in the process of being validated right now.
Right?
A. Hopefully, yes.
Q. Right. And so the reason why it's not being used right
now is because it hasn't been validated?
A. Correct. I mean, that's my understanding, yes.
Q. And, so, going back to the 2009 report talking about firearms comparison as it is practiced still today, the criticism was that it hasn't been scientifically validated. Right?
A. Yes, with regard to the yield and the results.
Q. And, so, just so we are clear, this research, it's done in the form of validation studies. Correct?
A. Correct. That's one way.
Q. What a validation study does is seeks to demonstrate the accuracy of a particular method. Right?
A. Yes.
Q. So it would look at the method that you just sort of went through for this jury right now. Right?
A. Kind of, aspects of it, but, again, the yield is different. Today, really I have just talked about things that I did; whereas, the validation studies are getting at the heart of what an examiner does as to what is drawn from that, what conclusions are drawn.
Q. The validation study, Mr. McVeigh, is seeking to demonstrate whether or not you can actually do what you say you can do. Right?
A. With regard to the -- with regard to the distilled yield of the analysis; in other words, reaching certain -- a certain
set bar of conclusions, that's the -- that's the -- the point
that is in a validation study that is seeking to be either
validated or invalidated.

MR. OPPENHEIMER: The Court's indulgence.

BY MR. OPPENHEIMER:

Q. Now, one of the -- one of the goals of validation of
studies is to determine how reliable the particular method is.
Right?
A. Yes.

Q. And you, yourself, have participated in validation
studies. Right?
A. I have, yes, several.

Q. And, so, what -- what a validation study does, with
regard to your discipline, is it attempts to test examiners.
Right?
A. Yes.

Q. And to -- to be valid according to the scientific
community, it tries to test you under real-world conditions.
Right?
A. At times. Some more real than others, but yes.

Q. As close to what -- as close to replicating the work that
you actually do?
A. Yes.

Q. In the form of a test?
A. Sure.
Q. And, so, another study that we -- or another report that we talked about was the 2016 PCAST Report. Right?
A. Yes.
Q. And just for the jury, "PCAST" stands for the President's Council --
THE COURT: -- of Advisors.
Q. -- "President's Council of Advisors on Science and Technology?"
A. Council of Advisors, C-A-S-T.
Q. PCAST for short?
A. Yes. That, we can agree.
Q. And PCAST was commissioned by the president of the United States. Right?
A. Yes, at the time.
Q. And the title of the report is Report to the President Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods.
And, again, this is another report where they were looking at the reliability of scientific methods in criminal cases. Right?
A. Yes.
Q. And firearms was one of the disciplines that they looked at?
A. That is correct.
Q. And the -- the folks that made up the body that put out
this report were from the scientific community. Right?
A. It was a mixed authorship of academics, jurists, and
scientists of -- of varying backgrounds, none of which were
practicing -- were practitioners of -- of -- of -- of the
discipline of -- with regard to my discipline, none were
practitioners of that. But yes, jurists, academics, and
scientists, that is correct.
Q. So you had judges. Right?
A. Yes.
Q. Professors. Right?
A. Yes.
Q. Professors from the top universities in the country. Right?
A. Yes.
Q. You had statisticians. Right?
A. Yes.
Q. Engineers. Right?
A. Yes. But I couldn't go much further. I am going to
assume there was an engineer or two on the -- on the Council as
well.
Q. All right.
A. I don't know the backgrounds, literally, of all of the
authors. I just know a few of them.
Q. And certainly I could go through the credentials, but I
think you would agree with me that this was a prestigious group
assembled of jurists, professors, and scientists?
A. Yes. It would have to be. The PCAST has opined on other issues when they are asked to, too, such as antibiotic resistance in medicine. There has been -- they have issued PCAST reports on other reports (sic). So this group has to have that sort of content of people in it in this -- and these were the same authors that served for that term that authored on that that are the esteemed people that we speak of.
Q. So you agree with me?
A. Yes, I do.
Q. And with regard to firearms, what PCAST did was invite all communities to submit validation studies. Right?
A. Yes.
Q. And that included the Association of Firearm and Toolmark Examiners. Right?
A. Yes, it did.
Q. Because that's the -- you mentioned during your last answer that people who do what you do were not members of the PCAST Report?
A. There was no one that does what I do that was invited onto the PCAST with regard to this PCAST Report you are talking about.
Q. Okay. But -- so PCAST invited folks to submit their validation studies. Right?
A. Correct. Yes.
Q. And what PCAST concluded was that they only could find one appropriately designed validation study in the area of firearm and toolmarking comparison?
A. Is that a question?
Q. Yes.
A. Yes.
Q. And that was the Ames study?
A. Yes, the first Ames, Iowa study.
Q. And the Ames study was conducted in 2014. Right?
A. It was.
Q. And it was done by an independent lab. Right?
A. Yes.
Q. It was actually part of the Department of Energy. Right?
A. It was, yes.
Q. And conducted at Iowa State University?
A. The Ames Laboratory.
Q. And what the Ames study was trying to figure out was what is the error rate of this discipline. Right?
A. I think they were looking at a number of things, but the error rate was -- was in the title, so --
Q. Right.
A. -- they were trying to get an error rate for, again, importantly, the conclusions that this discipline has traditionally distilled in its -- in its reportings, so that was an attempt to do -- to take the best sort of, at that
point, 2014, the best type of study and come up with an error rate that could be utilized for understanding that -- the discipline's findings.

Q. "Error rate" means "mistake." Right?
A. Yes. I mean, it's -- it's a rate of error in a set number, so yeah. But it's a mistake, yes.

Q. So when you are trying to calculate the error rate, you are trying to calculate, essentially, the false positives. Right?
A. When that's reported out, yeah, when that's -- when that's a consideration, which hasn't been discussed today.

Q. So, false positives, for instance, is when, for instance, including something when it shouldn't be included. Right?
A. Yes.

Q. And after reviewing the Ames study and determining that that was the only appropriately designed study, PCAST published the error rate from the Ames study. Right?
A. That's correct.

Q. And what they found was that there was a range, right, for firearms comparison?
A. Yes.

Q. And that range was on the low end between one and 66. Right?
A. Yes.

Q. And on the high end between one and 46. Right?
A. Yes.

Q. Now, you testified that you have performed over 2,000 examinations?

A. Conservatively, yes.

Q. And, so, according to PCAST and the Ames study in terms of validation of firearms comparison, the Ames study would say that in 2,000 comparisons, there would be at least 43 false positives. Right?

MR. NAUVEL: Objection, Your Honor.

THE COURT: Overruled.

THE WITNESS: Repeat the question, please.

BY MR. OPPENHEIMER:

Q. There would be at least 43 false positives in 2,000 examinations?

A. One in 43, yes, I believe that's...

Q. In the actual number 2,000, if a firearms examiner had conducted 2,000 examinations, the Ames study would say one could expect an error rate of 43, meaning 43 false positives?

A. Okay. If that's -- if that's what the numbers say, I would -- I have no reason to doubt you.

Q. And, so, what that means in the real world, 43 false positives, is, again, including something that shouldn't be included. Right?

A. Sure. Yes.

Q. And what it means in the real world is that it could
result in the prosecution of someone. Right?
A. I -- I guess, yeah. It's -- again, I think what's
missing here or what's not being discussed between you and I is
that that's when an opinion about something is -- is rendered,
and that has not been done today.
Q. I want to, you touched on it briefly during your direct,
about the NIBIN system.
MR. NAUVEL: Objection, Your Honor.
THE COURT: Come on up.
(The following took place at sidebar outside the presence
of the jury; all counsel present.)
THE COURT: The basis of your objection?
MR. NAUVEL: I don't believe NIBIN was discussed.
THE COURT: Beyond the scope, is that what you are
saying?
MR. NAUVEL: Beyond the scope.
THE COURT: 611(b), scope of cross, subject matter,
direct, subject matter affecting credibility, if there was no
more than a tangential mention of NIBIN, then that would be an
understandable objection to make. It doesn't preclude the
examination, but then if it's precluded, the examination has to
be conducted, if it's beyond the scope, in a form that would be
non-leading questions.
Can you tell me what you want to get into with NIBIN?
MR. OPPENHEIMER: The difficulty we have, though, is
that it was referenced yesterday by Detective Dalton as the lead and the sort of impetus and the start of the investigation, and there were certain questions --

THE COURT: Right. But this witness didn't testify to that, so it's not part of the subject matter of the examination of this witness. Right?

MR. OPPENHEIMER: I believe on cross, I should be able to get into that he has direct knowledge of the NIBIN system.

THE COURT: Well, that's not within the scope of the direct examination is what I am asking you. Right?

MR. OPPENHEIMER: I don't think I should be limited just because they didn't ask him that question.

THE COURT: First of all, just answer my question. We agree that he did not testify about the NIBIN system during his direct examination. Correct?

MR. OPPENHEIMER: He referenced D.C. getting the cartridge. I don't think he used NIBIN specifically.

THE COURT: Okay. So what you are now saying is I want to exceed the scope of direct examination, I want to examine him about the NIBIN system. I can allow you to do that under Rule 611(b), but that examination then has to be in a manner that you would use if he was your witness, which means you are no longer allowed to ask leading questions under 611(c).
I will let you do that, but the problem we face if you do -- and I am not saying you can't, I will let you do it -- is that on redirect, they get to go into that, and there is no recross.

So I would -- I would -- I don't recall very much being said about NIBIN yesterday at all and certainly not anything about what NIBIN may have shown, so I just am concerned about using the narrow focus of the testimony that I think we worked pretty hard to keep, so I am just making my observations.

I am not going to prevent you from doing it if you want to do it, Mr. Oppenheimer. But I am not sure, when that jeannie is out of the bottle, how easy it is to put the chain back is what I am saying because I don't know what he would say and I don't know -- so that's my ruling.

MR. OPPENHEIMER: I understand. Not that this is necessarily your concern, my worry is it's -- there is a sort of completing the narrative here, that the gun magically appears in the office today through his testimony; yesterday, they heard testimony, a snippet, about a lead, and then I -- but I guess we can talk about that.

THE COURT: Well, I mean, I hear you on that. I am not telling you you can't do it. I am just saying that we have really exercised a great deal of control over what the witness is saying.

MR. OPPENHEIMER: I am trying to and I understand
that he is.

THE COURT: The witness has been very faithful to that, as has been Mr. Nauvel. So I -- I -- a limitation on the scope of the examination can -- can no longer apply if, through the party that benefited from the limitation, a new area is gone into and we open up doors that we don't know what's behind those doors. So my concern is where this might go, and --

MR. OPPENHEIMER: I understand.

THE COURT: -- if you want to re-call the witness who testified yesterday about the NIBIN system, but I don't know -- that's it's own different -- that's it's own different can of worms, if you get what I am saying. So I am just making these observations at this point when we are pretty much still on course with where we have been on this thing.

MR. OPPENHEIMER: Yes. Yeah.

THE COURT: So give that some thought.

MR. OPPENHEIMER: I understand.

THE COURT: If you want to go there, I will let you go there. We just have to use non-leading questions.

MR. OPPENHEIMER: I understand.

(End of sidebar discussion.)

MR. OPPENHEIMER: Thank you, Your Honor.

BY MR. OPPENHEIMER:

Q. Mr. McVeigh, I want to transition again to something that we have spoke about before.
You know, your lab, I think -- I think you have described is it considers itself to be progressive. Right?

A. Yes.

Q. And by "progressive," you mean trying to address some of the criticisms that I have talked about here today. Correct?

A. Yeah. Make a difference where we can with regard to participating or assisting research, and making sure the -- the current management, making sure we are better off, you know, we leave it better than we found it and that we are moving in the right direction.

Q. And so that includes participation in validation studies?

A. Yes. That's one -- one way, yes.

Q. That includes participating in emerging technologies?

A. To the -- to the -- when we are able to, yes.

Q. So it's fair to say that you and your lab understand the criticisms and are trying to make the discipline better?

A. That -- that is -- that is true. We would always want to -- to -- to take every endeavor we do as humans for it to be better and better and better, and we are no different in that regard. PCAST, NAS report notwithstanding, I like to do my job better each day.

Q. Because it's important?

A. To me it is, yes.

Q. And it's important to other people. Right?

A. I hope so.
Q. It's important to people who may be charged with crimes. Right?

A. Certainly. We take that, our neutral, unbiased analysis, very seriously. Even though we are part of the police department, we take our neutral position very seriously, so, yes, for that very reason.

MR. OPPENHEIMER: I have nothing else.

THE COURT: Any redirect, sir?

MR. NAUVEL: Very, very brief, Your Honor.

THE COURT: Yes, sir.

REDIRECT EXAMINATION

BY MR. NAUVEL:

Q. Mr. McVeigh, the defense counsel mentioned the PCAST Report, which was critical of portions of firearm analysis. Correct?

A. Yes, some portion of it, that's correct.

Q. Is this report universally accepted in the field?

A. Well, there was really only one aspect of the report that was embraced universally, and that's the idea that we need, and will always for the foreseeable future, need more research money for research and development in forensic science. And that's not just firearms. That's all forensic disciplines applications. That was something that the PCAST said that no one that I have ever spoken to has disagreed.

But with regard to some of the detailed comments that --
that people at PCAST, there was a -- there were dissenting
voices within the courts and agencies that I have both worked
with or are aware of.
Q. And did some of these agencies or organizations offer
responses to the PCAST study that was discussed by the defense?
A. Yes. They -- they -- the responses came in as soon as
after the first version of the PCAST was published.
Q. Is it fair to say that there is an ongoing debate within
the community right now?
A. I think that's absolutely fair to say.
Q. Okay. To the best of your knowledge, was there anything
in the PCAST Report that was critical of anything you have
demonstrated to the jury today?
A. No.
Q. You -- the defense asked whether you and your colleagues
have internalized the criticisms from PCAST and other sources.
Is that true, first of all? Have you internalized the
criticisms from --
A. I think we have internalized --
MR. OPPENHEIMER: Objection.
THE COURT: I am not sure what is meant by
"internalized."
THE WITNESS: I am not sure either.
THE COURT: That's one of those things where if you
don't understand the question, you let me know. I didn't
understand the question.

MR. NAUVEL: Let me ask it a different way.

BY MR. NAUVEL:

Q. Fully understanding what the -- what the criticism from PCAST says, how much does that change in terms of what you explained?

A. I am not sure I understand that question either.

Q. Does -- does -- do any of the reports or studies cited by the defense change what you have told the jury about toolmarks, about consistent toolmarks, does it change any of your testimony today?

A. No, none whatsoever.

MR. NAUVEL: Nothing further, Your Honor.

THE COURT: May the witness be excused?


THE COURT: Hold on one second.

Is that it?

MR. NAUVEL: Yes, Your Honor.

THE COURT: May the witness be excused?

MR. NAUVEL: Yes, Your Honor.

THE COURT: Mr. McVeigh, thank you for your time. You are free to go about your business. Because the case is ongoing, please do not discuss your testimony with anyone until the case is over.

THE WITNESS: I shall not.
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UNITED STATES of America v.
Marcus Jay DAVIS, et al., Defendants.

Case No.: 4:18-cr-00011
Signed 09/11/2019

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MEMORANDUM OPINION

Michael F. Urbanski, Chief United States District Judge

The court conducted a Daubert hearing and heard evidence and argument on September 3 and 4, 2019. ECF Nos. 699 & 704. These issues are now ripe for decision.

For the following reasons, the court GRANTS in part and DENIES in part defendants’ motions, ECF Nos. 570, 577, 581, and 612, and will permit the testimony of the proposed experts, subject to the limiting instructions described below. Additionally, the court GRANTS in part and DENIES in part the government’s motion in limine filed on September 6, 2019, the day after the Daubert hearing. ECF No. 713.

I.

This multi-defendant, multi-count RICO prosecution began on June 11, 2018 when a federal grand jury issued two indictments bringing charges against members of the Rollin 60s Crips gang and gang associates on violations of the RICO statute, 18 U.S.C. § 1962, VICAR statute, 18 U.S.C. § 1959, and several other factually related charges. ECF No. 1; ECF No. 207. The government alleges that, in the summer of 2016, members of the Rollin 60s and Milla Bloods collaborated to facilitate criminal activities in the Danville, Virginia area. See ECF No. 207 (describing alleged racketeering conspiracy). This collaboration resulted in: (1) the attempted murders of the “Philly Boys” at North Hills Court on June 15, 2016, resulting in the assault and attempted murder of Armonti Womack and Dwight Harris; (2) the attempted murder of Justion Wilson and murder of Christopher Motley at North Hills Court on August 20, 2016; and (3) the attempted murder of Tyliek Conway on August 24, 2016.

The government proposes three experts in the field of firearms and toolmark identification: Wendy Gibson (a forensic scientist with the western lab of the Virginia Department of Forensic Science’s (“DFS”) Firearm and Toolmark section), Courtney Etzelmiller (a senior forensic scientist with the eastern lab of the Virginia Department of Forensic Science’s Firearm and Toolmark section), and Scott McVeigh (a Senior Firearm and Toolmark Examiner with the Prince George’s County, Maryland, Police Department Firearm Examination Unit). Gibson proposes to testify, based on DFS reports and supporting documentation, about the characteristics of spent shell casings found at numerous crime scenes and render an opinion that certain bullets and casings found at one crime scene can be associated with bullets, spent shell casings, or firearms recovered from other crime scenes. Etzelmiller proposes to testify, based on DFS reports and documentation, about the cartridge case found at the scene of the murder of Christopher Motley and that the casing found exhibited markings that “made it suitable for identification with the firearm from which it was fired.” McVeigh proposes to testify, based on reports and his examination, that a recovered cartridge from the Motley murder was fired from a .40 caliber Smith & Wesson pistol recovered in Hyattsville, Maryland by the Maryland National Capital Park Police.

Defendants raise objections to both the reports and qualifications of the government’s proposed experts and the overall reliability of the field of firearm and toolmark identification. First, defendants point out that McVeigh is “a police officer with a Criminal Justice certificate from a two year college—not a trained scientist or engineer,” and that Etzelmiller has a Masters Degree in forensic science with an area of emphasis in psychology, rather than a degree in materials engineering, metallurgical engineering, materials science, “or any other academic discipline which deals with the actual science of what happens to metal when it comes into contact with other metal.” ECF No. 570, at 3-4. Second, defendants object to the reports offered by McVeigh, Gibson, and Etzelmiller, arguing that none of them provide sufficient information as to the bases and reasons they relied upon in reaching their conclusions. Defendants contend that more is required to satisfy Federal Rule of Criminal Procedure 16.

Finally, and perhaps most significantly, defendants object to the type of testimony offered, arguing that “firearm identification evidence is scientifically bankrupt, completely subjective, and almost always favors law enforcement.” ECF No. 582, at 5. In support, they cite three reports, the first published in 2008 by the National Research Council (“NRC”), the second in 2009 again by the NRC, and the third in 2016 by the President’s Council of Advisors on Science and Technology (“PCAST”), all of which point out weaknesses in the field questioning the reliability of such evidence. Defendants argue that firearm identification is “based primarily on a visual inspection of patterns of toolmarks and is largely a subjective determination based on experience and expertise.”
United States v. Monteiro, 407 F. Supp. 2d 351, 355 (D. Mass. 2006). They contend that attempts to standardize the field and establish standard practices have not yet been generally accepted. ECF No. 582, at 6. Defendants argue that recent caselaw indicates that federal courts are no longer as accepting of firearm identification testimony as they once were, and that the granting of their motions would be the logical next step in the current progression of the law. Defendants ask for the exclusion of all evidence of this type from trial. In lieu of this, defendants request a limiting instruction preventing the witnesses from expressing a specific degree of certainty in their conclusions.

The government responds that no court has ever excluded toolmark examination expert testimony under Daubert or any other standard, and that there is no scientific or legal basis to exclude the evidence the government intends to offer. ECF No. 673, at 20. See United States v. Santiago, 199 F. Supp. 2d 101, 111 (S.D.N.Y. 2002) (“The Court has not found a single case ... that would suggest that the entire field of ballistics identification is unreliable.”). The government asserts that all three objected-to experts are extremely qualified through training and experience. Further, the field of forensic firearm and toolmark identification “continues to undergo testing in the form of (1) technical research; (2) validation studies; and (3) proficiency testing.” ECF No. 673, at 10. The government concedes that courts have found the maintenance of standards and controls to be the weakest of the Daubert factors in firearm identification. Monteiro, 407 F. Supp. 2d at 371-72; United States v. Green, 405 F. Supp. 2d 104, 114 (D. Mass. 2005); United States v. Glynn, 578 F. Supp. 2d 567, 572 (S.D.N.Y. 2008). However, the government posits that “nothing in hundreds of peer-reviewed journal articles to date has invalidated the foundational premise that a trained examiner can reliably identify a cartridge case/bullet to a particular gun or a case to another case.” ECF No. 673, at 29.

II.

Federal Rule of Evidence 702 states that “[a] witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if” the following four criteria are established:

*3 the expert’s scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue; (b) the testimony is based on sufficient facts or data; (c) the testimony is the product of reliable principles and methods; and (d) the expert has reliably applied the principles and methods to the facts of the case.

Fed. R. Evid. 702.

The Supreme Court of the United States has held that Rule 702 “clearly contemplates some degree of regulation of the subjects and theories about which an expert may testify.” Daubert, 509 U.S. at 589. Accordingly, the Supreme Court in Daubert expounded upon the relevancy and reliability requirements of Rule 702. First, to establish “a standard of evidentiary reliability,” an expert must testify about scientific knowledge.” Id. at 589–90. This means that the testimony must be “grounded in the methods and procedures of science” and must consist of “more than subjective belief or unsupported speculation.” Id. at 590. Second, in order to ensure relevancy, the expert’s evidence or testimony must “ ‘assist the trier of fact to understand the evidence or to determine a fact in issue.’ ” Id. at 591 (quoting Fed. R. Evid. 702).

This “ ‘helpfulness’ standard requires a valid scientific connection to the pertinent inquiry as a precondition of admissibility.” Daubert, 509 U.S. at 591–92. When faced with potential expert testimony, then, the trial judge must make a “preliminary assessment of whether the reasoning or methodology can be applied to the facts in issue.” Id. at 592–93. The proponent of the evidence bears the burden of proof by a preponderance of the evidence. Daubert, 509 U.S. at 593 n. 10.
III.

Before the court is an evidentiary issue of increasing interest and controversy. The questions posed by these motions have been addressed by several courts, resulting in a heightened apprehension in the scientific reliability and admission of this evidence. See Green, 405 F. Supp. 2d at 109 (“This reliance on long-standing use of ballistics evidence in the courts is troubling.”). The series of reports issued on this subject reflects the ever-growing number of members of the legal and scientific communities who recognize problematic aspects of this discipline. Any discussion of this subject, however, must be based in a foundational knowledge of the specific technical variety that lawyers generally lack—specifically, what firearm and toolmark identification is, how these examiners conduct their analyses, and upon what their conclusions are based.

A.

Firearm identification has been a forensic discipline since the 1920s. See Hamby, J., The History of Firearm and Toolmark Identification, THE ASSOCIATION OF FIREARM AND TOOLMARK EXAMINERS (“AFTE”) Journal, Vol. 31(3), Summer 1999, at 266-84. Toolmark examiners are trained to examine the marks left by tools on surfaces to “match” a toolmark to the tool that made the mark. Firearms are a subset of tools that leave marks; unlike most other tools, they primarily impart marks on bullets and cartridge cases. See Foundational Overview of Firearm/Toolmark Identification, ASSOCIATION OF FIREARM AND TOOL MARK EXAMINERS: SWGGUN ADMISSIBILITY RESOURCE KIT (2019), AFTE.org/resources/swggun-ark. Firearm identification deals with toolmarks that bullets, cartridge cases, and shotshell components acquire by being fired and that unfired cartridge cases and shotshells acquire by being worked through the action of a firearm. Adina Schwartz, A Systematic Challenge to the Reliability and Admissibility of Firearms and Toolmark Identification, COLUM. SCI. & TECH. L. REV. 2 (2005), at 3–5.

*4 Firearm identification is based on two propositions—that toolmarks imparted by different tools will rarely be similar enough to lead a qualified examiner to conclude the marks were made by the same tool, and that most manufacturing processes involve the transfer of rapidly changing or random marks onto work pieces such as barrel bores, breech faces, firing pins, screwdriver blades, and the working surfaces of other common tools. See Stephen G. Bunch et al., Is a Match Really a Match? A Primer on the Procedures and Validity of Firearm and Toolmark Identification, FORENSIC SCIENCE COMMUNICATIONS, Vol. 11(3), July 2009. Examiners are trained to recognize and evaluate the following characteristics: (1) class characteristics (shared by all tools of a certain type); (2) subclass characteristics (features that occur during the manufacturing process, resulting in differences between tools of the same type but manufactured in different “batches”); and (3) individual characteristics (held to be unique to a single tool). Qualified examiners use a method known as “pattern matching” to determine whether two toolmarks are similar enough to conclude that two bullets or cartridge cases came from the same firearm. Committee for the Advancement of the Science of Firearm & Toolmark Identification, Theory of Identification as it Relates to Toolmarks: Revised, AFTE JOURNAL, Vol. 43(4), Fall 2011, p. 287. Examiners can come to four possible conclusions: (1) identification; (2) inconclusive; (3) elimination; and (4) unsuitable for comparison.

In 2008, the NRC observed in its report that studies of the uniqueness, reproducibility, and permanence of individual characteristics of toolmarks are “limited in scale and have been conducted by firearms examiners (and examiners in training) in state and local law enforcement laboratories as adjuncts to their regular casework,” and concluded that “the validity of the fundamental assumptions of uniqueness and reproducibility of firearms-related toolmarks has not yet been fully demonstrated.” National Research Council, Ballistic Imaging, NATIONAL ACADEMIES PRESS, 81 (2008). In 2009, the NRC issued a report raising significant questions about the state of firearm and toolmark analysis:

A fundamental problem with toolmark and firearms analysis is the lack of a precisely defined process. As noted above, AFTE
[Association of Firearm and Tool Mark Examiners] has adopted a theory of identification, but it does not provide a specific protocol ... This AFTE document, which is the best guidance available for the field of toolmark identification, does not even consider, let alone address, questions regarding variability, reliability, repeatability, or the number of correlations needed to achieve a given degree of confidence. Committee on Identifying the Needs of the Forensic Sciences Community, Strengthening Forensic Science in the United States: A Path Forward, NATIONAL RESEARCH COUNCIL, 2009, at 155.

Since the issuance of these two reports, federal courts, which once routinely admitted firearm and toolmark identification evidence, have approached such testimony with more caution. Though no federal court has outright barred testimony from a qualified firearm or toolmark identification expert, many have discussed the handicaps of the field, observing that “[p]ro-prosecution bias might affect the reliability of firearms examinations because the ‘field consists entirely of individuals who work for law enforcement agencies,’ ” United States v. Green, 405 F.Supp.2d 104, 109 n.7 (D. Mass. 2005), and that the reliability of toolmark identification is questionable because it is not possible to calculate an absolute error rate. Monteiro, 407 F. Supp. 2d at 367. Many of these courts admitted the proffered testimony only under limiting instruction restricting the degree of certainty to which firearm and toolmark identification specialists may express their identifications. See United States v. Taylor, 663 F. Supp. 2d 1170 (D.N.M. 2009) (“reasonable degree of certainty in the firearms examination field”); Glynn, 578 F. Supp. 2d at 570 (“more likely than not”); United States v. Diaz, No. CR 05-00167 WHA, 2007 WL 485967, at *11-12 (N.D. Cal. Feb 12, 2007) (“reasonable degree of ballistic certainty”); see also Monteiro, 407 F. Supp. 2d at 355 (stating that appropriate standard is “reasonable degree of ballistic certainty”).

*5 In 2016, PCAST issued a report identifying additional steps that should be taken “beyond those already taken ... in the aftermath of the highly critical 2009 National Research Council report on the state of the forensic sciences, that could help ensure the validity of forensic evidence used in the Nation’s legal system.” President’s Council of Advisors on Science and Technology, Report to the President Forensic Science in Criminal Cases: Ensuring Scientific Validity of Feature-Comparison Methods, EXECUTIVE OFFICE OF THE PRESIDENT, September 2016, at x. The report expressed several concerns, one of which was that AFTE’s “Theory of Identification as it Relates to Toolmarks,” which defines the criteria for making an identification, is circular: The “theory” states that an examiner may conclude that two items have a common origin if their marks are in “sufficient agreement,” where “sufficient agreement” is defined as the examiner being convinced that the items are extremely unlikely to have a different origin.

Id. at 104. The report went on to conclude that, because firearms analysis is presently a subjective feature-comparison method, its foundational validity can only be established through multiple independent black box studies; unfortunately, many past studies and tests involved designs “that are not appropriate for assessing the scientific validity or estimating the reliability of the method as practiced.” Id. at 109–111. Comparison of past studies and those conducted more recently “suggests that, because of their design, many frequently cited studies seriously underestimate the false positive rate.” Id.

B.

At the Daubert hearing held on September 3 and 4, the court heard testimony from the proposed expert witnesses and from defendants’ expert. The court also heard argument from government’s counsel and all defendants’ counsel who wished to be heard. The government’s
proposed experts acknowledged the inherent subjectivity of their work and the impossibility of establishing reliable error rates for their conclusions, but testified to the extensive training, courses, and proficiency exams each had taken. They also testified that the Association of Firearm and Tool Mark Examiners (“AFTE”), of which each expert is a member, hosts seminars, publishes a journal, issues standards, procedures, and a glossary of terms, and maintains the National Integrated Ballistic Information Network (“NIBIN”) used by experts in making comparisons between recovered evidence and previously entered cartridge cases and weapons. Finally, they cited extensively the value of “validation studies,” the results of which are peer reviewed and often published.

The court is persuaded that all three witnesses proposed by the government are sufficiently qualified to be deemed experts in firearm identification. While Gibson, Etzelmiller, and McVeigh did not receive degrees in metallurgy, engineering, or any other related course of study, Rule 702 permits experts to be qualified through experience and on-the-job training, rather than education. After viewing all three experts’ curriculum vitae and listening to both Gibson and McVeigh discuss the training each underwent after their formal schooling was concluded, the court believes that the experts possess the knowledge, training, experience, background, education, and skill necessary to offer testimony that will be helpful to the trier of fact. Fed. R. Evid. 702.

More troubling are the systematic problems with firearm identification as a discipline. As both Gibson and McVeigh explained at the hearing, the methodology of a firearm identification examination involves two major steps: (1) an objective evaluation of the existing class and subclass characteristics, if similar; and (2) a comparative microscopic evaluation of individual characteristics. This second stage, while no doubt grounded in technical knowledge and skill, is unavoidably subjective. As observed by PCAST in an addendum to its 2016 report:

*6 Forensic scientists rightly cite examiners’ experience and judgment as important elements in their disciplines. PCAST has great respect for the value of examiners’ experience and judgment. They are critical factors in ensuring that a scientific evaluation and a reliable method is practiced correctly. However, experience and judgment alone, no matter how great, can never establish validity or a degree of reliability of any particular method. Only empirical testing can do so.


Thus, defendants’ argument is well-taken. Given the subjectivity of the field and the lack of any established methodology, error rate, or statistical foundation for firearm identification experts’ conclusions, the testimony of the government’s proposed witnesses will not be admitted in full. Neither, however, is the court persuaded that the above discussed fallibilities of firearm identification rob the entirety of the experts’ testimony of value. Rule 702 and Daubert set requirements that extend broadly to permit expert testimony beyond that which is purely scientific and empirically-based. See Avondale Mills, Inc. v. Norfolk Southern Corp., No. CA 1:05-2817-MBS, 2007 WL 7724843, at *1 (D.S.C. Nov. 5, 2007) (“[T]he inquiry into an expert’s reliability may focus instead upon personal knowledge or experience.”).

What is required is a measure of reliability in the proposed testimony and that such testimony be helpful to the jury. Fed. R. Evid. 702 (permitting the qualification of an expert if his/her “specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue” and if “the testimony is the product of reliable principles and methods.”). After reading the parties’ briefs, surveying the caselaw, studying the submitted treatises, and listening to the testimony and argument at the hearing, the court believes that this testimony, in large part, should be heard by the jurors. The experts’ work, using their technical knowledge, skill, and training to make microscopic observations of and comparisons between cartridge cases, would be helpful to the trier of fact.
The court is thus left with the question of what limitations to place on Gibson, Etzelmiller, and McVeigh’s testimony so that they may impart the substance of their work without misleading the jury. Of the recent opinions addressing the field of firearm and toolmark identification, many cited the reports issued in 2008 and 2009 by the NRC, but only one addressed the 2016 report by PCAST. Judge Paul Grimm, in United States v. Medley, 312 F. Supp. 3d 493 (D. Md. 2018), thoughtfully addressed similar challenges to this type of testimony (indeed, the expert at issue was McVeigh himself). Judge Grimm observed the difficulty a layman would have in ascertaining just how an expert like McVeigh concludes that “there were enough similarities to be consistent with similarities from [cartridge cases] from the same gun and greater than the number of similarities known to exist in [cartridge cases] from different guns,” and how little explanation is offered of this in reports that followed internal laboratory procedures. Medley, No. PWG 17-242 (D. Md. April 24, 2019), ECF No. 111, at 115.

Judge Grimm went on to hold, however, that there was no “reason why it would not be helpful to the jury for Mr. McVeigh to testify with his photographs and matching up the marks that he saw that were similar and pointing out the characteristics that were similar between the firearm cartridges fired at the scene and what was test fired, subject to cross-examination.” Id. at 118. The Maryland district court also held that it was appropriate for an expert to “express an opinion that the marks ... that were found on the crime scene cartridges are consistent with the marks found on the test fire.” Id. at 119. Judge Grimm tempered the admission of the examiner’s testimony with the limitation that McVeigh would not be permitted to express the opinion that these cartridges came from the same gun and would not be permitted to express any level of confidence in his conclusions. Id.

*7 The court agrees with Judge Grimm and is persuaded that these limitations effectively balance the value of this testimony with its inherent subjectivity. The court thus rules that Gibson, Etzelmiller, and McVeigh are all sufficiently qualified to testify as expert toolmark examiners. Consistent with the photographs included in their expert reports produced in discovery, these toolmark examiners may compare the marks on various cartridge cases and identify marks on such cartridge cases they find to be similar and consistent with each other.

Concerns over the reliability of this testimony expressed in the NRC and PCAST reports and those reflected in a recent chorus of federal decisions lead the court to impose certain restrictions on the testimony of these toolmark examiners. The examiners may not testify that the marks indicate a “match,” or that cartridge cases were fired by the same firearm. They may not testify that cartridge cases have “signature” toolmarks identifying a single firearm. The court expressly precludes the examiners from testifying “to a level of practical impossibility” that cartridges could be identified to a single firearm. Given the absence of any empirical basis upon which to ascertain an error rate for these examiners’ testimony as to the existence of similar toolmarks, the examiners will not be permitted to express any confidence level. See Medley Hearing Transcript, id. at 119.

After the Daubert hearing, the government filed an additional motion in limine seeking to broaden the scope of the toolmark examiners’ testimony, including the ability to testify as to their belief in a “match,” should the certainty of their conclusions be challenged on cross-examination at trial. ECF No. 713. Defendant Deshaun Trent responded to the government’s motion and conceded that the government’s position regarding defense counsel potentially “opening the door” on cross-examination to the certainty with which the examiners hold their opinions is reasonable. ECF No. 731, at 1. Trent agreed that a second Daubert hearing was in no way necessary, and expressed confusion as to why the government felt the defense might attempt to conduct one. Id. at 2.

Although the court cannot precisely predict the lines of cross-examination that will be advanced at trial, responses to cross-examination cannot serve to skirt the court’s Daubert ruling. In other words, while the toolmark examiners may defend their opinions as to the existence of similar or consistent marks on certain cartridges, their witnesses may not testify as to a “match,” that the cartridges bear the same “signature,” that they were fired by the same gun, or words to that effect. Nor may they proffer a confidence level, unless defense counsel “opens the door” to this issue through questioning. As the court has exhaustively considered this issue, there is no need for an additional Daubert hearing.
Finally, the court rules that Federal Rule of Criminal Procedure 16 has not been met. Rule 16 states that, at defense request, the prosecution must disclose “a written summary of any testimony that the government intends to use under Rules 702, 703, or 705 of the Federal Rules of Evidence during its case-in-chief at trial.” Fed. R. Crim. Pro. 16(a)(1)(G). This written summary “must describe the witness’s opinions, the bases and reasons for those opinions, and the witness’s qualifications.” “The level of detail of this summary depends on the complexity of the expert testimony.” United States v. Caputo, 382 F. Supp. 2d 1045, 1049 (N.D. Ill. 2005) (citing United States v. Jackson, 51 F.3d 646, 651 (7th Cir. 1995)).

Review of the material produced in discovery makes clear that the government has not sufficiently explained the bases and reasons for the opinions expressed by the toolmark examiners. In Government’s Exhibit 2, for instance, in which Gibson records her analysis and conclusions regarding a cartridge case recovered in Danville, only a small parenthetical note, written in a cryptic shorthand that proves largely unintelligible for a layperson, explains why Gibson reached her conclusion. Gov. Ex. 2A, ECF No. 703, at 5. The cryptic nature of these notes does not satisfy the government’s discovery obligation under Rule 16(a)(1)(G). The court thus DIRECTS the government to supplement Gibson’s and Etzelmiller’s reports with a more sufficient narrative to provide the bases and reasons for the opinions reached by them as to the presence of similar or consistent toolmarks.

The court is less concerned about this issue as it pertains to McVeigh. During his testimony at the Daubert hearing, McVeigh provided sufficient details of his analysis and method, referencing the photos taken of the cartridge case provided to him. The court believes that McVeigh’s report, as supplemented by his testimony at the Daubert hearing, is sufficient to satisfy Rule 16(a)(1)(G) as regards McVeigh.

McVeigh, Gibson, and Etzelmiller MAY:

- Provide testimony explaining their examination procedure and describe the comparison micrographs accompanying the reports produced in discovery;
- Describe any similar characteristics in the toolmarks observed on examined cartridge cases;
- Based on these observations, render an opinion as to whether toolmarks on certain cartridge cases bear marks consistent with each other.

McVeigh, Gibson, and Etzelmiller MAY NOT:

- Opine that certain cartridge cases were fired by the same gun;
- Opine that a cartridge case is a “match” to other cartridge cases or firearms;
- Opine that toolmarks reflect a “signature” permitting the conclusion that certain cartridge cases may be traced to a single firearm; or
- Express confidence in their opinions to any specific level of certainty, including whether the examiners’ observations exclude other firearms or cartridge cases “to a level of practical impossibility.”

Additionally, the court DIRECTS the government to supplement the expert reports of Gibson and Etzelmiller to provide a sufficient narrative summary of the bases and reasons for their opinions.

Finally, the court GRANTS in part and DENIES in part the government’s motion in limine filed on September 6, 2019, the day after the Daubert hearing. ECF No. 713.

An appropriate Order will be entered.

All Citations
Slip Copy, 2019 WL 4306971
United States v. Davis, Slip Copy (2019)

Footnotes

1 The court makes no comment and passes no judgment on the validity of these propositions.
MEMORANDUM OPINION

In this case, the defense raised and extensively litigated its objection to the government’s proffer of expert testimony regarding firearms and toolmark identification, a species of specialized opinion testimony that judges have routinely admitted in criminal trials. Specifically, the government sought to introduce the testimony of the firearms and toolmark examiner who used a high-powered microscope to compare a cartridge casing found on the scene of the charged homicide with casings test-fired from a firearm allegedly discarded by a fleeing suspect. According to the government’s proffer, this analysis permitted the examiner to identify the recovered firearm as the source of the cartridge casing collected from the scene. The defense argued that such a conclusion does not find support in reliable principles and methods, and thus must be excluded pursuant to the standard set by the District of Columbia Court of Appeals in Motorola Inc. v. Murray, 147 A.3d 751 (D.C. 2016) (en banc); by the United States Supreme Court in Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579 (1993); and by Federal Rule of Evidence 702.

Courts across the country have regularly admitted such source attribution statements from firearms and toolmark examiners, without restriction, for several decades. However, on the heels of several major reports emanating from outside of the judiciary calling into question the
foundations of the firearms and toolmark identification discipline, recent decisions of the District of Columbia Court of Appeals have imposed significant limitations on the conclusions that an expert in this field can render in court.

After conducting an extensive evidentiary hearing in this case—one that involved detailed testimony from a number of distinguished expert witnesses, review of all of the leading studies in the discipline, pre- and post-hearing briefing, and lengthy arguments by skilled and experienced counsel—this Court ruled on August 8, 2019 that application of the Daubert factors requires substantial restrictions on specialized opinion testimony in this area. Based largely on the inability of the published studies in the field to establish an error rate, the absence of an objective standard for identification, and the lack of acceptance of the discipline’s foundational validity outside of the community of firearms and toolmark examiners, the Court precluded the government from eliciting testimony identifying the recovered firearm as the source of the recovered cartridge casing. Instead, the Court ruled that the government’s expert witness must limit his testimony to a conclusion that, based on his examination of the evidence and the consistency of the class characteristics and microscopic toolmarks, the firearm cannot be excluded as the source of the casing. The Court issues this Memorandum Opinion to further elucidate the ruling it made in open court.

I. BACKGROUND

A. Firearms and Toolmark Identification: The Basics

Numerous reports and court decisions have described in detail the theory and methodology behind the forensic discipline of firearms and toolmark identification. See, e.g., United States v. Johnson, (S5) 16 Cr. 281 (PGG), 2019 U.S. Dist. LEXIS 39590, at *16–21,

The discipline of firearms and toolmark identification derives from the theory that the tools used in the manufacture of firearms leave distinct markings on the internal components of a firearm, such as the barrel, breech face, and firing pin. Otero, 849 F. Supp. 2d at 427. These distinct markings, sometimes referred to as “individual characteristics,” are said to result from the cutting, drilling, grinding, and hand-filing involved in the firearm manufacturing process. Monteiro, 407 F. Supp. 2d at 359. Such markings are supposedly individualized to each particular firearm as a result of the changes undergone by the tool being used to manufacture the firearm each time it cuts and scrapes metal to produce a new weapon. Otero, 849 F. Supp. 2d at 427. According to the theory, no two firearms, even those consecutively produced on the same production line, should bear microscopically identical toolmarks. See id.
When a firearm discharges a round of ammunition, the components of that ammunition come into contact with the internal components of the firearm. *Monteiro*, 407 F. Supp. 2d at 359–60. According to the proponents of firearms and toolmark identification, the tool markings on the firearm then transfer to the ammunition’s components. *Id.* at 360. The theory underlying firearms and toolmark identification ultimately hypothesizes that “no two firearms should produce the same microscopic features on bullets and cartridge cases such that they could be falsely identified as having been fired from the same firearm.” *Id.* at 361 (citation omitted). Stated more simply, firearms and toolmark examiners believe they can trace the toolmarks left on spent ammunition back to a particular firearm and that firearm only. *See 2009 NRC Report* at 150.

Trained firearms examiners generally follow a particular methodology in attempting to reach conclusions as to the source of a bullet or cartridge casing. By using a comparison microscope to examine the markings on ammunition test fired from a particular firearm and those on spent ammunition recovered from a crime scene, trained firearms examiners attempt to determine whether the spent ammunition was fired from that particular firearm. *See Monteiro*, 407 F. Supp. 2d at 361. When making these comparisons, examiners observe three types of characteristics of the ammunition—class, subclass, and individual characteristics. *Otero*, 849 F. Supp. 2d at 428. “Class characteristics are gross features common to most if not all bullets and cartridge cases fired from a *type* of firearm,” such as caliber and the number of lands and grooves on a bullet. *Id.* (emphasis added). These characteristics are predetermined at manufacture, *Simmons*, 2018 U.S. Dist. LEXIS 18606, at *8, 2018 WL 1882827, at *2, and have been described as “family resemblances,” *Monteiro*, 407 F. Supp. 2d at 360. Subclass characteristics appear on a smaller subset of a particular make and model of firearm, such as a group of guns
produced together at a particular place and time. *Id.* They are produced incidental to manufacture, sometimes as the result of being manufactured by the same irregular tool. *Otero,* 849 F. Supp. 2d at 428. Individual characteristics are microscopic markings produced during manufacture by the random and constantly-changing imperfections of tool surfaces as well as by subsequent use or damage to the firearm. *Id.* These are the markings purported to be unique to a particular firearm and that permit an individualized source determination—in other words, a conclusion that a particular firearm discharged a particular component of ammunition. *See United States v. Taylor,* 663 F. Supp. 2d 1170, 1174 (D.N.M. 2009).

The forensic examination begins with the identification of class characteristics. *2009 NRC Report* at 152. If the observable class characteristics differ between the recovered and test fired ammunition, the examiner can immediately eliminate the recovered firearm as the source of the recovered ammunition. President’s Council of Advisors on Sci. and Tech., Executive Off. of the President, *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods* 104 (2016) [hereinafter *PCAST Report*]. If the class characteristics match, the examiner will use the comparison microscope to identify and compare the individual characteristics in both samples. *Id.* Under the theory of identification promulgated by the Association of Firearm and Tool Mark Examiners ("AFTE") and discussed in detail infras at Section III(D), an examiner may declare the two samples to be of common origin (i.e., fired from the same gun) if she finds “sufficient agreement” between their individual characteristics. *See 2009 NRC Report* at 153. Dissimilarities in observed subclass and/or individual characteristics can allow an examiner to exclude or eliminate the firearm as the source of the questioned sample of ammunition. The examiner may also render an inconclusive determination when there is agreement between the two samples’ class characteristics but insufficient agreement or
disagreement between their individual characteristics to make an identification or exclusion determination. See Johnson, 2019 U.S. Dist. LEXIS 39590, at *9, 2019 WL 1130258, at *3.

B. Proffered Firearms and Toolmark Evidence in this Case, and the Defendant’s Motion to Exclude

Mr. Tibbs is charged with one count of first degree murder while armed as well as other related offenses. According to the government, a .40 caliber Smith & Wesson cartridge casing from a semi-automatic weapon was recovered from the scene of the homicide on November 11, 2016. The government alleges that a police officer observed Mr. Tibbs discarding a .40 caliber Smith & Wesson semi-automatic pistol shortly after the homicide occurred. On December 21, 2016, District of Columbia Department of Forensic Sciences Examiner Christopher Coleman prepared a report of examination, which indicated the recovered cartridge casing “was microscopically examined and identified as having been fired in [the recovered pistol], based on breechface marks and firing pin aperture shear marks.” Christopher Coleman, D.C. Dep’t of Forensic Sci., Report of Examination: Firearms Examination Unit Report 1 (Dec. 21, 2016), Def.’s Mot. Ex. A, at 3 (Dec. 18, 2018).

Through his counsel, Mr. Tibbs challenged the admissibility of Mr. Coleman’s opinion testimony with regard to firearms and toolmark identification. Specifically, the Defendant filed his Motion to Exclude the Testimony of Government’s Proposed Expert Witness in Firearms Examination (“Defendant’s Motion”) on December 18, 2018. The government filed its Opposition to Defendant’s Motion on January 24, 2019; the Defendant filed a Reply on March 23, 2019, to which the government filed a Surreply on April 15, 2019. The defense supplemented its pleadings with affidavits from Professor David Faigman and Dr. Nicholas
Scurich, while the government submitted a declaration from Todd J. Weller, a report by Dr. Nicholas Petraco, and an affidavit from Dr. Bruce Budowle.

The Court conducted an extensive hearing on Defendant’s Motion during the week of May 13, 2019, hearing lengthy testimony from Dr. Petraco, Mr. Weller, Dr. Scurich, and Professor Faigman. The parties’ arguments on these issues spanned several days and finally concluded on June 10, 2019. Subsequent to the conclusion of the hearing, the Court provided the parties with the opportunity to file supplemental pleadings on the effect of the District of Columbia Court of Appeals’ June 27, 2019 decision in Williams v. United States (Williams II), 210 A.3d 734 (D.C. 2019), on the Court’s resolution of Defendant’s Motion; the parties each filed such a brief on July 10, 2019.¹

In his written pleadings, the Defendant asked the Court to exclude all testimony regarding firearms examination and identification in this case. In the alternative, he requested that the Court preclude Mr. Coleman from testifying that the recovered pistol fired the recovered cartridge casing, and limit his testimony to a conclusion that he could not exclude the recovered firearm as the source of the recovered cartridge casing. At the hearing, Mr. Tibbs proposed alternative restrictions on Mr. Coleman’s proposed testimony but ultimately conceded that Mr. Coleman should at least be permitted to testify about his comparison of class characteristics between the recovered and test fired cartridge casings.

¹ On June 27, 2019, the government also filed a Motion to Correct Factual Inaccuracies in the Record. The Defendant filed his Reply on August 2, 2019.
II. LEGAL STANDARD

A. Daubert and Rule 702: General Principles

In 2016, the District of Columbia Court of Appeals, sitting en banc, abandoned this jurisdiction’s previous standard for the admissibility of expert opinion testimony. Motorola, 147 A.3d at 756–57. That standard, commonly referred to as the Frye/Dyas test, was originally developed by the United States Court of Appeals for the District of Columbia, and held that a scientific technique or principle could serve as the subject of expert testimony to the extent it had been “general[ly] accept[ed]” within its field of origin. See Frye v. United States, 293 F. 1013, 1014 (D.C. Cir. 1923). See generally Dyas v. United States, 376 A.2d 827, 831–32 (D.C. 1977). In Motorola, the Court of Appeals adopted the admissibility standard announced by the United States Supreme Court in Daubert—the same standard that has been applied in federal courts for over twenty years and that now appears in Federal Rule of Evidence 702. See Motorola, 147 A.3d at 756–57.

Daubert itself repudiated Frye by holding its standard had been “superseded by the adoption of the Federal Rules of Evidence” and, in particular, by Rule 702. See 509 U.S. at 587–89. The Supreme Court stated that trial judges considering the admissibility of proffered expert opinion testimony must conduct a “preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether that reasoning or methodology properly can be applied to the facts in issue.” Id. at 592–93. Thus, under Daubert and Rule 702, the admissibility of proffered expert opinion testimony does not exclusively rest on the acceptance of the opinion’s underlying theory or methodology within a community of scientists or practitioners. See id. at 594–95. Nor does it turn on the trial judge’s view on the ultimate accuracy of the offered conclusion. See id. at 595. Instead, the admissibility inquiry
focuses on whether reliable principles and methods support the proposed testimony and on whether those principles and methods were reliably applied in the case at hand. *Id.* at 594–95; see also *Motorola*, 147 A.3d at 754. Rule 702 articulates the elements of the *Daubert* inquiry:

A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:

(a) the expert’s scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;

(b) the testimony is based on sufficient facts or data;

(c) the testimony is the product of reliable principles and methods; and

(d) the expert has reliably applied the principles and methods to the facts of the case.

In changing the standard for the admissibility of expert opinion testimony, *Daubert* also modified the judge’s role in making the admissibility determination. A judge must serve as a gatekeeper to “ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable.” *Daubert*, 509 U.S. at 589. Indeed, *Daubert*, its progeny, and subsequent amendments to Rule 702 “gave to the courts a more significant gatekeeper role with respect to the admissibility of scientific and technical evidence than courts previously had played.” *United States v. Glynn*, 578 F. Supp. 2d 567, 569 (S.D.N.Y. 2008). *Daubert* noted that such an assessment would involve the examination of a diverse set of factors. See 509 U.S. at 593. Envisioning a flexible inquiry, the Supreme Court did “not presume to set out a definitive checklist or test.” *Id.* at 593–94. It did, however, enumerate five factors that would generally guide a trial court’s admissibility inquiry:

(1) whether a theory or technique can be (and has been) tested;

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2 In *Kumho Tire. Co. v. Carmichael*, the United States Supreme Court held that the *Daubert* reliability standard applies not just to expert testimony based on “scientific” knowledge, but to testimony based on “technical” or “other specialized” knowledge as well. 526 U.S. 137, 149 (1999).
(2) whether the theory or technique has been subjected to peer review and publication;

(3) the theory’s or technique’s known or potential rate of error;

(4) the existence and maintenance of standards controlling the technique’s operation; and

(5) whether the theory or technique is generally accepted within the relevant scientific community.

Id.; see also Motorola, 147 A.3d at 754.

The proponent of the expert testimony bears the burden of proving its reliability by a preponderance of the evidence. Cf. Daubert, 509 U.S. at 592 n.10. Our Court of Appeals has consistently held that admissibility determinations are within the discretion of the trial court. See, e.g., Johnson v. United States, 960 A.2d 281, 296 (D.C. 2008) (citing Dockery v. United States, 853 A.2d 687, 697 (D.C. 2004); Smith v. United States, 686 A. 2d 537, 542 (D.C. 1996))

B. Daubert and Firearms and Toolmark Identification

1. Mr. Tibbs’s Daubert challenge

Mr. Tibbs raised a general challenge to the reliability of the principles and methods underlying firearms and toolmark identification. See generally Def.’s Mot. Accordingly, he at times moved to exclude all such evidence. At other points in his pleadings and arguments, however, he offered a series of concessions and alternative proposals as well. As described in the Court’s August 8, 2019 oral ruling, the undersigned found it useful to conceptualize Mr. Tibbs’s challenge in several different ways. The Court could have analyzed the issues raised in Defendant’s Motion by first determining whether the discipline of firearms and toolmark identification generally employs reliable principles and methods—such that it is admissible under Daubert, Motorola, and Rule 702—and subsequently, whether Daubert requires any
limitations on the proffered testimony. Alternatively, the Court could have treated Mr. Tibbs’s challenge as requiring two separate Daubert inquiries: (1) whether the Court could characterize the underlying theory of firearms and toolmark identification—the theory that manufacturing tools leave certain unique marks on firearms, and that firearms therefore leave unique and/or identifiable marks on bullets and cartridge casings—as reliable; and (2) whether the Court could conclude that a firearms examiner’s opinion that she can compare bullets or cartridge casings and make an accurate source attribution statement (that is, a conclusion that a particular firearm fired a particular bullet or cartridge casing) finds support in reliable principles and methods.

Regardless of the framework under which Mr. Tibbs’s challenge was to be evaluated, Defendant’s Motion ultimately required the Court to determine what type of opinion, if any, can be rendered with respect to firearms and toolmark evidence.

2. The limited persuasive value of existing case law

Judges across the United States have considered similar challenges to firearms and toolmark identification evidence. Of course, “for many decades ballistics testimony was accepted almost without question in most federal courts in the United States.” Glynn, 578 F. Supp. 2d at 569. Based on the pleadings in this case, as well as the Court’s own research, there do not appear to be any reported cases in which this type of evidence has been excluded in its entirety. Earlier this year, the United States District Court for the District of Nevada also surveyed the relevant case law and concluded that no federal court had found the method of firearms and toolmark examination promoted by AFTE—the method generally used by American firearms examiners and employed by Mr. Coleman in this case—to be unreliable. United States v. Romero-Lobato, 379 F. Supp. 3d 1111, 1117 (D. Nev. 2019); see also Simmons,
2018 U.S. Dist. LEXIS 18606, at *28, 2018 WL 1882827, at *9 ("Defendants concede, as they must, that no court has ever totally rejected firearms and toolmark examination testimony.");

State v. DeJesus, 7 Wn. App. 2d 849, 864 (2019) ("[T]he judicial decisions uniformly conclude toolmark and firearms identification is generally accepted and admissible at trial.").

In evaluating the persuasive weight of these decisions, however, the undersigned could not help but note that, despite the enhanced gatekeeping role demanded by Daubert, see 509 U.S. at 589, the overwhelming majority of the reported post-Daubert cases regarding this type of expert opinion testimony have not engaged in a particularly extensive or probing analysis of the evidence’s reliability. In 2009, the National Research Council ("NRC") specifically criticized the judiciary’s treatment of issues relating to the admissibility of firearms and toolmark evidence and the judiciary’s failure to apply Daubert in a meaningful fashion. In the NRC’s view, “[t]here is little to indicate that courts review firearms evidence pursuant to Daubert’s standard of reliability.” 2009 NRC Report at 107 n.82. The NRC observed that trial judges

. . . often affirm admissibility citing earlier decisions rather than facts established at a hearing. Much forensic evidence—including, for example, bite marks and firearm and toolmark identification—is introduced in criminal trials without any meaningful scientific validation, determination of error rates, or reliability testing to explain the limits of the discipline.

Id. at 107–08 (footnote and internal quotation marks omitted). Without disparaging the work of other courts, the NRC’s critique of our profession rings true, at least to the undersigned: many of the published post-Daubert opinions on firearms and toolmark identification involved no hearing on the admissibility of the evidence or only a cursory analysis of the relevant issues. Our Court of Appeals has noted that “[t]here is no ‘grandfathering’ provision in Rule 702.” Motorola, 147 A.3d at 758. Yet, the case law in this area follows a pattern in which holdings supported by limited analysis are nonetheless subsequently deferred to by one court after another. This pattern
creates the appearance of an avalanche of authority; on closer examination, however, these precedents ultimately stand on a fairly flimsy foundation. The NRC credited Professor David Faigman—one of the defense experts who testified at the *Daubert* hearing in this matter—with the observation that trial courts defer to expert witnesses; appellate courts then defer to the trial courts; and subsequent courts then defer to the earlier decisions. *See 2009 NRC Report* at 108 n.85.


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³ Because many decisions on evidentiary issues do not result in the issuance of a reported or written opinion, the weight of authority from other courts and jurisdictions cannot be precisely determined. *See 2009 NRC Report* at 97.
Even in the few cases in which a Daubert hearing was conducted, it most often consisted only of the testimony of the examiner who worked on the case at issue, rather than of experts with a broader understanding of the foundational validity of the field.4 See Romero-Lobato, 379 F. Supp. 3d at 1115; Johnson, 2019 U.S. Dist. LEXIS 39590, at *3–5, 2019 WL 1130258, at *1–2; Simmons, 2018 U.S. Dist. LEXIS 18606, at *3, 2018 WL 1882827, at *1. The Court does not suggest that these decisions represent an abuse of discretion by the judges who issued them. The seemingly perfunctory nature of many of these written decisions does, however, lessen the persuasive weight of what would have otherwise been afforded to a near unanimous set of judicial opinions.

3. Judicial restrictions on firearms and toolmark identification testimony

Although, as stated supra, no trial court has entirely excluded firearms and toolmark evidence in its entirety, some judges admitting firearms and toolmark evidence have recently restricted the conclusions examiners can render before a jury. See Romero-Lobato, 379 F. Supp. 3d at 1117; DeJesus, 7 Wn. App. 2d at 864 (“Courts have considered scholarly criticism of the methodology, and occasionally placed limitations on the opinions experts may offer based on the

methodology.”). For example, at least one judge has precluded the sponsor of such evidence from referring to it as a “science.” Glynn, 578 F. Supp. 2d at 568–69. Other courts have prohibited examiners from stating their conclusions to an absolute or statistical certainty. See, e.g., Monteiro, 407 F. Supp. 2d at 372. Some of these judges have permitted examiners to state their opinions only to a “reasonable degree of ballistic certainty” or a “reasonable degree of certainty in the ballistics field,” see Ashburn, 88 F. Supp. 3d at 249; Monteiro, 407 F. Supp. 2d at 372; Simmons, 2018 U.S. Dist. LEXIS 18606, at *30, 2018 WL 1882827, at *10, while others have precluded any reference to the concept of “certainty,” regardless of what modifiers the examiner may attach, see White, 2018 U.S. Dist. LEXIS 163258, at *7, 2018 WL 4565140, at *3; United States v. Willock, 696 F. Supp. 2d 536, 549 (D. Md. 2010); Glynn, 578 F. Supp. 2d at 568–69. A number of courts have prevented examiners from stating that recovered ballistics evidence can be matched to a firearm to the exclusion of all other firearms. See Taylor, 663 F. Supp. 2d at 1180; Green, 405 F. Supp. 2d at 124.

Other judges have gone further in limiting expert opinion testimony regarding firearms and toolmark examination. In Glynn, a United States District Court Judge permitted a firearms examiner to state his conclusions of the match between the recovered ammunition and recovered firearm in terms of “more likely than not, but nothing more.” 578 F. Supp. 2d at 575 (internal quotation marks omitted). And in State v. Terrell, a state trial court judge referenced a case in which he had limited an examiner “to describing the similarities and dissimilarities between the known and unknown shell casings” and allowed her to conclude only that “the casings were consistent with having been fired from the subject hand gun.” CR170179563, 2019 Conn. Super. LEXIS 827, at *19, 2019 WL 2093108, at *5 (Mar. 21, 2019). Nonetheless, despite the handful of judges that have imposed these restrictions, “limitations on firearm and toolmark expert
testimony [have been] the exception rather than the rule.” *Romero-Lobato*, 379 F. Supp. 3d at 1117.

The District of Columbia Court of Appeals, in a series of cases, has similarly restricted the conclusions firearms examiners may offer in court. *See Williams II*, 210 A.3d at 738; *Gardner v. United States*, 140 A.3d 1172, 1184 (D.C. 2016); *Jones v. United States*, 27 A.3d 1130, 1139 (D.C. 2011). Although, as discussed in Section IV infra, some ambiguity exists as to the state of the law post-*Williams II*, there can be no dispute that these authorities preclude firearms examiners from stating their conclusions with absolute or 100% certainty. *See, e.g.*, *Gardner*, 140 A.3d at 1177. Nor can these expert witnesses identify a particular firearm as the source of spent ammunition to the exclusion of all other firearms. *Id.* Furthermore, it is unlikely examiners are even able to state their conclusions “with a reasonable degree of certainty.” *See id.* at 1184 n.19 (“[W]e have doubts as to whether trial judges in this jurisdiction should permit toolmark experts to state their opinions with a reasonable degree of certainty.” (internal quotation marks omitted)). None of these precedents, however, entirely control the *Daubert* challenge posed by Defendant’s Motion. *Jones, Gardner,* and *Williams II* addressed the reliability of an examiner’s conclusion, but all three were decided prior to the Court of Appeals’ decision in *Motorola*—when the *Frye/Dyas* test still governed the admissibility of expert opinion testimony in the District of Columbia. None of them explicitly evaluated the admissibility of firearms and toolmark evidence under *Daubert* and Rule 702. And, while providing some examples of what firearms examiners cannot say in court, none of these cases provide definitive guidance as to what these witnesses can say.
4. **Conclusion**

Granted, the precedents from other jurisdictions do provide at least some amount of guidance as to the challenge presented, and the Court of Appeals’ recent opinions do have some bearing on the Court’s present decision. However, particularly in light of the absence of any District of Columbia authority applying *Daubert* to firearms and toolmark identification testimony and the lack of any particularly persuasive authority from other jurisdictions, Defendant’s Motion posed an issue of first impression. Accordingly, the Court undertook to determine the admissibility of the proffered testimony under *Daubert, Motorola*, and Rule 702. As explained by Judge Gertner, “*Daubert* plainly raised the standard for existing, established fields, inviting a reexamination even of generally accepted venerable, technical fields. Refusing to do so would be equivalent to grandfathering old irrationality.” *Green*, 405 F. Supp. 2d at 118 (internal citations and quotation marks omitted).

III. APPLICATION OF THE *DAUBERT* FACTORS TO FIREARMS AND TOOLMARK ANALYSIS

A. **Can and has the technique been tested?**

The first of the *Daubert* factors—whether the technique or process in question can and has been tested—represents a “key question” in determining whether expert testimony should be admitted. *Romero-Lobato*, 379 F. Supp. 3d at 1118. As described in the Advisory Committee Notes to Rule 702, the “testability” of a theory refers to “whether the expert’s theory can be challenged in some objective sense, or whether it is instead simply a subjective, conclusory approach that cannot be reasonably assessed for reliability.” As *Daubert* itself noted, “generating hypotheses and testing them to see if they can be falsified . . . is what distinguishes science from other fields of human inquiry.” *Daubert*, 509 U.S. at 593 (citation omitted).
“There appears to be little dispute that toolmark identification is testable as a general matter.” Johnson, 2019 U.S. Dist. LEXIS 39590, at *44, 2019 WL 1130258, at *15. Indeed, virtually every court that has evaluated the admissibility of firearms and toolmark identification has found the AFTE method to be testable and that the method has been repeatedly tested. See, e.g., Romero-Lobato, 379 F. Supp. 3d at 1118–19; Simmons, 2018 U.S. Dist. LEXIS 18606, *18, 2018 WL 1882827, at *6; Ashburn, 88 F. Supp. 3d at 245; Otero, 849 F. Supp. 2d at 433. Although the NRC and PCAST reports have levied significant criticism against firearms and toolmark analysis, courts have found that such reports do not affect the method’s testability. See, e.g., Romero-Lobato, 379 F. Supp. 3d at 1119; see also Otero, 849 F. Supp. 2d at 433 (“Though the methodology of comparison and the AFTE ‘sufficient agreement’ standard inherently involves the subjectivity of the examiner's judgment as to matching toolmarks, the AFTE theory is testable on the basis of achieving consistent and accurate results.”). Additionally, some courts have cited annual proficiency testing undergone by firearms and toolmark examiners as further evidence of the method’s testability. See Johnson, 2019 U.S. Dist. LEXIS 39590, at *45–46, 2019 WL 1130258, at *15 (citing United States v. Diaz, No. CR 05-000167 WHA, 2007 U.S. Dist. LEXIS 13152, at *15, 2007 WL 485967, at *5 (N.D. Cal. Feb. 12, 2007)); United States v. Johnson, 2015 U.S. Dist. LEXIS 111921, at *9, 2015 WL 5012949, at * 3.

Here, the propositions advanced by the government in support of its proffer of the expert testimony at issue—namely, that firearms leave discernible toolmarks on bullets and cartridge casings fired from them, and that trained examiners can conduct comparisons to determine whether a particular gun has fired particular ammunition—can be, and have been, tested. The Defendant’s written pleadings and oral argument did not specifically contest this particular point, and the government met its burden with respect to testability.
B. Has the theory or technique been subjected to peer review and publication?

The second of the Daubert factors considers whether the theory or technique “has been subjected to peer review and publication.” Motorola, 147 A.3d at 754 (quoting Daubert, 509 U.S. at 593–94). As the Supreme Court emphasized in Daubert, “submission to the scrutiny of the scientific community is a component of ‘good science,’ in part because it increases the likelihood that substantive flaws in methodology will be detected.” 509 U.S. at 593. While the existence of peer reviewed literature can help determine a methodology’s reliability under Daubert, the “fact of publication (or lack thereof) in a peer reviewed journal” is not dispositive. Id.; see also Romero-Lobato, 379 F. Supp. 3d at 1119; United States v. Mouzone, 696 F. Supp. 2d 536, 571 (D. Md. 2009).

Evidence presented at the hearing demonstrated that studies assessing the foundational validity and reliability of the type of firearms pattern matching evidence proffered here—that is, studies that attempt to show whether trained firearms examiners can accurately attribute a particular firearm as the source of a particular cartridge casing or bullet—have been published and subjected to varying types of review. Two of the studies in this area, the 2019 study by James E. Hamby et al., A Worldwide Study of Bullets Fired from 10 Consecutively Rifled 9MM RUGER Pistol Barrels—Analysis of Examiner Error Rate, 64 J. Forensic Sci. 551 (2019) [hereinafter 2019 Hamby Study], and the 2016 study by Tasha P. Smith et al., A Validation Study of Bullet and Cartridge Case Comparisons Using Samples Representative of Actual Casework, 61 J. Forensic Sci. 692 (2016) [hereinafter 2016 Smith Study], were published in the Journal of Forensic Sciences, and thus have undergone meaningful peer review. The Journal of Forensic Sciences employs “double-blind” peer review, a type of review process used throughout many scientific disciplines and designed to limit various types of bias by requiring that neither the
study’s authors nor the journal’s reviewers know the identity of the other. Scurich Test. May 15, 2019, 37:3-7; Expert Report of Nicholas Scurich, PhD, 6 [hereinafter Scurich Report] (citing Author Guidelines, https://onlinelibrary.wiley.com/page/journal/15564029/homepage/forauthors.html (last visited August 28, 2019)). Further, this particular publication is an independent journal, unaffiliated with AFTE, any crime lab, or any individual with a financial or professional interest in the validation of the field of firearms and toolmark analysis.

However, most of the other studies in this field—including the vast majority of those relied upon by the government and the expert witnesses it presented at the Daubert hearing—have been published in the AFTE Journal, a publication produced by the Association of Firearm and Toolmark Examiners. The government’s experts, Mr. Weller and Dr. Petraco, contended that the studies published in the AFTE Journal are subjected to both pre- and post-publication peer review. Prior to publication, articles submitted to the AFTE Journal are reviewed by AFTE members; the AFTE Journal utilizes an “open” pre-publication peer review process in which the author and the reviewers know each other’s identity and may communicate directly during the review period. Scurich Report 7 (citing AFTE Peer Review Process – August 2009, https://afte.org/afte-journal/afte-journal-peer-review-process (last visited Aug. 28, 2019)). Both government experts primarily focused on post-publication peer review, and characterized letters to the editor in response to a published study as part of the AFTE Journal’s peer review process. Suppl. Decl. of Todd J. Weller 7–8 [hereinafter Weller Suppl. Decl.]; Report of Dr. Nicholas Petraco 1–2 [hereinafter Petraco Report]; Petraco Test. May 13, 2019, 20:7–18. Further, Dr. Petraco also discussed the publication of “counter studies” as part of the peer review process. Petraco Report at 2.

In the undersigned’s view, three aspects of publication in the *AFTE Journal* make this journal’s review process far less meaningful (and its published articles that much less reliable) than *Daubert* contemplates. First, as noted supra, the *AFTE Journal* peer review process itself is “open,” meaning that both the author and reviewer know the other’s identity and may contact each other during the review process. Scurich Report 7 (citing AFTE Peer Review Process – August 2009, https://afte.org/afte-journal/afte-journal-peer-review-process (last visited Aug. 28, 2019)). This open process seems highly unusual for the publication of empirical scientific research, as Dr. Scurich testified and as Dr. Petraco admitted in his written report. Scurich Test.

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5 Indeed, one court has recently found that the PCAST and NRC Reports themselves—despite their negative treatment of the established validity of firearms and toolmark evidence—constitute relevant peer review of the articles published in the *AFTE Journal*. *See Romero-Lobato*, 379 F. Supp. 3d at 1119. If negative post-publication commentary from an external reviewing body can satisfy this prong of the *Daubert* analysis, then the peer reviewed publication component would be more or less read out of *Daubert*, leaving behind only the requirement of *some type* of publication.
The practice of double-blind peer review, by contrast, constitutes the standard among scientific publications and guards against personal and institutional biases by shielding both reviewer and author from the identity of the other. Mr. Weller, even while defending the AFTE Journal’s open process, acknowledged that the publication is now moving toward a blind peer review process. Weller Test. May 14, 2019 (1), 23:18; Weller Suppl. Decl. 8. While neither Daubert, Motorola, nor Rule 702 mandate any specific type of peer review process, the AFTE Journal’s use of a so-called “open” process diminishes the extent to which proponents of firearms and toolmark identification evidence can claim that its articles have been subjected to meaningful, stringent peer review.

Second, AFTE does not make this publication generally available to the public or to the world of possible reviewers and commentators outside of the organization’s membership. Of course, an interested party can receive the publication by joining AFTE, if such a person meets the organization’s membership requirements, or can pay to access specific articles. Weller Test., May 14, 2019 (1), 18:16–21. But unlike other scientific journals, the AFTE Journal is not more broadly available and cannot even be obtained in university libraries. Id. 18:11–13. Such restricted access effectively forecloses the type of review of the journal’s publications by a wider community of scientists, academics, and other interested parties that could serve as an important mechanism for quality assurance. Indeed, a National Commission on Forensic Science’s (NCFS) publication listed among the criteria for “foundational, scientific literature supportive of forensic practice” that the articles be “published in a journal that is searchable using free, publicly available search engines (e.g. Pub Med, Google Scholar, National Criminal Justice Reference Service) that search major databases of scientific literature (e.g. Medline, National Criminal Justice Reference Service Abstracts Database, and Xplore)” and “published in a journal that is
indexed in databases that are available through academic libraries and other services (e.g. JSTOR, Web of Science, Academic Search Complete, and SciFinder Scholar).” Nat’l Comm’n on Forensic Sci., Scientific Literature in Support of Forensic Science and Practice, 3 (2015), justice.gov/archives/ncfs/file/786591/download [hereinafter NCFS Report]. The AFTE Journal, by generally limiting the review of its publications and making them available only to its members or others who pay, avoids the scrutiny of scientists and academics outside the field of firearms and toolmark analysis. These limitations significantly diminish the stringency of the review that a study published in the AFTE Journal can be said to have undergone, even after its publication.

Third, the very nature of AFTE impacts the meaningfulness of its review process. The AFTE Journal is published by the largest organization of practicing firearms and toolmark examiners, and its articles are reviewed by members of an editorial board composed entirely of members of AFTE. Scurich Report 7 (citing AFTE Peer Review Process – August 2009, https://afte.org/afte-journal/afte-journal-peer-review-process (last visited Aug. 28, 2019)). This oversight structure may create a threshold issue in terms of quality of peer review: as Dr. Scurich pointed out, those who review the AFTE Journal’s articles may be trained and experienced in the field of firearms and toolmark examination, but do not necessarily have any specialized or even relevant training in research design and methodology. Scurich Report 7–8. Perhaps more importantly, members of the Journal’s editorial board—those who review its articles prior to publication—have a vested, career-based interest in publishing studies that validate their own field and methodologies. In contrast with this particular publication’s editorial structure, the National Commission on Forensic Science has specifically stated that foundational

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6 Although surely not what the NFCS’s recommendations contemplate, AFTE’s website indicates that the public may search its articles’ abstracts and keywords in its own index available on the AFTE website. See What is the Journal?, https://afte.org/afte-journal/what-is-the-journal (last visited Aug. 28, 2019).
scientific literature should be “published in a journal that utilizes rigorous peer review with independent external reviewers to validate the accuracy in its publications and their overall consistency with scientific norms of practice.” NCFS Report at 3 (emphasis added). The *AFTE Journal* is thus, in a sense, “comparable to talk within congregations of true believers” rather than an example of “the desired scientific practice of critical review and debate mentioned in *Daubert*.” David H. Kaye, *How Daubert and its Progeny Have Failed Criminalistics Evidence and a Few Things the Judiciary Could Do About It*, 86 Fordham L. Rev. 1639, 1645 (2018).

While the Court does not doubt the good faith of AFTE or those who serve on the editorial board of the *AFTE Journal*, neither can it ignore this intrinsic bias and lack of independence when analyzing the nature of peer review this journal utilizes. Discussing a similar journal within the field of handwriting analysis, Judge Jed. S. Rakoff of the United States District Court for the Southern District of New York highlighted the issue central to the question of whether publication in the *AFTE Journal* should qualify as peer reviewed publication under *Daubert*: the very meaning of the term “peer.” As Judge Rakoff reasoned:

> Of course, the key question here is what constitutes a ‘peer,’ because just as astrologers will attest to the reliability of astrology, defining ‘peer’ in terms of those who make their living through handwriting analysis would render this *Daubert* factor a charade. While some journals exist to serve the community of those who make their living through forensic document examination, numerous courts have found that ‘[t]he field of handwriting comparison . . . suffers from a lack of meaningful peer review’ by anyone remotely disinterested.

*Almeciga v. Ctr. for Investigative Reporting, Inc.*, 185 F. Supp. 3d 401, 420 (S.D.N.Y. 2016) (citation omitted). So, too, with the field of firearms and toolmark analysis: although studies analyzing error rates among practicing firearms and toolmark examiners have, on two occasions, been published in other journals utilizing double-blind peer review presumably performed by

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7 At least one other court has made similar observations regarding the *AFTE Journal’s* lack of independence. See *Green*, 405 F. Supp. 2d at 109 n.7.
disinterested referees, the vast majority of published articles in the field have not undergone peer review by a “competitive, unbiased community of practitioners and academics, as would be expected in the case of a scientific field.” *Id.* (internal quotation marks omitted); see also United States v. Starzepyzel, 880 F. Supp. 1027, 1037–38 (S.D.N.Y. 1995).

Overall, the *AFTE Journal*’s use of reviewers exclusively from within the field to review articles created for and by other practitioners in the field greatly reduces its value as a scientific publication, especially when considered in conjunction with the general lack of access to the journal for the broader academic and scientific community as well as its use of an open review process. Ultimately, the Court has seen only two meaningfully peer reviewed journal articles regarding the foundational validity of the field, as the vast majority of the studies are published in a journal that uses a flawed and suspect review process. While the implications of these conclusions arise again with respect to the third *Daubert* factor regarding the demonstrated rate of error, this factor on its own does not, despite the sheer number of studies conducted and published, work strongly in favor of admission of firearms and toolmark identification testimony.

C. *Does the methodology have a known or potential rate of error?*

The parties focused most of their attention on the third *Daubert* factor—“the known or potential rate of error.” And with good reason: determining the error rate for a particular methodology appears essential to determining its ultimate reliability. On this question, the undersigned agrees with one of the essential premises of the 2016 PCAST Report:

Scientific validity and reliability require that a method has been subjected to empirical testing, under conditions appropriate to its intended use, that provides valid estimates of how often the method reaches an incorrect conclusion. For subjective feature-comparison methods, appropriately designed black-box studies are required, in which many examiners render decisions about many independent tests (typically, involving “questioned” samples and one or more “known”
samples) and the error rates are determined. Without appropriate estimates of accuracy, an examiner’s statement that two samples are similar – or even indistinguishable – is scientifically meaningless: it has no probative value, and considerable potential for prejudicial impact. Nothing – not training, personal experience nor professional practices – can substitute for adequate empirical demonstration of accuracy.

PCAST Report at 46. Likewise, an expert witness’s ability to explain the methodology’s error rate—in other words, to describe the limitations of her conclusion—is essential to the jury’s ability to appropriately weigh the probative value of such testimony. As Judge Rakoff stated in United States v. Glynn: “The problem is how to admit [ballistics comparison evidence] into evidence without giving the jury the impression – always a risk where forensic evidence is concerned – that is has greater reliability than its imperfect methodology permits.” 578 F. Supp. 2d at 574.

Courts considering this issue have rather uniformly weighed this third Daubert factor in favor of admissibility. A few courts have characterized the calculation of an error rate for firearms and toolmark pattern matching evidence as an impossible or exceedingly difficult task and acknowledged that an error rate is “presently unknown.” Johnson, 2019 U.S. Dist. LEXIS 39590, at *55, 2019 WL 1130258, at *18 (citing Ashburn, 88 F. Supp. 3d at 246; Diaz, 2007 U.S. Dist. LEXIS 13152, at *27, 2007 WL 485967, at *9); Romero-Lobato, 379 F. Supp. 3d at 1119 (quoting Monteiro, 407 F. Supp. 2d at 367); Ashburn, 88 F. Supp. 3d at 246. The vast majority of courts have nonetheless accepted the notion that existing studies support the conclusion that the discipline’s error rate is quite low—between one and two percent. Romero-Lobato, 379 F. Supp. 3d at 1119–20; Johnson, 2019 U.S. Dist. LEXIS 39590, at *56–57, 2019 WL 1130258, at *18–19; Johnson, 2015 U.S. Dist. LEXIS 111921, at *10, 2015 WL 5012949, at *4 (citing Otero, 849 F. Supp. 2d at 433–34); Ashburn, 88 F. Supp. 3d at 246. Indeed, one court
ratified the assertion that the error rate for this discipline is “almost zero.” Wrensford, 2014 U.S. Dist. LEXIS 102446, at *56–57, 2014 WL 3715036, at *17.

In spite of the court system’s widespread acceptance of the discipline’s assertion that it enjoys low error rates, several extensive reports originating from institutions independent of the judiciary have recently taken a different view of the sufficiency of the existing studies in establishing an error rate and in validating the discipline in general. Two National Research Council reports have directly addressed the sufficiency of the published studies purporting to show a low error rate in the field of firearms and toolmark identification. In the first report, the NRC commented:

The validity of the fundamental assumptions of uniqueness and reproducibility of firearms-related toolmarks has not yet been fully demonstrated. . . . A significant amount of research would be needed to scientifically determine the degree to which firearms-related toolmarks are unique or even to quantitatively characterize the probability of uniqueness.

Nat’l Research Council, Ballistics Imaging 3 (2008) [hereinafter 2008 NRC Report]. Similarly, the NRC’s second report noted, “[s]ufficient studies have not been done to understand the reliability and repeatability of the methods.” 2009 NRC Report at 154. Finally, and most recently, PCAST concluded that most of the 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. . . . The scientific criteria for foundational validity require appropriately designed studies by more than one group to ensure reproducibility. Because there has been only a single appropriately designed study [the Baldwin/Ames Laboratory study], the current evidence falls short of the scientific criteria for foundational validity. There is thus a need for additional, appropriately designed black-box studies to provide estimates of reliability.
PCAST Report at 111. Together, these reports raise significant questions as to the extent to which courts should rely on certain studies and the low error rates they claim when evaluating this evidence under Daubert.

As a general matter, those courts that have found low error rates for this discipline appear to have done so by simply accepting the conclusions of the studies as presented and without any analysis of the methodological or other issues presented in them. See, e.g., Otero, 849 F. Supp. 2d at 434; Romero-Lobato, 379 F. Supp. 3d at 1119–20; Johnson, 2019 U.S. Dist LEXIS 39590, at *56–57, 2019 WL 1130258, at *18–19; Johnson, 2015 U.S. Dist LEXIS 111921, at *10, 2015 WL 5012949, at *4; Ashburn, 88 F. Supp. 3d at 246. However, after extensive review of the testimony of the expert witnesses and of the studies about which those experts testified, the undersigned finds it difficult to conclude that the existing studies provide a sufficient basis to accept the low error rates for the discipline that these studies purport to establish. Although the Defendant and the government provided expert testimony and argument on a range of issues presented by these studies, three main problems with the design and interpretation of these studies provide the greatest cause for concern. First, most of the studies suffer from basic, threshold design flaws that undermine the value of their stated results. Second, the reliance of most of these studies on “closed” and/or “set-based” design structures substantially limit the reliability of the error rates claimed in these studies. Third, and perhaps most significantly, the

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8 To be sure, a few judges who have admitted firearms and toolmark identification testimony have addressed, at least in some fashion, various criticisms of the discipline related to the methodology’s error rate and its calculation. See Romero-Lobato, 379 F. Supp. 3d at 1120; Ashburn, 88 F. Supp. 3d at 246; Otero, 849 F. Supp. 2d at 434; Taylor, 663 F. Supp. 2d at 1177. In response to the PCAST Report’s criticism regarding the general lack of adequately designed studies for firearms and toolmark validation, the United States District Court for the District of Nevada explained that it would not “adopt such a strict requirement for which studies are proper and which are not.” Romero-Lobato, 379 F. Supp. 3d at 1120. The court went on to find that “Daubert does not mandate such a prerequisite for a technique to satisfy its error rate element.” Id. The United States District Court for the Eastern District of New York rejected a separate criticism levied by the 2009 NRC Report—that “the lack of objective standards prevents a ‘statistical foundation for estimation of error rates’”—and argued that the “information derived from [] proficiency testing is indicative of a low error rate[].” Ashburn, 88 F. Supp. 3d at 246 (first quoting 2009 NRC Report at 154; then quoting Otero, 849 F. Supp. 2d at 434).
studies permit participants to label toolmark comparisons as “inconclusive” without adequately assessing the impact of such inconclusive determinations on the results of the study as a whole.

1. Most of the studies in the field of firearms and toolmark analysis suffer from basic, threshold design flaws.

Generally, studies published within the area of firearms and toolmark analysis are designed exclusively by toolmark examination professionals who have no experience or training in research methods or decision science. Though these professionals have varying levels of experience within the field of firearms and toolmark analysis, there is no indication that they have experience or training in human subjects research that would facilitate the design of studies that, for example, account for test-taking biases and achieve consistent results by providing specific and uniform procedures for test takers to follow. See Scurich Test., May 14, 2019 (2), 79:20–22, 80:3–10.

Concerns with test-taking biases arise from the notion that a person being tested on her ability to perform a task will, consciously or not, perform differently while being monitored, either guessing the purpose of the test and responding accordingly, Faigman Test., May 16, 2019, 84:23–85:6, or being influenced by a test designer’s cues toward one response over another, Angela Stroman, Empirically Determined Frequency of Error in Cartridge Case Examinations Using a Declared Double-Blind Format, 46 AFTE J. 157, 157 (2014) [hereinafter 2014 Stroman Study]; see also 2009 NRC Report at 122–24. A test-taker may, consciously or not, try harder or behave more conservatively to avoid being wrong and thus appear to be performing the task better than she would under other circumstances. See 2016 Smith Study at 693 (noting possible “fear of answering incorrectly” when taking a test lacking anonymity). Mr.
Weller, having personally participated in research studies in this field, testified that questions regarding test-taking bias need not concern the courts:

I think if you ask a human factor person that is always a concern; the concept of test taking bias; that decisions, there may be a subconscious thing that is going on. So, the test may not be completely reflective of true casework decisions. From my own perspective, I treated the case samples in the same way I would treat casework and I used the same methods and comparison techniques and my own criteria to reach those conclusions. So, I appreciate the concern. I don’t know how tangible that concern is and how you rectify that potential problem.

Weller Test., May 14, 2019 (1), 30:20–31:7. The Court simply cannot accept the conclusion that a recognized bias-related concern should not be a concern at all because a person participating in a study did not himself perceive any impact of that bias. This is, of course, precisely the problem with biases, which have their greatest impact whenever and wherever they operate completely unacknowledged. See 2009 NRC Report at 124. Based on the evidence adduced at the hearing, it appears that the studies relied upon by the government do not address the potential impact of such biases.

A more concrete study design concern stems from the lack of clarity in these studies as to how the test-takers were expected to perform the work, and the resulting lack of information about what practices and procedures the test-takers actually followed when participating in a study. Many of the studies failed to instruct their participants clearly on whether to follow the testing policies and protocols of their individual laboratories, or to conduct the comparisons in a particular manner in order to ensure uniformity. See, e.g., 2014 Stroman Study at 169 (instructing examiners to follow their “normal” procedures); Mark A. Keisler et al., Isolated Pairs Research Study, 50 AFTE J. 56, 58 (2018) [hereinafter 2018 Keisler Study] (instructing examiners to complete the research study like they would casework, but noting it was “unclear if

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9 Mr. Weller’s training and experience, which involves a Master of Science degree in Forensic Science as well as over ten years of training and casework experience in firearms and toolmark analysis, see Decl. of Todd J. Weller 1, does not include any training or experience in decision science.
participants . . . deviated from laboratory policy’’); 2016 Smith Study at 698 (failing to instruct examiners but noting factors “such as a laboratory’s quality assurance program (which includes verifications and peer review), would influence error rates in casework”). This inconsistency poses a significant interpretive problem because different labs have different policies for how to conduct toolmark examinations. Scurich Test., May 15, 2019, 53:12–19; Faigman Test., May 16, 2019, 85:24–86:6. For example, some lab policies require a second examiner to verify a first examiner’s work while others do not; similarly, some labs have policies that prohibit rendering a conclusion of “exclusion” when class characteristics are all in common, while others do not have such a policy. See, e.g., 2018 Keisler Study at 58. In other words, in many of the studies that the government and its experts rely on, it is unknown whether one or more of the test participants had a colleague verify his or her work, and whether reported “inconclusives” were only deemed inconclusive due to adherence with a policy demanding such a result rather than on an actual analysis of the patterns on a particular bullet or casing.10 These design issues prevent the Court from evaluating whether the test-takers in these studies were even taking the same test—as it cannot be determined what instructions each examiner followed in completing the comparisons—and thus reduce the ability of these studies to support the foundational validity of the field.

Yet another study design issue relates to the manner in which the test administrators selected practicing examiners to participate in the studies. Scurich Test., May 14, 2019 (2), 93:9–20, 93:22–94:1. Some studies provided no information regarding how their participants were selected and recruited, see, e.g., 2018 Keisler Study, but those studies that did indicated that

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10 In one frequently-cited study, the test designers simply did not make clear whether their participants were to follow their specific lab’s policies. 2018 Keisler Study at 58; Faigman Test., May 16, 2019, 85:24–86:6. The same study recognized this concern and specifically asked participants what their labs’ policies were with respect to not excluding samples with matching class characteristics. 2018 Keisler Study at 58. However, when analyzing its data, that study made no attempt to disaggregate that data by the different policies used. Id. at 57–58.
they had solicited volunteer participation from AFTE membership lists or from groups of employees in specific crime laboratories: one study, for example, used only examiners employed by a Federal Bureau of Investigation laboratory, Charles DeFrance and Michael D. Van Arsdale, *Validation Study of Electrochemical Rifling*, 35 AFTE J. 35, 36 (2003) [hereinafter 2003 DeFrance Study]; another engaged a third party to solicit volunteers from laboratories, 2016 Smith Study at 693; and two others recruited volunteers via email, using a list of AFTE members, Thomas G. Fadul, Jr., et al., *An Empirical Study to Improve the Scientific Foundation of Forensic Firearm and Tool Mark Identification Utilizing 10 Consecutively Manufactured Slides*, 45 AFTE J. 376, 379 (2013) [hereinafter 2013 Fadul Study]; Thomas G. Fadul, Jr., et al., *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*, Final Report on Award Number 2010-DN-BX-K269, 16 (2013) [hereinafter Miami-Dade Study]. Other studies simply report that they used volunteers from laboratories or AFTE membership lists without clarifying further as to how the participants were recruited. David P. Baldwin et al., *A Study of False-Positive and False-Negative Error Rates in Cartridge Case Comparisons*, 7 (2014), [https://www.ncjrs.gov/pdffiles1/nij/249874.pdf](https://www.ncjrs.gov/pdffiles1/nij/249874.pdf) [hereinafter Ames Laboratory Study]; David J. Brundage, *The Identification of Consecutively Rifled Gun Barrels*, 30 AFTE J. 438, 440, 442 (1998) [hereinafter 1998 Brundage Study]; 2014 Stroman Study at 168. Still, others do not specifically describe their pool of participants, let alone how those participants were solicited to take part in the study. *See* 2019 Hamby Study; 2018 Keisler Study; Dennis J. Lyons, *The Identification of Consecutively Manufactured Extractors*, 41 AFTE J. 246 (2009). In spite of this vagueness in some of these articles, these studies generally appear to use a self-selected set of volunteers. While simply soliciting volunteers is obviously the easiest way
to perform these experiments, use of volunteers for what amounts to a proficiency examination does not provide the clearest indication of the accuracy of the conclusions that would be reached by average toolmark examiners. Scurich Test., May 14, 2019 (2), 93:19–20.

These design issues do not necessarily invalidate the results of these studies, and Daubert does not necessarily require the proponent of a theory or methodology to present only studies with the best possible design. Undoubtedly, experts with extensive training in research methods could likely find fault with the methodology of any study. But these threshold design issues—perhaps the result of their designers not securing the assistance of individuals with design science expertise—surely impact the validity of these studies’ conclusions and limit their utility to some extent.

2. Because of their reliance on “closed” and “set-based” designs, the studies in the field of firearms and toolmark analysis do not provide reliable data regarding the ability of an examiner to match unknown and known samples.

In general, the firearms and toolmark identification field has produced two types of comparison studies—those that are referred to as “open” and “independent comparison” studies (also called “pairwise comparison” studies), and those that are referred to as “closed” and “set-based” studies. See PCAST Report at 106–10. In the “open” and “independent comparison” studies, participants are given an unknown sample and asked to determine whether it matches another specific sample. Id. at 110. Such a study may involve a series of separate comparisons, but each comparison presents as a separate problem. See id. Most importantly, not all of the unknown samples will have a matching known sample, so the participant will not have reason to know whether the correct match is present. See id. Based on the testimony at the hearing and the materials submitted by the parties, it appears that only two studies have been conducted using
this approach: the 2014 Ames Laboratory study and the 2018 Keisler study. In the Ames Laboratory study, participants were given a test kit consisting of fifteen separate problem sets for comparison. Ames Laboratory Study at 10. Each set contained three cartridge casings designated as being from the same “known” firearm and one cartridge casing designated as the “unknown” or “questioned” sample; unknown to the participants, each test kit contained five same-source pairs and ten different-source pairs. Id. Participants were asked to approach each of the fifteen problems separately and to render a conclusion, and they were not told whether any of the questioned samples would match the known samples. Id. Similarly, the Keisler study provided participants with a test kit made up of twenty sets of two cartridge casings each, and unknown to the participants, each test kit contained twelve same-source pairs and eight different-source pairs. 2018 Keisler Study at 56. Participants were asked to examine each pair separately from any other pair and to render a conclusion as to each pair. Id.

By contrast, virtually all studies published in this field utilize a “closed” universe, where a match is always present for each unknown sample, and a “set-based” design, where comparisons are made within a set of samples. See PCAST Report at 106. This methodology differs from the “open” and “independent comparison” studies because the comparisons are not divided up into individual problems for the participant to consider one at a time; instead, participants are either given a group of samples and asked to compare all of those samples to each other and to find matches, or participants are given a group of known samples and a group of unknown samples and asked to make comparisons between the two groups to find matches. See id. at 106–08. For example, the 2019 Hamby Study, using the same design and test kits as the 1998 Brundage Study and published incorporating all data from several iterations of Brundage’s original study over the last twenty-one years, provided participants with fifteen
questioned samples and ten pairs of known samples and asked the participants to make comparisons. 2019 Hamby Study at 556; 1998 Brundage Study at 440. Similarly, the two Fadul studies gave participants a quantity of questioned samples and a number of known samples and asked them to make comparisons between the two groups. 2013 Fadul Study at 380; Miami-Dade Study at 19. These studies, and others like them, often involved the use of an answer sheet to allow the participant to indicate the known sample to which an unknown sample could be matched. See, e.g., Miami-Dade Study at 19.

During the hearing, counsel and witnesses debated the question of whether one of the study types better mimics casework. The PCAST report concluded that the “closed” and “set-based” studies did not replicate casework. PCAST Report at 106. The government expert witnesses, Mr. Weller and Dr. Petraco, disagreed with this contention. Weller Test., May 13, 2019, 126:21–127:19; Petraco Test., May 13, 2019, 71:15–21, 71:24–72:5. While the Court presently lacks sufficient information to resolve this empirical question, its answer would not provide much guidance for the Daubert question at issue here. As Dr. Scurich stated, the question of whether a study mimics real-world casework differs from the question of whether a study accurately measures the ability of examiners to make source determinations based on pattern matching. See Scurich Test., May 15, 2019, 77:20–24.

Having reviewed the studies and considered both parties’ arguments on the different study designs, the undersigned finds that the independent comparison studies, or “pairwise” studies, best test the validity of the assumptions underlying the firearms and toolmark analysis field and that the closed, set-based studies have inherent limitations that preclude them from providing substantial validation. This conclusion mirrors that of PCAST, which explained:

Specifically, many of the studies employ ‘set-based’ analyses, in which examiners are asked to perform all pairwise comparisons within or between small samples
sets. . . . The study design has a serious flaw, however: the comparisons are not independent of one another. Rather, they entail internal dependencies that (1) constrain and thereby inform examiners’ answers and (2) in some cases, allow examiners to make inferences about the study design. . . . Because of the complex dependancies among the answers, set-based studies are not appropriately-designed black-box studies from which one can obtain proper estimates of accuracy. Moreover, analysis of the empirical results from at least some set-based studies (‘closed-set’ designs) suggest that they may substantially underestimate the false positive rate.

PCAST Report at 106. Of course, the PCAST report is hardly beyond critique, and the government’s experts stated many valid criticisms of it throughout the hearing: the Council did not include anyone from the firearms and toolmark examination community, id. at v-ix; it criticized studies for lack of peer review but was not itself peer reviewed, Petraco Test., May 13, 2019, 34:20–24; and the report apparently miscounted or omitted data from several studies, Weller Test., May 13, 2019, 108:10–109:8. Despite these shortcomings, the Court finds the conclusions of PCAST (as echoed by Dr. Scurich at hearing) about the very limited utility of closed-set studies to have been essentially correct.

Closed, set-based studies have two significant problems that make them difficult to rely upon as evidence of the reliability of conclusions regarding toolmark evidence. First, a set-based study involves an unknown number of total comparisons that a participant makes in the process of matching samples to each other, which means that such a study cannot calculate a true error rate based on the total comparisons made. In other words, the total number of comparisons made remains unknown at the conclusion of the study because it is not known whether a participating examiner compared a particular unknown sample to only one other sample, or to a few of the other samples, or to all of the other samples before making a conclusion regarding that sample. One of the government’s expert witnesses acknowledged this issue in his testimony and agreed that
in closed, set-based studies, it is not possible to know the total number of true different source comparisons performed and that a false positive error rate thus cannot be calculated. Weller Test., May 14, 2019 (2), 22:17–23.

Second, and perhaps more importantly, the participants in a closed, set-based study can see all of the questioned samples and all of the known samples at once and can thus employ inferences gained from looking at one of the individual problems in order to solve other individual problems. In independent comparison studies, the examiner simply makes a one-to-one comparison, an exercise well-suited to gauge her ability to look at two items and, based only on the features of those two items, make a determination of match. PCAST likened closed, set-based studies, by contrast, to a Sudoku puzzle, “where initial answers can be used to help fill in subsequent answers.” PCAST Report at 106. This puzzle analogy, which Dr. Scurich also employed to explain this pitfall of closed, set-based studies, identifies a substantial problem with the closed and set-based study design. Such a design allows participants to rely on their own decisions and inferences about some of the samples to make decisions regarding the remaining samples, which the defense aptly characterized as the “interdependency problem.” Tr. June 10, 2019, 20:20. In other words, the participant can rely on other, unrelated parts of the puzzle—or even the puzzle as a whole—to solve an individual part of the puzzle, and thus a match determination for each of the individual problems evaluated would depend not simply on one-to-one comparisons but also on information and inferences gleaned from other individual problems (or from the set as a whole). Such a study design does not provide a reliable measure of the ability of firearms and toolmark
examiners to make comparisons between known and unknown samples where such inferences are not available to be drawn.

Because of these significant limitations of the closed and set-based studies, the vast majority of studies that the field relies upon to establish its foundational validity simply do not provide an adequate basis to do so. Unfortunately, the only studies with the more appropriate design for assessing reliability—the Ames Laboratory study and the Keisler study—have not, as described supra, undergone meaningful, independent peer review prior to publication.11

3. The large number of “inconclusive” results, and the studies’ failure to address them, undermines the reliability of the studies’ claimed error rates.

The final, and perhaps most substantial, issue related to the studies proffered to support the reliability of firearms and toolmark analysis relates to how the studies address—or fail to address—the “inconclusive” answers (hereinafter “inconclusives”) frequently given by the examiners participating in these studies, and how such answers affect the error rate. In field work, examiners analyzing bullets and cartridge casings recovered from a crime scene and comparing them to test fired samples from a recovered firearm can reach three possible conclusions: they can conclude that the samples match, and thus make an “identification”; they can conclude the samples do not match, and thus make an “elimination”; or they can characterize the comparison as “inconclusive.” Inconclusive appears to be a reasonable and acceptable conclusion in casework, possibly because the firearm may not have left sufficient marks for comparison, see Weller Test., May 13, 2019, 117:15–19, or because environmental factors may change or distort the soft metal of a cartridge casing or bullet. As Judge Rakoff described, “[t]he

11 The 2014 Ames Laboratory Study was made available on the internet without having undergone any clear peer review process, while the 2018 Keisler Study was published in the AFTE Journal.
bullets and/or shell casings recovered from the crime scene may be damaged, fragmented, crushed or otherwise distorted in ways that create new markings or distort existing ones.” *Glynn*, 578 F. Supp. 2d at 573.

Nevertheless, the methods used in the proffered laboratory studies make a compelling case that inconclusive should not be accepted as a correct answer in these studies. First and foremost, the study designers make efforts to control the effects of the environment on the samples. Rather than being fired such that the casings or bullets could roll, hit walls or cars, or be stepped on or exposed to the weather, these studies use samples collected under test fire conditions. In the Ames Laboratory study, for example, all of the test fired casings were collected in a brass catcher, and any that fell out of the catcher and hit the floor were discarded. Ames Laboratory Study at 12.

Additionally, most of the studies involved some quality assurance mechanism to ensure that the samples to be examined by the participants had sufficient markings for comparison purposes before the test kits were supplied to the examiners. For example, one study involved several test fires to account for a so-called “break-in period” to ensure that the newly-manufactured firearms were producing consistent markings, and the study designers checked the samples to ensure that the markings were then consistent. 2003 DeFrance Study at 35. In the two Fadul studies, study designers personally inspected every tenth test set to ensure that the samples had sufficient markings for comparison purposes. 2013 Fadul Study at 382; Miami-Dade Study at 19. Another study involved a “pre-test” that was conducted to review the test sets before they were delivered to participants. 2009 Lyons Study at 250–51. The 2018 Keisler

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12 The notion of a “break-in period,” during which time a firearm does not make consistent markings, would seem to undercut the general premise underlying the entire field of firearms and toolmark analysis—that is, that firearms reliably leave unique markings on casings and bullets fired based on marks left during the manufacturing process.
Study, at 57, and the 2016 Smith Study, at 694, also noted that the samples used for comparison had been deemed determinable.

The government and its expert witnesses view the number of inconclusives given by examiners in these published studies as irrelevant to the ultimate issue before the Court. Based on the premise that declaring a comparison inconclusive has no probative value, the government argues that such an opinion would not be given in court, and thus need not be a factor in assessing the reliability of pattern matching within the field of firearms and toolmark analysis. In other words, the government and its experts contend that only identifications—i.e., “match conclusions”—and a false positive error rate calculated based upon identifications combine to establish reliability. PCAST addressed inconclusives in this manner—by removing them entirely from analysis of the studies and their data, PCAST Report at 153—as did the United States District Court for the District of New Jersey in the only published opinion addressing this aspect of the studies, see Otero, 849 F. Supp. 2d at 434.13

However, in laboratory testing situations, in which samples were collected using procedures to minimize environmental alterations and in which samples were checked by test administrators to ensure they contained sufficient marks suitable for comparison purposes, a conclusion by an examiner characterizing the comparison as inconclusive should not qualify as a correct answer. Dr. Scurich opines, based on principles of mathematics and statistics in particular, that such responses should be viewed as false positive errors (i.e., included among false identifications),14 but such a characterization fails to make logical sense: while under

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13 The studies themselves have treated inconclusives differently. For example, the Ames Laboratory study included the inconclusives in the denominator of the error rate calculation, such that inconclusives counted toward the total number of comparisons made, likely underestimating the overall error rate. Ames Laboratory Study at 15. The Lyons study, by contrast, treated an inconclusive response as a correct response in its calculations. Lyons Study at 254–55; Scurich Test., May 14, 2019 (2), 100:13–17, 19–21.
14 The Court understands Dr. Scurich to reason as follows: (1) The only correct answers in laboratory studies are “identification” or “exclusion” because the samples are such that they can be identified, Scurich Test., May 14, 2019
laboratory conditions such inconclusives are surely some type of error, it does not follow that inconclusives are functionally the same as a false conclusion by an examiner who attributes a cartridge casing to a gun that did not fire it. While the Court does not accept Dr. Scurich’s inclusion of inconclusives in the false positive error rate, it agrees with his essential premise that such responses should represent an error by the examiner. Under these controlled circumstances, an examiner who looks at a casing collected in a laboratory test fire and that has been examined by a test administrator to make sure it has markings suitable for comparison, and who nonetheless describes her comparison as yielding inconclusive results, is making an error of some kind. In these published studies, at the very least, the test taker giving an answer of inconclusive may simply be avoiding the most difficult problem on the test. Or it may be that the examiner’s failure to identify or exclude the sample constitutes a mistake in her analysis. Alternatively, there may be some ambiguity, discussed at length in the Ames Laboratory study, regarding why some examiners make a determination of inconclusive, and whether some of those determinations are the result of laboratory policies against declaring exclusions when class characteristics are the same. Ames Laboratory Study at 18–19.

Based on the studies and the testimony of the government’s expert witnesses, no adequate explanation has been offered regarding the reason for examiners returning inconclusives in these controlled circumstances. The government’s experts insist that inconclusives should not be treated as any kind of error because inconclusive is not a conclusion at all. See Petraco Report at 3. Nevertheless, and again under these controlled circumstances, an inconclusive response is a

(2) 102:13–24; (2) In such a scenario involving a binary question, the basic principles of mathematics mean that the rate of true exclusions (called “specificity”) and the rate of false identifications or false positives (called “1 minus specificity”) must sum to 100% (i.e., of all the bullets that are known not to match, the percent declared “excluded,” and the percent declared “match” must sum to 100%), Scurich Test., May 14, 2019 (2), 86:6–19, 87:11–16, 87:21–88:2; and (3) Therefore, the false positive rate must equal 100% minus the percentage of correct exclusions, Scurich Test., May 14, 2019 (2), 87:12–16. For an example, out of all of the possible correct exclusions, if examiners correctly concluded “exclusion” 80% of the time, then it must be true that they reached incorrect conclusions the remaining 20% of the time. See Scurich Test., May 14, 2019 (2), 99:10–14.
conclusion, even if it is only a conclusion against making any other conclusion. In a recent article, Itiel Dror asserts that inconclusive determinations may be the result of “over-reliance” by forensic examiners on the option of “decid[ing] not to decide.” Itiel E. Dror & Glenn Langenburg, “Cannot Decide”: The Fine Line Between Appropriate Inconclusive Determinations Versus Unjustifiably Deciding Not to Decide, 64 J. Forensic Sci. 10, 11 (2019).

Where there is sufficient information for concluding “identification” or “exclusion,” “[a]n inconclusive determination is an erroneous decision because the evidence does not support that decision.” Id. at 13. In the end, all that is known is that some examiners in these studies, taking these tests involving samples collected under carefully controlled circumstances, responded that the comparison was “inconclusive.”

Viewing these inconclusives as an error of some type greatly affects the overall error rates produced by the studies. Focusing on the only two “open” studies, the Ames Laboratory study calculated a false positive error rate of 1.01%, while the Keisler study reported a false positive error rate of 0%. If the inconclusives are considered as errors, however, the Ames Laboratory study’s error rate among different source comparisons soars to 34.76% while the Keisler study’s error rate rises to 20.14%. Again, Dr. Scurich’s approach of treating inconclusives as false positives does not appropriately address the issue presented by inconclusives, but the large number of the inconclusives reported in the studies greatly reduces their persuasive force in establishing the ability of a firearms and toolmark examiner to make accurate source determinations. Indeed, even Dr. Petraco acknowledged that the number of inconclusives increased uncertainty about calculations of the error rate, Petraco Test., May 13,

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15 Additionally, it is important to note that inconclusives appear more frequently in open studies compared to closed and set-based studies, see PCAST Report at 109, and more frequently when the compared samples are true exclusions. For example, the Ames Laboratory Study, at 16–17, reported 735 inconclusives for 2,178 true different-source comparisons compared to only eleven for 1,090 possible true same-source comparisons. The evidence and testimony presented in the hearing did not adequately account for these disparities.
2019, 26:10–12, while Mr. Weller testified that the questions surrounding inconclusives and the error rate calculation were, in his words, “not well studied,” Weller Test., May 14, 2019 (1), 53:25–54:1.

4. Conclusion

Based on the basic design of the studies, the prevalence of closed-set studies, and the uncertain relationship in the open studies between inconclusives and the ultimate error rates, the undersigned was unable to conclude that the field has established a known or potential error rate with regard to the ability of a firearms and toolmark examiner to make a source determination. Dr. Petraco testified, and the government repeated several times in argument, that no studies refute the proposition that “firearms examiners can identify bullets or fired cartridge casings to particular guns with a high degree of accuracy.” Petraco Test., May 13, 2019, 12:24–13:4. This formulation of the issue turns both the scientific method and the Daubert burden of proof on their heads: instead, the question before the Court turns on whether the government can establish the foundational validity of the discipline, not whether the opposing party can prove a negative.

With regard to the proffered discipline, most of the studies on which the government relies involved closed-set designs that cannot provide an accurate accounting of the error rate. While the two studies that employ an open, independent comparison design could yield an accurate error rate measurement, neither was subjected to meaningful peer review, and both were plagued by a large number of “inconclusive” responses. Under such circumstances, the Court cannot conclude that the government has established that this forensic discipline has established a “known or potential rate of error.” See Motorola, 147 A.3d at 754 (citing Daubert, 509 U.S. at 593–94). While other studies being conducted now or in the future may change this conclusion,
the Court finds that this factor currently weighs against the admission of source attribution statements made by a firearms and toolmark examiner.

D. Is there a standard controlling the technique’s operation?

The fourth Daubert factor requires an inquiry into “the existence and maintenance of standards controlling the technique’s operation.” Motorola, 147 A.3d at 754 (quoting Daubert, 509 U.S. at 593–94). As described supra, the operative standard for firearms and toolmark identification is known as the “AFTE theory of identification,” which states that the examiner can make a conclusion of common origin when microscopic surface contours of the toolmarks are in “sufficient agreement.” PCAST Report at 59–60 (citing Ass’n of Firearm and Tool Mark Examiners, Theory of Identification as it Relates to Tool Marks: Revised 43 AFTE J. 287 (2011)). Stated in full, the AFTE Theory of Identification reads as follows:

1. The theory of identification as it pertains to the comparison of toolmarks enables opinions of common origin to be made when the unique surface of two toolmarks are in “sufficient agreement.”

2. This “sufficient agreement” is related to the significant duplication of random toolmarks as evidenced by the correspondence of a pattern or combination of patterns of surface contours. Significance is determined by the comparative examination of two or more sets of surface contour patterns comprised of individual peaks, ridges and furrows. Specifically, the relative height or depth width, curvature and spatial relationship of the individual peaks, ridges and furrows within one set of surface contours are defined and compared to the corresponding features in the second set of surface contours. 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. The statement that “sufficient agreement” exists between two toolmarks means the agreement of individual characteristics is of a quantity and quality that the likelihood another tool could have made the mark is so remote as to be considered a practical impossibility.

3. Currently the interpretation of individualization/identification is subjective in nature, founded on scientific principles and based on the examiner’s training and experience.
As other courts have noted, and as the Defendant argues here, one of the primary challenges to firearms and toolmark identification stems from the methodology’s lack of objective criteria for examiners to use in determining a “match.” See, e.g., Romero-Lobato, 379 F. Supp. 3d at 1120. Courts that have admitted firearms and toolmark identification testimony in the face of a Daubert challenge have found the standard articulated in the AFTE theory of identification sufficient. See Johnson, 2019 U.S. Dist. LEXIS 39590, at *51, 2019 WL 1130258, at *17; Johnson, 2015 U.S. Dist. LEXIS 111921, at *10–11, 2015 WL 5012949, at *4; Ashburn, 88 F. Supp. 3d at 247; Wrensford, 2014 U.S. Dist. LEXIS 102446, at *54–55, 2014 WL 3715036, at *16. However, the AFTE theory of identification has been sharply criticized by a number of other courts as “inherently vague,” Glynn, 578 F. Supp. 2d at 572; “inherently subjective,” Romero-Lobato, 379 F. Supp. 3d at 1121; and “either tautological or wholly subjective,” Green, 405 F. Supp. 2d at 114. As one United States District Court Judge noted, “the AFTE Theory appears to be more of a description of the process of firearm identification rather than a strictly followed charter for the field.” Monteiro, 407 F. Supp. 2d at 371.

Both the NRC and PCAST lodged similar criticisms. The NRC focused its critique on this lack of an objective comparison standard:

AFTE has adopted a theory of identification, but it does not provide a specific protocol. . . . The meaning of “exceeds the best agreement” and “consistent with” are not specified, and the examiner is expected to draw on his or her own experience. This AFTE document, which is the best guidance available for the field of toolmark identification, does not even consider, let alone address, questions regarding variability, reliability, repeatability, or the number of correlations needed to achieve a given degree of confidence.

2009 NRC Report at 155. Calling this a “fundamental problem with toolmark and firearm analysis,” id., the NRC further stated, “even with more training and experience using newer techniques, the decision of the toolmark examiner remains a subjective decision based on
unarticulated standards and no statistical foundation for estimation of error rates.” *Id.* at 153–54.

And, more recently, PCAST criticized the AFTE standard as “circular.” PCAST Report at 60.

In this case, the evidence supports—and the undersigned agrees with—all of these assessments of the AFTE theory of identification. By its own terms, it is a fundamentally subjective standard that can only be characterized as entirely tautological: an opinion of common origin can be rendered when the surfaces of the two examined items are in “sufficient agreement,” which exists not when some objective measure is satisfied, but when the examiner determines, based on her training and experience, that it would be a “practical impossibility” for the two items not to share a common origin. In other words, this protocol permits the ultimate finding of “sufficient agreement” whenever an individual examiner concludes that she would be hard pressed (for reasons not specified in the governing standard) to find such similar markings on casings or bullets fired by different firearms. Although AFTE has attempted to use terms like “sufficient agreement” to resemble terminology that one would find in an objective or scientific standard, in the end it simply leaves the determination of common origin to the standardless, undefined judgment of an individual examiner. Therefore, under this so-called standard, the process for determining what constitutes a “match” lacks defined criteria; it is merely unconstrained subjectivity masquerading as objectivity.

Courts that have admitted this type of expert opinion testimony have responded to such criticisms about the standard’s subjective nature by correctly noting that “[t]he mere fact that an expert’s opinion is derived from subjective methodology does not render it unreliable.” *Romero-Lobato*, 379 F. Supp. 3d at 1120 (citing *Ashburn*, 88 F. Supp. 3d at 246–47; *Cohen v. Trump*, Case No.: 3:13-cv-2519-GPC-WVG, 2016 U.S. Dist. LEXIS 117059, at *35, 2016 WL 4543481,
at *11 (S.D. Cal. Aug. 29, 2016)). Even the *Romero-Lobato* court, which found the lack of objective criteria to weigh against admissibility, explained:

[Rule 702] does not impose a requirement that the expert must reach a conclusion via an objective set of criteria or that he be able to quantify his opinion with a statistical probability. Such requirements would, in most circumstances, exclude psychologists, physicians, and lawyers from testifying as expert witnesses. Of course, a litigant would be hard pressed to make a good faith argument that the methods used by mainstream medical and legal experts are unreliable under *Daubert*.

379 F. Supp. 3d at 1120.

Of course, expert witnesses in many fields testify to subjective opinions. For example, an assessor testifying about home values would provide a subjective opinion about the value of a particular piece of property, but that assessor would be able to describe the basis of her opinion in objective terms, premised on a comparison with other properties that are similar in certain defined ways (such as the number of bedrooms, total square footage, or specific location), or on a general change in home values in a particular neighborhood since the last time the house was sold. Such an opinion would ultimately be subjective in nature, but it would be grounded in objective criteria, the applicability of which can be analyzed, debated, and critiqued, and not simply on the assessor’s judgment, based on her experience, as to what the property is worth. Similarly, an expert in a medical malpractice case testifying about whether a doctor satisfied a particular standard of care would base her subjective opinion on objective criteria in the form of promulgated and practiced nationwide standards of care within that medical specialty and not in her personal opinion, based on her own training and experience, as to what that standard should be.

The AFTE theory of identification is more subjective than such other examples of subjective opinions. “[B]allistics comparison lacks defining standards to a degree that exceeds most other kinds of forensic expertise.” *Glyn*, 578 F. Supp. 2d at 574. Unlike the standards
underlying opinions in other fields, the AFTE theory provides no objective yardstick to support or explicate the expert’s opinion; instead, the expert is left to rely on her own thoughts and conclusions based only on the vagaries of her own training and experience. An opinion that “the agreement in individual characteristics exceeds the best agreement demonstrated between toolmarks known to have been produced by different tools” and “the agreement of individual characteristics is of a quantity and quality that the likelihood another tool could have made the mark is so remote as to be considered a practical impossibility” relies entirely on subjective judgment, without any underlying objective criteria that the examiner must reference or apply. For all of these reasons, this fourth Daubert factor strongly militates against the admission of expert witness testimony in the field of firearms and toolmark analysis.

E. To what degree is the technique accepted within the scientific community?

The final enumerated Daubert factor—the “degree of acceptance within [a relevant] scientific community”—incorporates, at least to some extent, the Frye/Dyas principles that the general acceptance of theories speaks to their validity. See Daubert, 509 U.S. at 594; see also Motorola, 147 A.3d at 754. As stated in Daubert, “[w]idespread acceptance can be an important factor in ruling particular evidence admissible, and a known technique which has been able to attract only minimal support within the community may properly be viewed with skepticism.” 509 U.S. at 594 (citation and internal quotation marks omitted). Every published opinion evaluating the admissibility of firearms and toolmark evidence has found that the AFTE method enjoys general acceptance in the relevant community and that such acceptance weighs in favor of admissibility. See, e.g., Romero-Lobato, 379 F. Supp. 3d at 1122; Johnson, 2019 U.S. Dist. LEXIS 39590, at *58, 2019 WL 1130258, at * 19; Johnson, 2015 U.S. Dist. LEXIS 111921, at *11, 2015 WL 5012949, at *4; Ashburn, 88 F. Supp. 3d at 247; Wrensford, 2014 U.S. Dist.
However, these precedents have generally limited the scope of the so-called “relevant
community” to the specific community of firearms and toolmark examiners, or to those generally
operating within the field of criminal forensics. See Romero-Lobato, 379 F. Supp. 3d at 1122;
Dist. LEXIS 111921, at *11, 2015 WL 5012949, at *4; Ashburn, 88 F. Supp. 3d at 247; Otero,
849 F. Supp. 2d at 435.

In the undersigned’s view, if Daubert, Motorola, and Rule 702 are to have any meaning
at all, courts must not confine the relevant scientific community to the specific group of
practitioners dedicated to the validity of the theory—in other words, to those whose professional
standing and financial livelihoods depend on the challenged discipline. As Judge Jon M.
Alander of the Superior Court of Connecticut aptly stated, “[i]t is self evident that practitioners
accept the validity of the method as they are the ones using it. Were the relevant scientific
community limited to practitioners, every scientific methodology would be deemed to have
gained general acceptance.” Terrell, 2019 Conn. Super. LEXIS 827, at *14, 2019 WL 2093108,
at *4. Indeed, in other forensic science fields, techniques and methods that had gained “general
acceptance” among practitioners have been deemed unreliable and have been excluded as a
result of Daubert challenges. See, e.g., United States v. Saelee, 162 F. Supp. 2d 1097, 1101–05

Here, the government failed to show general acceptance outside of the field of firearms
and toolmark practitioners of the theory that an examiner can microscopically analyze individual
toolmarks on a cartridge casing or bullet and reach a reliable conclusion that a particular firearm
fired that particular cartridge casing or bullet. The conclusions of the NRC and PCAST reports
indicate that the wider academic and scientific community does not necessarily generally accept this theory. With the majority of studies published by and for the review of professional firearms and toolmark examiners, there is currently insufficient evidence that this methodology is generally accepted as proven, established, or validated—a factor that weighs against admissibility.

\[ F. \text{ A balancing of these factors requires that the expert be constrained to testify only that the recovered firearm cannot be excluded as the source of the recovered casing.} \]

In weighing and applying these factors pursuant to Daubert, Motorola, and Rule 702, the Court found that—particularly in light of the inability of the published studies to establish an error rate, the absence of an objective standard for identification, and the lack of general acceptance of the foundational validity of the field outside of the community of practitioners within the field—reliable principles and methods do not adequately support the theory that a firearms examiner can identify a particular firearm as having fired a particular bullet or cartridge casing. Accordingly, the Court will not permit Mr. Coleman, the firearms examiner who conducted the comparison in the above-captioned case, to testify in the form of such a source attribution statement. Again, in light of the state of the evidence presented here, a conclusion that a particular firearm was the source of a particular bullet or cartridge casing does not yet find support in sufficiently reliable principles and methods.

Such a conclusion, however, does not require the exclusion of all specialized opinion testimony in the area of firearms and toolmark examination, nor does it equate to a finding that the entire discipline lacks foundational reliability. As such, the Court denied Defendant’s request to exclude Mr. Coleman’s testimony in its entirety. The defense has not challenged the general theory that tools used to create firearms leave accidental or incidental toolmarks on the
firearms, and that those toolmarks leave impressions that can be discerned on the contours of the bullets and cartridge casings discharged through the firearm; based on the evidence before it, the Court found that reliable principles support this theory, at least at that stated level of generality. Nor did the defense challenge the reliability of the basic method used by Mr. Coleman and other firearms examiners, i.e., the use of a comparison microscope to observe these marks on bullets and cartridge casings. In addition, reliable principles permit a conclusion that a firearm cannot be excluded as the source of a recovered casing or bullet; indeed, this limited conclusion is supported by the reliable principle that firearms leave toolmark impressions on discharged cartridge casings and the reliable method of viewing those impressions under a comparison microscope. As the defense acknowledges, such a conclusion does not imply a particular statistical weight, and furthermore, it does not stray into territory unsupported by reliable principles and methods, such as a conclusion that a firearm “matches” or was the source of a particular casing.

Accordingly, the Court ruled that the government’s proffered expert, Mr. Coleman, may testify and give general specialized opinion testimony in this case. Mr. Coleman may describe the work he performed and the comparisons he made; he may describe the basis of his conclusion regarding the physical consistency of the toolmarks that he observed; and he may make, as the Defendant concedes, a comparison of the samples based on class characteristics. In sum, Mr. Coleman may conclude that based on his examination and the consistency of the class characteristics and microscopic toolmarks, the recovered firearm cannot be excluded as the source of the cartridge casing found on the scene of the alleged shooting—in other words, that the firearm may have fired the recovered casing. Mr. Coleman may not state an ultimate conclusion in stronger terms. Similarly, Mr. Coleman will be precluded at any point in his
testimony from stating that individual marks are unique to a particular firearm or that observed individual characteristics can be used to “match” a firearm to a piece of ballistics evidence.

In fashioning this ruling, the Court found that the government’s alternative proposals for expressing Mr. Coleman’s opinion did not adequately address the concerns raised by the Daubert factors. The government’s proffer that Mr. Coleman could testify that, based on his training and experience, he believes that the recovered cartridge casing was fired from the recovered gun, represents no improvement over a simply-stated opinion that a recovered casing was fired from a particular gun, even if Mr. Coleman also expressed his opinion with the limitations on certainty statements imposed by the Court of Appeals. In this alternative, the expert would be characterizing his opinion as his own personal opinion—as any expert must—but would still be making a source attribution statement not sufficiently supported by reliable principles and methods.

Similarly, the Court strongly disagrees with the government that cross-examination could cure any reliability issues created by a source attribution statement. Of course, the Daubert decision recognized, and other courts have noted, that “[v]igorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence.” 509 U.S. at 596; see also Motorola Inc., 147 A.3d at 754. While cross-examination may often play such a role, this discipline and the disputes surrounding it seem far too complex for a series of questions on cross-examination to allow a full understanding of the limitations of the field. Indeed, a full

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16 Some cases have premised findings of the ability of cross examination to illuminate questions regarding the foundational validity of this discipline on the supposed simplicity of the issues involved. “These weaknesses [in the methodology of toolmark identification] are also not particularly complicated or difficult to grasp, and thus are likely to be understood by jurors if addressed on cross-examination.” Johnson, 2019 U.S. Dist LEXIS 39590, at *58, 2019 WL 1130258, at *19; see also Johnson, 2015 U.S. Dist. LEXIS 111921, at *8, 2015 WL 5012949, at *3.
exploration of the issues surrounding the reliability of this evidence in the present case required several days of testimony from multiple expert witnesses, close evaluation of numerous applied-science studies, exploration into the studies’ design and methodology and the problems arising therefrom, and advocacy by counsel on each side specially tasked with litigating forensic science issues. It would be fanciful to conclude that the normal adversarial process would enable a lay jury to adequately understand these issues, and it is similarly unrealistic to conclude that the average attorney in the average trial would be able to raise these issues in front of the jury in this fashion, particularly when this issue would be one among many issues to be presented to the jury in a trial. Ultimately, Judge Rakoff’s characterization in Glynn captures the essence of this issue:

> [O]nce expert testimony is admitted into evidence, juries are required to evaluate the expert’s testimony and decide what weight to accord it, but are necessarily handicapped in doing so by their own lack of expertise. There is therefore a special need in such circumstances for the Court, if it admits such testimony at all, to limit the degree of confidence which the expert is reasonably permitted to espouse.

578 F. Supp. 2d at 571.

For all of these reasons, the government’s expert may testify that based on his examination, the recovered firearm cannot be excluded as the source of the cartridge casing found on the scene of the alleged shooting. This formulation of the expert’s opinion is limited to the principles and methodologies which the evidence supports as sufficiently reliable. Any statements by the expert involving more certainty regarding the relationship between a casing and a firearm would stray into territory not presently supported by reliable principles and methodology.
IV. COHERENCE WITH recent district of columbia court of appeals precedents

The Court of Appeals issued its opinion in Williams II after the Daubert hearing was held in this case. Upon request of the Court, both parties filed additional pleadings to address what, if any, effect Williams II should have on the Court’s present determination.

After his conviction for first-degree felony murder while armed and other related offenses, Marlon Williams appealed his convictions—arguing, inter alia, that the trial court should not have permitted the government’s firearms examiner to testify, based on pattern-matching, that the gun recovered from Mr. Williams’s apartment was the murder weapon. Williams II, 210 A.3d at 737 (citing Williams v. United States (Williams I), 130 A.3d 343, 345, 347 (D.C. 2016)). At trial, the examiner testified that he microscopically examined the markings on three bullets recovered from the decedent’s vehicle and that they matched the markings on the bullets test fired from the gun recovered from Mr. Williams’s apartment. Williams II, 210 A.3d at 738. The expert further opined, “these three bullets were fired from [the recovered] firearm.” Id. On re-direct, the examiner also testified that he had no “doubt in [his] mind” that the recovered bullets were fired from the recovered gun. Id. The Court of Appeals initially affirmed Mr. Williams’s convictions, holding there had yet to be any precedent in the District of Columbia “limit[ing] a toolmark and firearms examiner’s testimony about the certainty of his pattern-matching conclusions.” Williams I, 130 A.3d at 347–48. On re-hearing, and relying on its intervening decision in Gardner, the Court of Appeals subsequently held it was error to allow the examiner to provide “unqualified opinion testimony that purports to identify a specific bullet as having been fired by a specific gun via toolmark pattern matching.” Williams II, 210 A.3d at 742–43. In Gardner, the Court of Appeals had held that “a firearms and toolmark expert may not give an unqualified opinion, or testify with absolute or 100% certainty, that based on
ballistics pattern comparison matching a fatal shot was fired from one firearm, to the exclusion of all other firearms.” 140 A.3d at 1177. The Court of Appeals did note, however, its decision allowed examiners to “offer an opinion that a bullet or shell casing was fired by a particular firearm,” just not with “absolute or 100% certainty.” Id. at 1184 n.19.

Williams II appears to extend, or at least clarify, the Court of Appeals’ holding in Gardner, even if not resolving the apparent contradiction between the language that appears in the text and in footnote 19 of the earlier case. See Williams II, 210 A.3d at 740–43. Not only does Williams II prohibit source attribution statements made with certainty, but it also prohibits any statement that conveys a “match” without sufficient qualification. See id. at 742–43. In Gardner, the “unqualified opinion” admitted in error was simply that the bullet recovered from the decedent’s body and cartridge casing recovered from the crime scene were fired from the recovered firearm. 140 A.3d at 1182. The testimony was, “[i]n essence,” that “[the recovered gun] was the murder weapon.” Id. On re-direct, the examiner reiterated his opinion by stating the recovered bullet “was fired from the pistol.” Id. Similarly, in Williams II, the examiner concluded, “these three bullets were fired from this firearm.” 210 A.3d at 738.17 The Court of Appeals disparaged the government’s argument—repeated as one of the bases of the post-hearing briefs filed in this case—that Gardner’s limitation on firearms and toolmark testimony only applies to certainty statements. See Williams II, 210 A.3d at 740. In sum, Williams II barred “unqualified” statements of “match” and source attribution. Id. at 742–43. The Court of Appeals failed, and thought it unnecessary, to address what type of qualification could make such a statement admissible. Id. at 741–42 (“We ultimately conclude that we need not resolve

17 On re-direct, the examiner said more about the uniqueness of the markings of the recovered firearm, Williams II, 210 A.3d at 738, but the Court of Appeals’ ruling did not turn on the examiner’s additional statements. cf. id. (“[W]e conclude that it was error to admit the examiner’s opinion testimony, based on pattern matching, that the gun recovered from Mr. Williams's apartment was the murder weapon.”).
the ambiguity of *Gardner*’s footnote 19 in this case where the firearms and toolmark examiner not only testified, like the examiner in *Gardner*, that a specific bullet could be matched to a specific gun, but also that he did not have “any doubt” about his conclusion.”). Judge Catharine Easterly indicated in her concurrence, however, that an examiner might be able to testify that a specific bullet was fired by a specific gun if he could “reliably qualify” his opinion with a “verifiable error rate.” *Id.* at 746 (Easterly, J., concurring).

The extent to which these cases should affect the Court’s decision seems a bit unclear. *Williams II*, like *Gardner* before it, reviewed trials that occurred in the pre-*Motorola* era, but nonetheless invoked the language of reliability in a manner more consistent with *Daubert* and Rule 702 than *Frye* and *Dyas*. See *Williams II*, 210 A.3d at 742. Although the Court’s present decision has been made pursuant to *Daubert* and Rule 702, it restricts the firearms examiner’s testimony such that he may not make a source attribution statement connecting the firearm and cartridge casing. This ruling fully comports with, and may even be compelled by, the strictures imposed by *Williams II* and other relevant precedent.18

For these reasons, as well as any others stated on the record in open court on August 8, 2019, Defendant’s Motion has been GRANTED IN PART and DENIED IN PART.

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18 Although not addressed by this Memorandum Opinion, Mr. Tibbs also challenges whether Mr. Coleman reliably applied the AFTE method in this case. Based on the Court’s present understanding of this aspect of Defendant’s argument, this challenge would only be appropriate if Mr. Coleman were permitted to testify to a “match” (i.e., that the recovered cartridge casing was fired from the recovered firearm). That, of course, is not the case; Mr. Coleman is restricted to testifying to his work, his observations, and the ultimate conclusion that the recovered firearm cannot be excluded as the source of the cartridge casing. It is not evident to the Court that the Defendant’s argument applies to Mr. Coleman’s application of the methodology given the restriction on any ultimate conclusion he would render. Accordingly, Defendant’s Motion as it relates to Mr. Tibbs’s as-applied challenge is denied as moot.
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(Signed in Chambers)