

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MARYLAND**

UNITED STATES OF AMERICA :

v.

JOVON MEDLEY

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Criminal No. PWG-17-CR-242

**Statement of John Nixon
Regarding the Validity of Firearm & Tool Mark Identification**

Personal Background

- 1 I John Nixon state that the following is true to the best of my knowledge:
- 2 I am originally from the United Kingdom, where I worked as a scientist and professional engineer for the UK government, conducting weapons systems research, design, development, performance testing, mid-life improvement, reverse engineering, and forensic examinations, including firearms. I am a professional engineer with a first class honors degree in mechanical engineering (recognized in the US under the terms of the Washington Accord) and a master's degree in business administration. I am a board certified forensic engineering scientist (IBFES). I am a Fellow of the Institution of Mechanical Engineers, a Fellow of the American Academy of Forensic Sciences, and a member of several other technical / professional societies.
- 3 I completed a 4 year engineering apprenticeship that covered mechanical and production (industrial) engineering. My apprenticeship involved both college study / examinations, and extensive practical workshop training in the use of both hand tools and machine tools. I am an NRA certified firearms/personal protection instructor and range safety officer. I qualified as a factory certified SIG firearms law enforcement armorer with 100% test scores. An armorer is someone who is certified by a manufacturer to inspect, assess, and repair problems with their firearms.
- 4 I am currently a consultant with Athena Research & Consulting LLC in Bippus, Indiana, specializing in technical and forensic consulting in the areas of firearms, ballistics, munitions, incident scene reconstruction, and explosives. I have conducted extensive forensic engineering research and hold patents for innovations in munitions design. I have published numerous research papers and technical articles, including items on firearm identification and tool mark analysis. I have presented training seminars to numerous groups of investigators, attorneys, engineers, law enforcement personnel, medical professionals, and students. My courses are certified for continuing education credit in numerous jurisdictions, and by the Indiana Supreme Court. Clients include

insurance companies, attorneys, defense contractors, municipal, state, and federal governments.

- 5 In addition to testifying in UK courts, I have testified as an expert approximately 70 times in numerous US Federal Courts, the District of Columbia, and many state courts, including Indiana, Illinois, Iowa, Kansas, New York, Maryland, Florida, and Kentucky. I have worked for both defense and plaintiff / prosecution.
- 6 My engineering apprenticeship included extensive education and practical training in the manufacture of machined components from metals, and other materials. I was required to pass proficiency tests in the manufacture of components using both hand tools, and machine tools, including drills, boring machines, vertical & horizontal milling machines, shaping machines, slotting machines, lathes, surface grinding machines and bench grinders. My education and training included additional component manufacturing methods, such as casting, forging, welding etc. These are the same processes and techniques used in the manufacture of firearms and ammunition.
- 7 I was required to manufacture test specimens to specified tolerances and surface finishes. In order to manufacture a component to a specified surface finish one needs knowledge of tool marks, how they are created, and how to reduce them to acceptable levels.
- 8 I have extensive knowledge and/or experience in the design of components, and manufacturing techniques, of precision investment casting, polymer injection moulding, metal matrix composites, polymer/glass/carbon/Kevlar composites, forging, and metal injection moulding (MIM).

Executive Summary

Firearms toolmark comparison has been used for decades to link suspect firearms to discharged ammunition components recovered from crime scenes and bodies. The basic concepts behind the discipline were that discernible uniqueness (individuality) exists and is, in most cases, reliably reproduced. These basic concepts of the discipline were largely accepted without question because their validity had not been evaluated by bona fide scientists. Prosecutors accepted firearm toolmark analysis because their prosecutions relied upon it, and the non-scientist practitioners (represented by trade association the Association of Firearms and Toolmarks Examiners – AFTE) accepted it because they knew no better and/or their perception was that their livelihoods depended upon it.

In the 1990s the criminal defense community began to seriously question the validity of the core concepts upon which firearms toolmark identification was based, and in the mid 2000s the US Federal Government commissioned the National Academies of Science (NAS) to review a range of forensic science techniques and crime laboratory procedures. The NAS review committees were comprised of the world's leading scientists and jurists. NAS published its findings in two reports in 2008 and 2009. The 2009 NAS Report was highly critical of the firearms toolmarks discipline and a number of related laboratory issues, such as the relevance of lab employee education, the bias inherent in law enforcement administered labs, and the quality of laboratory

reports. One finding communicated in the 2009 NAS Report was that there were no valid scientific studies demonstrating the foundation of firearms toolmark identification – i.e. that discernible uniqueness does not exist.

In response to the 2009 NAS Report, trade association AFTE initiated studies with the claimed objective of establishing that discernible uniqueness exists. In 2015, the Obama Whitehouse commissioned another study via the President's Council of Advisors on Science & Technology (PCAST). The PCAST Report was published on 20 September 2016, and dismissed as flawed and invalid all studies purporting to have demonstrated the existence of firearm toolmark discernible uniqueness. In response to the PCAST Report trade association AFTE submitted further studies in support of their claim that the discipline was scientifically valid. The PCAST Committee issued an Addendum to their Report on 6 January 2017 - it condemned as invalid all studies except one¹.

In summary, the current situation is that the firearms toolmarks discipline is accepted and promoted as valid by non-scientists with a vested financial interest in securing its continuation. The discipline is dismissed as invalid and unreliable by several organizations populated by the world's leading scientists and jurists – organizations and individuals who stand to gain nothing if the discipline is ruled as inadmissible in litigation.

Section A General Firearms Toolmarks Discipline Observations

- A1 Many firearms and tool mark examiners in the US are members of the Association of Firearms and Tool Mark Examiners (AFTE). AFTE is a trade association, and membership of the organization is neither a requirement for employment as a firearms examiner, nor a requirement to be a court qualified expert in the firearms toolmarks discipline.
- A2 AFTE has no specified educational requirements for admission to membership. AFTE has no specified level of education, neither do they have a required educational discipline. The only real requirement to be a member of AFTE is to be employed as a firearms and tool mark examiner. During my casework I have encountered AFTE members with no degrees, associates degrees, and bachelor's degrees in an array of disciplines, including English literature, psychology, sociology, anthropology, nursing, history, government & politics, criminal justice, agriculture, communications, and others.
- A3 AFTE members frequently cite brief tours of firearms and ammunition manufacturing facilities as proof of their expertise in firearms, ammunition, machining, manufacturing, and tool marks. This is analogous to touring a hospital and claiming to have acquired the expertise to be a doctor or surgeon.
- A4 Instead, AFTE members' expertise is effectively in comparing patterns of lines and / or discrete features, and this expertise comes from training and experience. And yet,

¹ The Committee were prepared to concede that the Ames study was valid but that one study was insufficient grounds to support the validity of the discipline. I consider that the Ames study is invalid for reasons that were not apparent to the PCAST committee.

AFTE's 'Theory of Identification', which was formulated without input from scientists & engineers with relevant education and expertise, is the only guidance in the field, and solely relied upon by most firearm and tool mark examiners to make the leap from their observance of corresponding patterns to their identity of a particular firearm to a high degree of certainty. Along the same lines, all of the studies cited as 'validation studies' for the field of firearms and tool mark identification were conducted by AFTE members, 'peer-reviewed' by AFTE members, and published through trade association AFTE. These studies are flawed and would likely not have made it through the peer-review process required by legitimate scientific journals with more rigorous standards and reviewers with knowledge of proper experimental design and a lack of vested interest in the study results. I discuss these studies further in Sections B&C.

- A5 Additionally, while it is common for crime lab examiners to link fired exhibits to suspect firearms using individual characteristics (when there is deemed to be sufficient agreement) it is extremely rare for them to eliminate a suspect firearm when the individual characteristics are substantially different – 'can neither be identified or eliminated' or 'inconclusive' are the usual phrases used in such instances..
- A6 The state of the science backing the firearms and tool mark field is far more accurately depicted in the 2009 NRC and 2016 PCAST reports. I concur with the NRC & PCAST as to the limitations on the field given the lack of objective standards, defined match criteria, and more generally, their findings regarding the flaws in the design, protocols, and analytical techniques employed in the so called validation studies that have been conducted by AFTE and their surrogates. The studies quoted use pristine ammunition components that have been fired into water tanks. In such instances 100% of the ammunition component's undistorted area is available for examination and comparison. In real casework it is more usual to encounter bullets that have impacted hard materials such as bone, concrete, automobile bodies etc. These bullets are usually deformed at best, fragmented at worst. Additionally, cartridge cases from incident scenes are frequently crushed or otherwise damaged due to the passage of human and/or vehicular traffic, and may receive small dings and scratches due to the simple act of impacting the ground during the routine ejection process. Further, many of the studies involved a select group of 10 or fewer examiners from the FBI Firearms Unit. These studies take no account of real world conditions where less experienced examiners are working under high stress conditions, under tight deadlines, with less than perfect equipment, and without prior knowledge of what to expect from the exhibits they have under the comparison microscope. Additionally, many of the studies use brands of test firearms that are known to have significant tool marks.
- A7 There are many methods of firearm barrel manufacture, and the lands and grooves may be created in different ways. The particular manufacturing technique is very important to the consistency, accuracy, and character of the rifling and the individual characteristics. For example, button rifled barrels have far fewer defects (and thus leave less individual and sub-class marks) than cut rifled barrels, and hammer forged barrels² tend to have the

² The problem of identifying bullets fired from hammer forged barrels is perhaps best exemplified by the Glock pistol. It is so difficult to positively identify or eliminate bullets fired through Glock barrels that the Miami police were unable to determine which officers had fired bullets recovered after officer-involved shooting incidents. This led to the development of the Glock 'Miami' barrel - a batch of Glocks that had significant defects manufactured into their

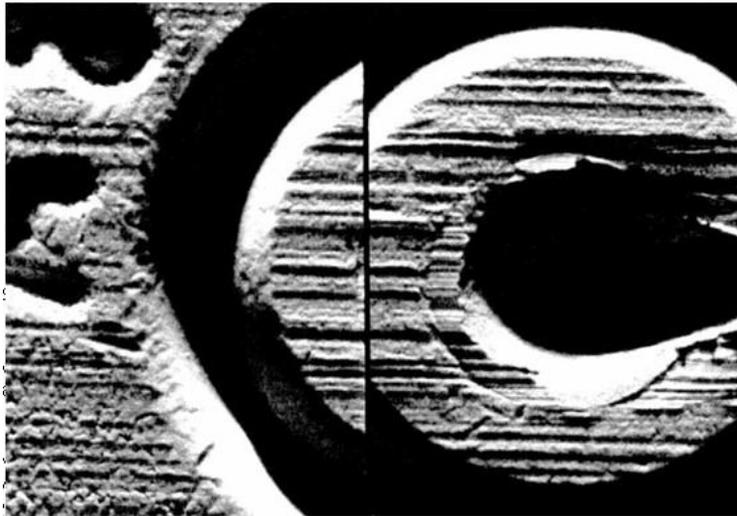
least marks of all. Many of the “validation studies” utilize barrels that have cut rifling, and this means that the potential for tool chatter and other generation type defects is greatly increased, thereby making identification of fired components easier.

- A8 In addition to the magazine lips, the feed ramp, and the chamber throat, the common semi-automatic pistol components that leave marks on cartridge cases and their primers include the firing pin, the breech face, the extractor, the ejector, and loaded chamber indicators. These components may be manufactured by a wide variety of techniques, including stamping, machining, casting, metal injection molding, and forging. These components may receive surface finish refinements (polishing, plating etc) and heat treatment. These finishing processes reduce the number of individual characteristic marks, and reduce the potential for the components to acquire in-service individual characteristics by wear, abuse, or corrosion.
- A9 Firearm examiners rely heavily on ‘validation studies’ to support the underlying assumptions of the firearms and tool marks discipline, as well as the subjective methodology employed by firearms examiners. However, as the NRC found, these studies do not serve either of these purposes. Firearm examiners seem to misunderstand what a validation study is. A validation study examines how a methodology performs under a range of conditions that could be encountered in applying the technique, in order to test the methodology’s limitations. For example, a firearms validation study might use firearms produced by a whole range of manufacturing techniques, firearms of different calibres, firearms that operate by differing principles, the entire range of ammunition types, varying degrees of damage to ammunition, etc. The “validation studies” frequently cited by prosecutors do not come close to achieving this goal. They are, in actuality, proficiency tests performed under unrealistic conditions – and proficiency tests cannot be used to validate a methodology. Claims of validity are premised on the assumption that these flawed studies actually validate the firearm and tool mark discipline; and as independent scientists have reported, they don’t come anywhere close to validating it.
- A10 Firearms examiners cite the AFTE Theory of Identification ‘sufficient agreement’ standard by claiming that 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. This claim is simply incorrect, and impossible. The view through the comparison microscope yields a two dimensional image, so the height, depth, and curvature of any observed features cannot reliably be assessed, and certainly cannot be measured.
- A11 Reviewing the bench notes in this case it is apparent that no descriptions of the height, depth, or curvature of individual characteristics were recorded. In other words, 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 – and in most cases (for common class characteristics), cannot limit the pool beyond several brands and models. Any

barrels so that firearms examiners would at least have a chance of making a positive identification or elimination with some degree of confidence. Administrators still had reservations concerning the ability of firearms examiners to correctly identify bullets fired through these barrels, despite the large defects purposefully manufactured into them.

features that the examiner might be using beyond these are not described or “defined” in any way. Photographs that accompany the bench notes do not include notations to describe which individual characteristics the examiner relied upon in drawing his conclusions.

- A12 The issue of sub-class characteristics is a persistent problem for the firearm and tool marks discipline. Sub-class characteristics are features accidentally imparted to the manufacturing tool as part of the tool/firearm manufacturing process – typically a group of imperfections – and are common to an entire batch of manufactured components (eg firing pins) produced by an imperfect manufacturing tool. By definition, these characteristics are unpredictable and appear on components of unknown batch size. Because the manufactured components may be installed in many firearms, perhaps several brands and/or models of firearms, it is extremely difficult, and potentially impossible, to determine either the size of a given batch of components that have sub-class characteristics, or their distribution in the population of firearms in circulation. This makes systematic scientific study and evaluation of the phenomenon all the more important. However, systematic scientific study and evaluation has not been attempted. This is why the AFTE Theory of Identification – while it concedes that sub-class characteristics exist and should be treated with caution – does not actually define or describe sub-class characteristics, nor does it explain what kind of sub-class characteristics might be associated with different tools/firearms, or different tool/firearm manufacturing techniques.
- A13 Despite this, many firearms examiners claim that they are constantly vigilant for the presence of sub-class characteristics in their casework. However, the only way to determine that observed marks are sub-class versus individual in nature is to examine other firearms with components from the same batch as the suspect firearm; this enables the firearm examiner to distinguish and filter out marks that are common to the suspect weapon and the other firearms from the same batch, or other brands of firearms incorporating the components from the same batch. This is not how firearms examinations are conducted; rather, firearms examinations are conducted as a side-by-side comparison between a questioned bullet or cartridge case and a bullet or cartridge case test-fired from a suspect firearm - assuming that one has been recovered. Without examining firearms with components from the same batch, the examiner will never know for sure if the observed characteristics are individual, or sub-class – and will most likely assume individual. This is even more likely to happen if the sub-class characteristics are prominent compared to any individual characteristics. For an example see the picture below, which shows a microscopic comparison of breech face marks on cartridge cases fired from two different Smith & Wesson pistols, showing “an alarming example of sub-class characteristics that could be mistaken for individual characteristics.” The concept of discernible uniqueness needs to be disproven only once – this is one example.



G. Rivera, *Subclass Characteristics in Smith & Wesson SW40VE Sigma Pistols*, AFTE Journal, Vol 39, No. 3, pgs. 247 and 251 (2007). If we were to screen out all of the marks that appear to be sub-class in nature (the marks that appear on both of these cartridge cases, fired from two different firearms), we would be left with practically no “individual” marks. Likely, a firearm examiner who encounters these marks in casework would presume that all of the marks are “individual” in nature and use them as the basis for a “match.”

- A14 Firearm examiners frequently assert that they are constantly searching for, and are alerted to, sub-class characteristics issues. This is complete nonsense: how can an examiner be alerted to something that is unique in appearance (within one group of components of unknown group size)? In recent times firearm examiners have asserted that they are trained to distinguish subclass characteristics from individual characteristics. Clearly, by definition, this is impossible.
- A15 Firearm examiners claim that presumptive validity checks involve examiners who investigate a new manufacturing technique to check for indications of sub-class marking. This process can be of absolutely no practical value to firearm examiners. Aside from the fact that the majority of manufacturing techniques can produce sub-class characteristics, the mere determination that a manufacturing technique can produce sub-class characteristics is of no value to a firearm examiner who is examining fired components under a microscope. The examiner needs to know not only that a manufacturing process is capable of imparting sub-class characteristics on batches of firearm components, but also what the sub-class characteristics specific to a particular batch look like. This is because sub-class characteristics can vary from batch to batch, even if the same manufacturing technique is used; after all, sub-class characteristics come from imperfections in the individual tools used in manufacturing. The only way a firearm examiner can discriminate between sub-class and individual marks given the current state of the science (i.e. without systematic, scientific studies of batches of firearm components) is by examining at least two firearms (or two firearm components) of the same sub-class.

- A16 I am aware that 6 correct numbers on a lottery ticket could win me a lot of money, I am aware of the 6 numbers that were on last Saturday's winning ticket, but just because I am aware of those facts does not give me the ability to determine if the 6 numbers on the ticket in front of me on Thursday, will win the lottery drawn on the following Saturday. This is essentially what is being said with respect to awareness of the possible presence of sub-class characteristics – just because you're aware that a given brand of firearm included/produced sub-class characteristics in the past, gives you zero ability to identify future sub-class characteristics on the same brand and model of firearm, because they will be different in appearance.
- A17 Firearms examiners claim that in making an identification, they utilize sound examination methods by employing the precepts of empirical research or study in the comparison of two toolmarks. This could not be further from the truth, and it demonstrates a basic lack of understanding of what constitutes scientific research. If firearms examiners were employing precepts of empirical research they would follow validated protocols and have objective criteria for assessing potential 'matches'. They would examine more than one firearm before identifying a firearm as the source of marks on bullets/cartridge cases – not only because there would be no other way for them to put the markings they viewed in proper context (class/sub-class/individual), but also because this at least, minimally, limits bias, one of the biggest concerns of scientific study. As currently practiced, and as described by the NRC, firearms examinations are conducted in a way that is decidedly unscientific and fraught with potential bias. This puts limitations on what conclusions firearm examiners can reliably draw based upon their observations.
- A18 Firearms examiners claim that consecutively manufactured firearms are the most likely to produce similar microscopic marks on bullets and cartridge cases (subclass marks). This statement is factually incorrect. A firearm is assembled from many components, and in the case of a semi-automatic pistol, for example, the key components, from a firearms identification perspective, comprise a barrel, slide (with breech face), extractor, ejector, and firing pin. With modern business/production practices, it is common to have these components manufactured independently, in large batches, and often in separate manufacturing facilities. Some manufacturers assemble pistols from components made in different countries (SIGARMS, for one). So, if you go out and purchase two consecutively manufactured pistols, it is almost certain that few if any of the individual components of that pistol were actually manufactured consecutively. Moreover, firearms examiners claim that validity tests using consecutively manufactured specimens have not undermined the basic underpinnings of firearm and tool mark identification. They support this opinion by citing the set of 'validation studies' previously alluded to. As set forth by the NRC, and as described in paragraphs A6 to A9, even if these studies have not undermined the firearms and tool marks discipline, they certainly do not support or otherwise provide a scientific basis for firearm and tool mark identifications.
- A19 Firearms examiners point out that comparison microscopes and pattern matching have been around for a long time, and that pattern matching has enjoyed broad acceptance within the forensic firearms community for decades. These are true statements; however, the fact that firearms examiners compare patterns using microscopes, have been doing so for a long time, and most firearm examiners are content with this ambiguous methodology misses the point of recent debate among scientists. Scientists

are not critical of the fact that firearms examiners compare patterns of marks. Rather, they are critical of the comparison of patterns without specified and validated criteria to give meaning to any observed similarity between patterns.

- A20 The 2009 NRC Report concluded that firearms and tool mark examiners have not demonstrated an ability to reliably match markings observed on bullets and cartridge cases to a particular firearm. The opinions of the 2009 NAS Report have been supported and reinforced by the 2016 PCAST Report. It is my opinion that these findings, and the other firearm-related findings and conclusions of this report, are well-informed and legitimate. Until a specific protocol for the examination and categorization of tool marks on fired ammunition has been formulated and validated by appropriately qualified scientists, engineers, and statisticians, then the discipline of tool mark analysis must be considered an unproven 'science', or pseudo-science, at best – and, in actuality, more of a subjective art.
- A21 The National Integrated Ballistics Information Network (NIBIN) was initiated in 1999 and it is an automated search system where images of fired ammunition components are photographed and entered into the computer database. When photographs of fired ammunition exhibits from other crime scenes are subsequently entered, the system seeks to identify evidence that may have been used in the same firearm. The system typically returns many candidate items, and it is left to a human examiner to physically compare the items to see if a 'match' can be confirmed. The fact that a human is required to complete the process is evidence of the subjective nature of this discipline, because if items of evidence discharged from the same firearm truly exhibited a significant number of individual characteristics, a computer search of the images would be able to confirm a 'match' or elimination without human assistance.

Section B Comments Relating to Documents Submitted in this Case

- B1 I was supplied with, and have reviewed, the discovery produced to the defense—dated January 22, 2018 and February 28, 2018—including the bench notes and report produced by Mr. McVeigh (MD) and Mr Chase (DC), the firearms examiners in this case. I have also reviewed the 2009 NRC report, *Strengthening Forensic Science in the United States: A Path Forward*, and the 2016 PCAST Report on Forensic Science, and the subsequent addendum to that Report.
- B2 The Prince George's County, MD, crime lab analysis (16 Jan 2017) included a search of the FBI General Rifling Characteristics (FBI/GRC) database. The result was that the exhibits examined could have been fired by firearms from 33 different manufacturers (the number of individual models was not reported).
- B3 This case includes reference to a NIBIN search and 'hit' reported by the DC MPD (Mr Chase). In this case the supplied reports and bench notes do not specify how many candidate exhibits NIBIN returned. There is also reference to a NIBIN search reported by the PG County. This search did not return any candidate for human examination.

- B4 Rock Island Armory (the manufacturer of Exhibit 2 – the claimed incident firearm) was not among the brands returned by the FBI/GRC database search.
- B5 In this case the exhibits from the Maryland crime scene were compared to one another and declared to have been fired from the same unknown firearm. A firearm was recovered in a DC case, and it was concluded that the firearm had discharged the fired ammunition exhibits in the MD case.
- B6 The crime labs in this case are accredited by American Society of Crime Laboratory Directors Laboratory Accreditation Board. This accreditation is based on meeting the requirements of (1) ISO/IEC 17025:2005. The laboratory also operates under the terms of its license issued by the State of Maryland Department of Health and Mental Hygiene Office of Health Care Quality.
- B7 ISO/IEC 17025:2005 reporting requirements stipulate:
“When opinions and interpretations are included, the laboratory shall document the basis upon which the opinions and interpretations have been made. Opinions and interpretations shall be clearly marked as such in a test report.”
ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories, Para 5.10.5.
- B8 ISO/IEC 17025:2005 record keeping requirements stipulate:
“The laboratory shall retain records of original observations, derived data and sufficient information to establish an audit trail.... The records for each test or calibration shall contain sufficient information to facilitate, if possible, identification of factors affecting the uncertainty....”
ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories. Para 4.13.2.1
- B9 ASCLD/LAB-International requires that forensic scientists and laboratory managers:
“Make and retain full, contemporaneous, clear and accurate records of all examinations and tests conducted, and conclusions drawn, in sufficient detail to allow meaningful review and assessment of the conclusions by an independent person competent in the field. Reports are prepared in which facts, opinions and interpretations are clearly distinguishable, and which clearly describe limitations on the methods, interpretations and opinions presented.”
American Society of Crime Laboratory Directors / Laboratory Accreditation Board (ASCLD/LAB), Supplemental Requirements for the Accreditation of Forensic Science Testing Laboratories, 2010, 32.
Requirements for the Accreditation of Forensic Science Testing Laboratories, 2010, 32.
- B10 ASCLD/LAB-International further requires that:
“Records to support conclusions shall be such that in the absence of the analyst (however named), another competent reviewer could evaluate what was done and interpret the data.”
American Society of Crime Laboratory Directors / Laboratory Accreditation Board (ASCLD/LAB), Supplemental Requirements for the Accreditation of Forensic Science Testing Laboratories, 2010, 9.

- B11 The documentation provided in this case does not divulge the data upon which the conclusions were drawn. The lab reports merely state conclusions without presenting raw data or analyses that are the bases for those conclusions. For example, the number of striations present on a fired bullet are not stated, and the number and location of striations being claimed to be in agreement are not disclosed. There is insufficient data for an independent reviewer to confirm the examiner's findings, nor assess the likely rate of error.
- B12 Additionally, the supplied photographs depict only a small (and unspecified) percentage of the total area of the exhibits, so any reviewer can only guess what features may be present on the remaining (majority) of the exhibits. Further, no annotation or notes are provided to indicate what areas visible in the photographs are being claimed to be in agreement, and what areas are being accepted as not in agreement.

Section C: Proper Limitations on Conclusions

- C1 It is my understanding that the prosecution firearms examiners in this case wishes to testify that cartridge cases and bullets were fired from a particular firearm – this is a conclusion of absolute identity, akin to the phrase 'to the exclusion of all other firearms in the world' or 'to a reasonable degree of scientific certainty' or a 'practical certainty'. All of these commonly used phrases express a conclusion of identification to either an absolute or very high degree of certainty. The NRC found, and I agree, that firearms examiners have not established that they can identify to any degree of certainty, much less high certainty. It is my view that these conclusions give far too much weight and credence to a process that has not yet been scientifically validated.
- C2 When I examine and compare fired ammunition I am often inclined to declare that two pieces of ammunition were fired from the same firearm. I must resist this temptation because I realize that I would be making a conclusion based upon 'gut feeling' rather than a firm science that could be statistically validated and proven.
- C3 The NRC report says that firearms examiners have not demonstrated that their methodology allows them to reliably identify a particular firearm to any level of certainty. The AFTE Theory of 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.”

“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;”

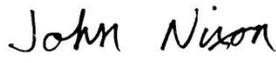
NRC, *Strengthening Forensic Science in the United States: A Path Forward*, pp. 154-55 (2009).

Even a conclusion of 'more likely than not' communicates an identification opinion to a degree of certainty, albeit not a high degree of certainty. A conclusion that would be completely in line with the NRC's findings, as well as accurate, is a conclusion of 'cannot exclude'. This communicates that I am drawing an association between a pattern of markings and a particular firearm, but I cannot narrow the pool of potential contributors down to one (as an identification conclusion to any degree of certainty would do). With the current limitations on the firearm and tool mark discipline, which are accurately described in the NRC & PCAST Reports, this is the most that the state of the 'science' reliably allows.

The preceding information represents my opinions, which are based upon the application of my scientific and engineering expertise to the critical evaluation of the current state of the discipline of forensic firearms and tool mark examination. I reserve the right to amend, correct, or modify this document should new information become available to me, or errors detected.

I affirm under the penalties of perjury that, to the best of my knowledge and ability, the foregoing representations are true & correct.

Date: 21 March 2018


John Nixon

References:

- [1] National Academies of Science, **Strengthening Forensic Science in the United States: A Path Forward**, National Research Council, Washington DC, 2009. 328pp. (National Academies Press 2009). ISBN-13: 978-0-309-13135-3 (hardcover). ISBN-13: 978-0-309-13131-5 (pbk.). pp. 150-155
- [2] **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 (PCAST), 160pp, Sept 2016.