The CACNews

News of the California Association of Criminalists • Third Quarter 2007

Lowell W. Bradford
1918 - 2007

The President's Desk

It Takes All of Us

When I joined the association just over ten years ago, the new members reception that I attended was very intimidating. I was new to the field, fresh out of school, and hoping for a job. The comment that stuck with me from that first reception was, "You get out of it what you put into it." I didn't think much about that comment during my early years as a member. I was one of those people that thought the business meeting was a time to go shopping. I never considered getting more involved as the Association seemed to be doing okay without my help.

Then someone suggested I start volunteering for committees. I started on the ethics committee, which luckily was quiet. Then on to the awards committee, and endowment for a very short tenure before becoming president-elect. This past year as president-elect has been an eye-opener.

The California Association of Criminalists was created to facilitate an exchange of information among criminalists in California. I think the most important thing we do is provide a venue for all of us to gather and discuss what is new in our field. We can step away from the procedures and practices of our own labs and see how other labs are solving problems. But it's not just about the conferences any more.

Now we are able to give scholarships and money for research projects, provide money for classes, and provide video tapes of classes through our training committee. It takes all of us to make this happen, not just a few who want to keep it going. We are 700 strong, but getting people to run for office is like pulling teeth. I know we are all busy, casework is never ending and management sometimes appears to be unsympathetic, but we are all necessary to make us even stronger in the coming years. This next year is going to be a very challenging one.

We have legislation coming up that will affect all of us and not necessarily for the best. We are not only going to have to represent our needs to the state, but carry on our day-to-day business.

Help is what I am asking for. Help to fill committee positions and to run for the board when a position opens. We are not single-minded people. We have skills other than science, whether it is writing, dealing with numbers or organizing events. We each have something to offer that would benefit the association as it progresses forward. At the new member reception in May, I saw a lot of new enthusiastic faces. I look forward to seeing these new faces stepping up and participating in this association that serves us all so well.

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I want to thank the members of the association for allowing me to serve you as president. This next year looks to be exciting!

Julie Leon
CAC President

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On the cover...
One of the CAC's founders, Lowell Bradford, passed away in April, 2007. Inside this issue: The history of the CAC in Lowell's own words.

The *CACNews, ISSN 1525-3090,* is published quarterly (January, April, July, and October) by the California Association of Criminalists (CAC), Editorial Secretary, c/o Bureau Alcohol, Tobacco and Firearms, 355 N. Wiget Lane, Walnut Creek, CA 94598-2413, (925) 280-3623, ronald.g.nichols@usdoj.gov.

The CAC is a private foundation dedicated to the furtherance of forensic science in both the public and private sectors.

Nonmember subscriptions are available for $16 domestic, $20USD foreign—contact the editorial secretary for more information. Please direct editorial correspondence and requests for reprints to the editorial secretary.

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The deadlines for submissions are: December 1, March 1, June 1 and August 15.

FEATURES

CAC*Bits*

CAC member Steve Dowell explains his procedure on a recent episode of Court TV's series, North Mission Road. *The episode, which aired April 24, was titled "Telltale Bones."*

New Slate of Officers Approved

The CAC Board of Directors welcomes newly elected members Michael Parigian, Ventura Sheriff, for the office of treasurer; Janet Anderson-Seaquist, Ventura Sheriff, for the office of regional director, south; Ron Nichols, ATF, for the office of editorial secretary and Jennifer Mihalovich, Oakland PD, for the office of president-elect.

We thank the outgoing board members for giving so much of their energy and creativity throughout their years of service to the CAC. Jim Stam leaves the board as immediate past president, being replaced by John Simms. Angel Moore retires as treasurer and Wayne Moorehead as regional director, south.

CAC October Meeting Call for Papers

The organizers of the fall CAC seminar, to be held in Berkeley, October 15-19, are requesting papers for presentation at the general and DNA sessions. Papers covering all topics and disciplines are welcome. Please submit abstracts in 500 words or less to Michelle.Halsing@doj.ca.gov or Eric.Halsing@doj.ca.gov. Abstracts should include the submitter's name, agency and contact info. The preferred format for presentations is MS Powerpoint.

Bob Blackledge Announces New Book

Rober Blackledge has edited a new book titled, "Forensic Analysis on the Cutting Edge: New Methods for Trace Evidence Analysis." With a foreword by Peter DeForest and contributions by 28 authors (including several CAC members) the table of contents includes such intriguing topics as "All that Glitters is Gold" and "Untangling Tape and Trace Evidence." The book is published by Wiley Interscience.

CAC Co-Founder Lowell Bradford, 1918-2007

Lowell W. Bradford passed away April 12, 2007 at the age of 86. Lowell was a co-founder of the CAC and participated in seminars as recently as 2002.

A short bio from one of Mr. Bradford's articles. (*J. of Criminal Law and Criminology*, 1950) reveals just a small sample of his involvement in the field of forensic science.

"Lowell W. Bradford has been Director of the Laboratory of Criminalistics, District Attorney's Office, Santa Clara County, California since its organization in 1947. A graduate of the University of California where he also spent a year's graduate work in the Division of Biochemistry following war service in the Ordnance Dept., U. S. Army, he has participated in the trial of numerous cases involving expert testimony on blood alcohol tests. Mr. Bradford also serves on a part time basis in the San Jose State College Police School program and was for a time, prior to his present appointment, State Criminologist, California Division of Criminal Investigation."

At the 2002 seminar, commemorating the 50th anniversary of the CAC, Lowell presented a paper on the formation of our association. It was published in the 1st Quarter, 2003 issue of the *CACNews*, but we will reprint it here because it captures the spirit of those early years. Without Lowell and his fellow visionaries, there would be no CAC.

The Genesis of the CAC

by Lowell W. Bradford

Presented at the 100th semiannual seminar of the CAC, Huntington Beach, Fall 2002.

When I first entered into the field of criminalistics in 1947 in the California State Crime Laboratory in Sacramento, the only existing organization for the exchange of professional information in identification work was the California Division of the International Association for Identification. This small group had its origins in the identification officers of the Berkeley, Oakland and San Francisco Police Departments, of Alameda County Sheriff's Department and some of the other major cities and counties in California. This group had formed in earlier years and was responsible for the formation of the statewide fingerprint bureau in the California Department of Justice in Sacramento. This state unit developed into the Criminal Identification and Investigation Division which included a technical laboratory Section. The laboratory when I joined the staff in 1947 was staffed by Roger S. Greene and David Q. Burd.

Dave Burd took me to an IAI meeting one evening where I met the leaders of the identification bureaus. This was a very serious group of fingerprint specialists who were hungry for information on new scientific approaches to physical evidence identification processes. At that time, they performed the role of what we now know as crime scene search technicians and coordinated the physical evidence collection work within their respective departments. Some had gone so far as to acquire microscopes and performed bullet comparisons and document examinations. The group looked to us in the laboratory for help and guidance in physical evidence utilization with a great deal of fervor and zeal. Consequently, we were frequently asked to present program material for their continued education. They also provided significant political support for the inauguration of local crime laboratories.

In those days, the terms criminalistics and criminalist were not in use. Those of us in the state crime laboratory had civil service position titles of criminologist. It remained for James P. Osterburg to publish "An Introduction to Criminalistics" in 1949, which marked the beginning of the usage of the terms in this country. "Crime Investigation" by Paul L. Kirk in 1953 closely followed and gave full meaning to "criminalistics." Chapter 33 of his first edition contains doctrine which is worth frequent review.

This was the scenario in which the embryo of the C.A.C. was formed. In 1953 I attended a state meeting of the IAI in Laguna Beach together with my colleague, James W. Brackett, Jr. There for the first time we met Ray Pinker and Clark Sellers, of Los Angeles, who were also on the program. It was our first opportunity to talk shop with someone in criminalistics from California. We learned from Ray Pinker the identities of other crime laboratory people in Southern California. In our discussions we thought that it would be of value to have a shop talk meeting of all criminalists in California.

In February 1953 I sent letters of invitation to every criminalist in California (there were only 16) to attend a seminar session on April 11, 1953 to present and discuss current technical developments and professional matters. The meeting was held on that date at the laboratory of criminalistics, Dept. of District Attorney, San Jose, which was located in the Santa Clara County Hospital. The meeting took place in the hospital library because the laboratory contained only 600 square feet of well used space. In 1954 a formal organization was formed with the name California Association of Criminalists.

It was agreed to not schedule a meeting for a particular date unless it would accommodate a hundred percent of the invitees. The group was so small that the consensus was that the import of meeting content would be wasted without 100 percent participation. During the early years, missing two consecutive meetings was grounds for expulsion.

I was elected executive secretary and held that position for four consecutive years. There were no dues, only periodic assessments to meet costs which were very small. We published a newsletter of abstracts that were presented at seminars. The constitution was changed eventually to provide for a president and other officers. I published "The California Association of Criminalists" in the *Journal of Criminal Law, Criminology and Police Science*, Vol. 53, No. 3, Sept. 1962, announcing our existence.

In 1963, Paul L. Kirk and I attended the first International Meeting in Forensic Toxicology in London. There we met members of the Forensic Science Society (of Great Britain). We worked out an arrangement for the C.A.C. to utilize the Journal of Forensic Science (organ of The Forensic Science Society) as our official publication after the Journal of Forensic Sciences (organ of The American Academy of Forensic Sciences) had rejected us.

Meanwhile, the semiannual seminars continued like clockwork so that the meeting in San Francisco in the spring of 1983 marked the 30th anniversary of the C.A.C. and its seminars. Aside from bringing forth an exchange of information forum, our greatest achievement has been the creation of a Code of Ethics, which has had a significant impact upon the profession.

The people present at the first meeting were as follows: James W. Brackett, Jr., Asst. Criminalist, Santa Clara Co.; Lowell W. Bradford, Director, Laboratory of Criminalistics, Santa Clara Co.; Ronald J. Briglia, Asst. Criminalist, Orange Co.; David Q. Burd, Criminologist, State of Calif.; W. J. Cadman, Chief Criminalist, Orange Co.; John E. Davis, Criminalist, Oakland PD; Patrick Fuller, Asst. Criminalist, Oakland PD; Roger S. Greene, Criminologist, State of Calif.; Donald Harding, Criminalist, Pasadena PD; Lee F. Jones, Forensic Chemist, Los Angeles PD; Paul L. Kirk, Prof. of Criminalistics, U.C., Berkeley; George Lacey, Chief Forensic Chemist, LA Sheriff; Raymond Pinker, Chief Forensic Chemist, LAPD; Hillard Reeves, Criminalist, Richmond PD.

Lowell Bradofrd is flanked by two CAC co-founders: On his right is James Brackett, and W. Jack Cadman sits to his left.

The Editor's Desk

The Meaning of Membership

Pulling from *Poltergeist*…

…"I'm baaaaaaaaaaaack." With no one completely willing to step up to the plate and not wanting to be told I would have to stay on the CAC Board of Directors because of some bylaws stipulation, I decided to re-up for yet another two years. I don't mind. The question is, "Can *you* deal with it?"

Once again…

…the Giants are in the thick of things in the National League West not because they are that good but because everyone is simply pretty much average. With an aging 42-year old left fielder accounting for nearly a third of the Giants home runs, much of the attention is going to the starting rotation. Of course, they can't hit or go nine innings so that will only get them so far.

Provisional or affiliate…

…what is the rhyme and reason? I have found over my many years that most conflicts are the result of poor communication or unmet expectations (or, unmet expectations because of poor communication). I joined the CAC in 1989 after having spent 5 years in the profession. I did not join when I got hired by my first lab because, simply put, I was being obstinate. The lab director at the time said it was a good thing and I should join. Early in my life I didn't respond well when someone told me I "should do" something. I am thankful for maturity, aren't you?

By the time my current term is up in two years, I will have been a member of this organization for 20 years and a member of the board for over half that time. Okay, it is time for someone new! This organization is 700 strong, give me a break people! Okay, mini-rant over. In my time on the board I have seen some issues come and go but there always seem to be those that recur every once in a while. The distinction between provisional and affiliate members is one of those. Considering the passing of yet another one of the founding fathers of this organization, Lowell Bradford, I thought it would be appropriate to touch upon this touchy subject.

The California Association of Criminalists was born in an era of forensic science that might best be termed a Generalist Era. Especially in California, forensic scientists were expected to have a wide-breadth of knowledge in many different disciplines. In addition, since it was not commonly taught at the university level as a single course of study, individuals entering the field were often taken under the wing of an experienced examiner, much in the way apprenticeships were conducted in the trades. It was against this background that the California Association of Criminalists took shape. It is against this background that it finds it roots and legacy.

Since then, the forensic science community has undergone significant changes. Gone are the days of the generalist and we are now entering the era of specialization. In fact, being a generalist is considered a specialization in some laboratories that need someone with the ability to tie the different pieces of the puzzle together. ASCLD/LAB accreditation has all but cemented this concept into place with training and proficiency testing requirements that make it difficult for laboratories to efficiently work in any other way. Tight budgets and personnel management have caused us to look anew at the way personnel are allocated in the laboratory. It is considered good budget and personnel-management to delegate duties and responsibilities to different individuals who do not need the same levels of training and experience that other responsibilities require. For example, gone are the days when a single firearms examiner would input evidence from a shooting into a ballistic database, routinely correlate that entry, compare it against potential hits, pull out any high confidence candidates, examine the weapon, do additional test firing if need be, make the comparison, write the report and do the testimony. It is more efficient for the firearms examiner to spend their time doing what they can with their level of experience, concentrate on doing comparisons and interpretations. It is more efficient, but none less important mind you, for another individual who doesn't need the same level of training to perform some of the more routine duties such as data entry and everything that goes along with that.

The CAC is maintaining a standard that says criminalistics as a profession cannot be boiled down to technical procedures, written protocols and policy guidelines.

So, how does an organization with such strong roots in a generalist era operate within

Ron Nichols
CAC Editorial Secretary

the changed environment? First and foremost, it needs to be understood that by maintaining its strong position, the CAC is neither being elitist nor ignoring the new environment. Rather, the CAC is maintaining a standard that says criminalistics as a profession cannot be boiled down to technical procedures, written protocols and policy guidelines. It is a profession that recognizes the essential nature of the time-tested application of techniques for the purpose of interpreting not only the identity but the significance and meaning of the physical evidence. When the membership guidelines were established, they were done so with this philosophy in mind, recognizing that those who are just entering the field do not have the same breadth and depth of knowledge to more fully address the significance and meaning of the physical evidence beyond its identity.

If it is ever understood that an application for a provisional membership was turned down as a result of simply a job title, then the board erred in not communicating it well enough. These applications are thoroughly examined beyond job title and we take into careful consideration everything that the applicant has provided. At the same time, without further definition of the applicant's responsibilities and role within a laboratory, it is difficult to assess them without drawing on our own databank of knowledge which might not accurately reflect the position of the applicant. If one is not approved for provisional membership it is not reflective of the applicant's drive, potential or value. What it does reflect is that, at this time, the board is uncertain of the applicant's well-rounded ability to fully appreciate not only the technical aspects of the work but also the significance and interpretative aspects of what it means to apply the results to the entire picture. Affiliate membership allows the board and the association the time to develop that level of comfort, much like in the early days when an experienced criminalist would begin handing over more and more to his or her apprentice.

Affiliate members share in all the benefits of the organization, save one: voting. There is no stigma attached to being an affiliate member because it has nothing to do with an individual's value. At the same time, being able to call oneself a member of the California Association of Criminalists has to have some meaning beyond filling out an application and sending in some money. What it means is that a member is considered to have demonstrated sufficient integrity, honesty and an ability not only to follow a written technical procedure but also to assess the significance and interpret the meaning of the results in the context of a much greater picture that goes beyond being able to operate a piece of equipment.

Of course, these are personal reflections and thoughts. You're getting them because no one else has the time or inclination to take up the reins of this thing. We (and I am speaking for the editorial staff, not as a board member) invite yours as a guest editorial provided it is written in a manner that is thoughtful and courteous. No ranting allowed—that is the purview of the editorial secretary and until you take the two years of responsibility that goes along with the privilege of ranting, well, I think you get the point!

Until next time, my best to you and your families.

Ron

Generally Speaking

A response to the CAC president's 1st Q CACNews *message*

Ok John, the gauntlet is thrown! You said that you wanted debate. ["ABC, CAC, GKE & KSA's" by John Simms, *The CACNews*, First Quarter, 2007] There weren't many times that I shied from debate. Of course, I know that ABC has changed course in the last few years. I don't really agree with that change. Here are my thoughts, in brief.

Once upon a time, after much discussion, argument and debate, the country remained divided on the pursuit of certification. In a state, far to the west, the decision was made to write their own test and implement certification in California. It was decided that the exam should be one that measures general knowledge.

After all, how can a criminalist process a crime scene, examine evidence and form conclusions without a general knowledge of the categories of evidence in those examinations? Remember, evidence presented to each and every laboratory can be from anything and everything in our environment. Hmmm, does anything come to mind as you consider this? Oh yes, that maybe the scientist must have general knowledge.

I was a criminalist beginning in the public sector in Ohio. That is considered the Midwest. My job scope there was as a generalist. I processed crime scenes, general evidence screening, vehicle related deaths and/or misdemeanor events, trace evidence analyses, serological analyses, tool marks, B&E's, you name it. We were expected to be generalists, to have General Knowledge. I met John Simms during this period of my career. John was in a lab requiring analyst's to be specialists. I was in a lab requiring generalists. We met and studied microscopy together at McCrone Institute; John because of his specialty, me because I was the generalist.

The more specialized the analysts get, the less in touch with the case as a whole. Evidence will be missed, the big picture of the case will be lost, wrong conclusions will be made. Doesn't sound like the best direction for criminalistics to take.

Now I'll move to the future. I don't think that the standard under which we hold ourselves to should change, albeit science moves ahead. During my years in private practice reviewing cases, specialization began to ooze into criminalistics. This is what I observed in the cases that I reviewed from some laboratories that moved into specialization. In a case with a case manager whose specialization was DNA, all the evidence was DNA. Alleged blood crusts were tossed into the microtube for processing without even a quick microscopic exam. Here's a question. Could there be hairs or fibers, GSR or other trace materials that might add to the information? Should that analyst first look for these possible evidence items, prior to DNA processing? My answer is absolutely. My experience was, DNA analysts only know one thing. Dumping the biological sample into a tube. Which is what this analyst did.

Oh, here's another example. An article of clothing or a firearm examined for blood to answer the question "Is there blood and who could it be from?" Oh but wait a moment, if there is blood present, is it present in any particular pattern? Is the pattern significant? Does it help to understand the event? There were cases that I reviewed that the blood was simply removed without further exam or photo-documentation.

And one more, then I hope that the picture is clear. It's the reverse of above examples based upon specialization. Trace evidence analysts would not uncommonly mount hairs or fibers permanently after one of the following two events:

1. Unconsciously washing the hair or fiber, without examining first for other significant evidence such as blood, GSR, other trace particles

2. Unconsciously permanently mounting a hair or fiber without initial examination for other trace materials that could be significant

I guess, in my last example #2, the evidence might not be gone forever, just not quite as accessible.

In your last paragraph you wrote " The GKE has become almost anachronistic in today's forensic field. [It's Forensic Science, John] If no one is being trained as a generalist anymore, why should ABC require the generalist exam be taken before you could take a specialty exam? To continue otherwise would be both out of touch with reality and bad business. ABC actually tried to find a balance by stocking the specialty exam with about 40% GKE questions. Is this enough? Is this still too much?"

Here's the problem in this thinking. It's the problem in much of the country. Because criminalists are not being trained as generalists, they are on a slippery slope skidding toward sloppy analyses and erroneous conclusions. The more specialized the analysts get, the less in touch with the case as a whole. Evidence will be missed, the big picture of the case will be lost, wrong conclusions will be made. Doesn't sound like the best direction for criminalistics to take.

There were strong feelings and a firm belief held by the founders of the first GKE examination. That belief is obvious. To perform your job to the best of your ability, you need a strong foundation in the General Knowledge of Forensic Science.

But what do I know?

Good luck. Hope the generalist's win. They deserve to. Otherwise, the profession is in trouble.

Carol L. Hunter

Southern Section Report

On March 8, 2007, the San Bernardino County Sheriff's Department hosted the CAC Southern Regional Study Group and Luncheon. The luncheon was at the Shandin Hills Golf Club where forty eight people enjoyed a nice buffet. The guest speaker, Senior Deputy District Attorney Anil Kaushal, detailed a tragic and complex homicide case where an ex-sheriff deputy father murdered his teenage son, who was a good student, an athlete, had volunteered to help the needy, and worked to earn money to pay for school.

The CSI group, led by Steve Cordes, with seven people in attendance, discussed two magazines, The Forensic Teacher and Evidence Technology Magazine, that may provide information for training issues and then went on to discuss the University of Tennessee Law Enforcement Innovation Center 10-week class. The future of the CSI study group was examined with topics such as protocols from different labs for crime scene investigation, back-to-basics training formats with 1 or 2 topics per meeting including hosting guest speakers and presentations from study group members and lastly, how to "deal" with outside expert witnesses.

Trace evidence, chaired by Mel Kong, had eight people in attendance. The past history of the study group, a lively chat on gunshot residue, and good questions from the newer trace members introduced other trace topics for discussion. The future study group topics will include a back-to-basics component.

The Forensic Alcohol study group, co-chaired by Janet Seaquist and Ron Moore, watched MADD sponsored video tapes on the impact of alcohol related vehicle accidents and the survivors and relatives of the victims. Nine people were in attendance. A tape that included various police agencies in California, displayed driving under the influence and reenactments of specific driving behaviors that officers observe in drivers, providing probable cause to stop the motorists.

The Controlled Substances study group with 23 people in attendance had a guest speaker, Hiram Evans. The co-chairs of the study group, Mandel Medina and Jeff Lowe, invited Hiram to give a presentation on the history and literature of microcrystal tests and to discuss a recent court decision resulting from a Daubert hearing regarding microcrystal tests for drugs. The court found that while microcrystal tests were old technology, they remain valid.

The DNA study group chairs, Connie Milton, Juli Buckenberger, and Annette McCall, invited 3 guest speakers: April Orbison from Applied Biosystems presented the new Minifiler(r) Kit including various parameters researched to maximize through-put and DNA recovery, Maurice Padilla from Applied Biosystems, who discussed valid software and validation services provided by Biosystems, and Rhonda Roby from NIJ, who talked about the software Expert Systems Testbed Project. Twenty one people attended the DNA talks.

Wayne Moorehead,
Regional Director, South

A few scenes from the recent southern study group meeting. (above) Hiram Evans leads the drug study group, (below) dinner speaker Deputy District Attorney Anil Kaushal, (bottom) Rhonda Roby addresses the DNA study group to discuss new software.

Photos by Wayne Moorehead.

ABSTRACTS FROM THE CALIFORNIA ASSOCIATION OF CRIMINALISTS 2007 SPRING SEMINAR

It's A Really Small World: Properties and Applications of Nano-structured Materials

Presenter: Asst. Prof. Javier Garay,School of Engineering, A303 Bourns Hall, University of California, Riverside, CA 92521, jegaray@engr.ucr.edu

The fundamental differences in the characteristics and behavior of materials at the nanometer scale compared with their bulk counterparts will be discussed. Current and future applications of these materials such as for sensors, fluid and mechanical manipulators, drug delivery, and hi-tech materials will be surveyed. Ways and techniques for distinguishing and characterizing these materials beyond elemental and chemical analysis will be touched upon. The promise and limitation of the technologies will be briefly critiqued.

Detection of Trace Organic Explosives on Bomb Squad Equipment by Ion-Trap GC-MS Using Electron Impact (EI) and Negative Ion Chemical Ionization (NICI)

Presenter: Aletha Basconcillo,Graduate Student, Pace University, NYC, NY. Intern, Orange Co. Sheriff-Coroner Dept., 320 N. Flower St., Santa Ana, CA 92703 rd131123@fss.ocgov.com. Contributing Author(s): Wayne Moorehead, Orange Co. Sheriff-Coroner Department.

The focus of this study was to see if detectable amounts of high explosive residue could be found on bomb squad equipment using an ion trap gas chromatograph mass spectrometer. Two issues were examined. 1) whether trace amounts of explosive residue on bomb squad equipment can be detected by instrumental analysis and 2) if this residue is significant enough to be transferred onto evidence during collection. An ion trap GC/MS was chosen over a quadrupole GC/MS because of better sensitivity as well as use of negative ion chemical ionization (NICI) and tandem mass spectrometry capabilities (MS/MS). Samples were acquired from bomb squad equipment and the hands of several bomb squad members by swabbing various surfaces with cotton swabs and monitoring for several high explosives using electron impact ionization (EI) and NICI. A demonstration of using tandem mass spectrometry for the detection of several explosives standards in a complex matrix was included in the study. Explosive residues were not detected in the any of the samples from the bomb squad. Therefore, evidence from bombing scenes will not likely be contaminated through the use of bomb squad equipment and handling.

A Case Study: The Kenny K. Wilson Homicide – Vehicle Search to Courtroom

Presenter: Elizabeth Swanson,Los Angeles Police Department 555 Ramirez St., Space 270, Los Angeles, CA 90012 V8197@lapd.lacity.org. Contributing Author(s): Daniel Rubin, Los Angeles PD

April 1999, a routine vehicle search requested by Northeast Division LAPD detectives investigating the murder of a young African-American, Kenny Wilson, initiated the examination of a 1984 Fleetwood Cadillac for the collection of evidence. The victim had been shot and killed inside the vehicle. After an initial visual assessment of the Cadillac, the search was expanded to include trajectory documentation by a firearms Criminalist. Multiple projectile impacts were observed and projectile fragments were located throughout the vehicle. The Kenny Wilson homicide was included in a ground-breaking civil rights case brought forth by the U.S. Department of Justice. Wilson's murder was one of four racially motivated homicides perpetrated by four Hispanic gang members who targeted African-Americans and which were tried by the U.S. Attorney in August, 2006. In retrospect, the most routine fieldwork can have profound effects in the judicial system.

Microscopic Examination of Hairs to Determine Suitability for Nuclear DNA Analysis

Presenter: Kimberly Sylvester, Santa Clara County DA Crime Lab, 1557 Berger Dr., #B-2, San Jose, CA 95112, ksylvester@crimelab.cscgov.org. Contributing Author(s): Brooke Barloewen, Santa Clara Co. District Attorney

Human hairs are often recovered as biological forensic evidence from various crime scenes. For nuclear DNA analysis, the condition of the hair root is essential. The growth stage and amount of tissue adhering to the root bulb can suggest its potential nuclear DNA content prior to DNA analysis testing. Each hair sample was temporarily mounted in sterile water, and the root was viewed using polarized light microscopy at 100X. The root was classified depending on its growth stage and if any adhering tissue were present. Next, the sample was carefully rinsed with distilled water, trying to prevent the possible removal of any tissue around the bulb. The root was then cut from the hair shaft and subjected to nuclear DNA analysis via organic extraction, quantification with RT-PCR, amplification, and STR analysis. All roots in the beginning stages (anagen and catagen) of the hair growth cycle produced either full or partial profiles. Hair roots in the resting stage (telogen) with no adhering tissue produced no typeable results approximately 90% of the time. The other 10% of the time, only a few single alleles (between 1-5) were obtained. Therefore on a routine basis, telogen roots with no adhering tissue will not be subjected to nuclear DNA analysis. Anagen/catagen roots or telogen roots with tissue attached are better candidates for nuclear DNA-typing.

Phosphine Generation from Clandestine Methamphetamine Laboratory Waste

Presenter: Rochelle Hranac, Arizona Department of Public Safety,

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This small lab-scale study was designed to test amorphous red phosphorus for the creation of phosphine (PH3) gas. These results can assist the training of first responders and officers so they may know what dangers can exist in a methamphetamine cook. Some current cleaning methods rely on the presence of methamphetamine in a lab cook area, where as the other chemicals, like iodine or red phosphorus, may still be present in the area. The study subjected red phosphorus to four different relative humidity levels at four different temperatures and also to three metal oxides that the red phosphorus may come in contact with at a methamphetamine lab cook. These temperatures were 20, 25, 30, and 40°C with relative humidity levels of 20%, 40%, 60% and 80%. The three metal oxides were copper (I) oxide, iron (III) oxide, and aluminum oxide. Phosphine gas formed in all temperature and relative humidity exposures with the lowest at 20°C/20% relative humidity with 0.1611 ± 0.0205 mg PH3/ml N2. Phosphine was most abundant at 40°C/80% relative humidity with 0.6810 ± 0.0302 mg PH3/ml N2. The NIOSH has the IDLH levels of phosphine set at 70 mg/m3. Even the lowest levels exceeded the IDLH levels.

Command and Control on the Witness Stand: Employing the Principles of the O.O.D.A. Loop

Presenter: Raymond J. Davis, CourtSkills, 652 Watergrove Dr., Eagle, ID 83616, courtskills@msn.com.

The first part of the presentation will cover the principle elements contained in the OODA Loop developed by Colonel John Boyd. Boyd was an Air Force fighter pilot who served at the end of World War II, the Korean War, and in Vietnam. He developed fighter pilot strategies that were adopted by the military and used most notably in the first Gulf War. His talent for elucidating the steps required for obtaining and maintaining control in an adversarial/confrontational situation has also been used in every facet of human enterprise. The second part will cover how the OODA Loop functions to provide the expert witness with a high degree of command and control on the witness stand. The third part will cover examples from the author's experience of 1600 courtroom trials. Specifically, how the principles inherent in the OODA Loop reduced confrontations on cross examination, shortened time on the witness stand, increased juror appreciation, and increased credibility as an expert witness.

Evaluation of Ultraviolet Radiation Absorbing Compounds in Textile Fibers Utilizing High Performance Liquid Chromatography and Atmospheric Pressure Ionization Mass Spectrometry (HPLC-MS)

Presenter: Trevor Wilson, Sacramento County District Attorney Laboratory of Forensic Services, 4800 Broadway, Suite 200, Sacramento, CA 95820 wilsont@saccounty.net (916) 874-9240 Contributing Author(s):Sara S. Wiltshire, Forensic Science Graduate Group, University of California, Davis & Sacramento Co. District Attorney Office, Faye Springer – Sacramento Co. District Attorney Office.

Classical fiber dye analysis involves the use of various extraction solutions and thin-layer chromatography to compare dyes from fiber samples. The information provided is limited and cannot be applied in instances of pale colors or small samples. High performance liquid chromatography mass spectrometry (HPLC-MS) has been shown to be a technique that does not suffer from these limitations while also providing the ability to identify dyes by their mass spectra. Recently, the Sacramento County Laboratory of Forensic Services analyzed fiber evidence using a HPLC-MS. Some of the samples displayed differences in the ultraviolet region when compared to the known samples. The source of these differences, as well as their relevance, could not be determined. A research project was designed to evaluate possible causes with HPLC-MS. Three possible sources of variation were pursued: inherent variability in the dying of commercial fibers, environmental exposure, and consumer impact. The current data indicates no inherent variation in the extracted fiber dye components in the acrylic or polyester fibers. Samples collected and analyzed from interior radiation sources show little to no obvious changes in their spectra. The samples subjected to weather and natural light show a decrease in intensity of the visible components and in some cases, the dye components are no longer detected. The impact of consumer products is currently being evaluated.

Muzzle Flash: Why Many See It and a Few Do Not

Presenter: Lucien C. Haag, Forensic Science Service, P.O. Box 5347, Carefree, AZ 85377, haagfssi@aol.com.

Witnesses often report seeing flashes of light when certain firearms are discharged in low light conditions and the propensity for a recovered firearm and ammunition combination to produce a noticeable muzzle flash can and has been documented in the laboratory. One such case still stands out in the author's memory and that was a situation where two seemingly honest and credible witnesses both claimed to have been looking in the direction of a nighttime gunshot but only one of these witnesses saw a muzzle flash. Subsequent examination of the gun and ammunition associated with this incident was found to consistently produce a large red-orange fireball just forward of the muzzle. This presentation demonstrates a method to document the occurrence and appearance of firearms muzzle flash as well as a method for measuring the approximate duration of such events with the finding that the time intervals for small arms muzzle flashes are often much shorter than the duration of our normal, spontaneous eye blinks.

Words We Use and What They Tell Us about Our Thinking

Presenter: Lucien C. Haag, *Forensic Science Service, P.O. Box 5347, Carefree, AZ 85377, haagfssi@aol.com.*

The words we use to describe our work, what we observed and what opinions we derived from these observations should be chosen with great care. Our personal biases (we all have them), likes and dislikes can quickly creep into our reports and testimony as evidenced by our choice of

words. This brief presentation will illustrate some examples of language this writer has observed in reports, trials and depositions and subsequently given much thought to over the years. It is hoped that the attendees will do likewise and make every effort to carefully craft their reports and testimony in a concise and objective manner in all their future efforts.

Report on the Regional Roundtables on Science and the Law

Coordinator: Peter Barnett, Forensic Science Associates, 3053 Research Dr., Richmond, CA 94806, pbarnett@fsalab.com, Other Panelists: John DeHaan, Fire-Ex Forensics, Inc., Dean M. Gialamas, Orange County Sheriff-Coroner Dept., Fred Tulleners, University of California, Davis, Moderator: Peter De Forest, John Jay College.

The California Judicial Council is the policymaking body for the Court system in California. Through an assortment of Advisory Committees and Task Forces, the Judicial Council develops policies and procedures utilized by California courts. The Science and The Law Task Force "develops recommendations regarding science, technology, and the law to facilitate a comprehensive, statewide approach to addressing these issues through collaboration with Judicial Council advisory committees." In furtherance of this responsibility, the Task Force sponsored three roundtable discussions in which members of the judiciary and legal communities, along with various representatives of science, technology, and medical professions, who are involved in judicial matters, met for day-long sessions to discuss matters of mutual concern and interest. We attended these meetings and will report on matters of interest to criminalists that were discussed at those meetings. These matters include such topics as admissibility of scientific evidence, qualifications of expert witnesses, uses of technology in courtroom presentations, better education of the judiciary, and use of court experts. Working criminalists need to be aware of the role of the Judicial Council and seek ways to better inform and influence the deliberations the Council on matters of our concern.

Walk on the Wild Side: Animal DNA Analysis in Criminal Investigations

Presenter: Elizabeth Wictum, Veterinary Genetics Forensic Laboratory, UC Davis, One Shields Ave., Davis, CA 95616-8744 ejwictum@ucdavis.edu.

The molecular analysis of human biological material is widely accepted, but the use of animal DNA in crime-scene investigations is largely under utilized. Once considered a curiosity, animal DNA evidence is receiving increased recognition and acceptance by law enforcement officers and the court system. There are an estimated 65 million pet dogs and 78 million pet cats in the United States. The close relationship between pets and their owners provides for abundant biological material and the potential for evidence transfer in the form of hair, saliva, urine, feces, and blood. Animal DNA results have been used to link a perpetrator to a crime scene or victim in instances of homicide, burglary, arson, and sexual assault. Where the animal was the victim, we have used DNA to illustrate a pattern of abuse and to associate a weapon with an individual animal. When the animal has been the aggressor, we have used DNA to illustrate the manner of the attack and identify the animal(s) responsible. Here we present an overview of cases where animal crime-scene evidence was successfully used to charge and prosecute offenders.

Applications of Forensic Entomology

Presenter: David K. Faulkner, Forensic Entomology Services, 5434 Redland Pl., San Diego, CA 92115, Dkfaulkner41@cox.net.

Most of the attention given to Forensic Entomology involves interpreting a minimal Post-mortem interval based on insect development and succession on animal remains. However, it usefulness extends to cases of food contamination, environmental law, and cases of possible child and elder abuse. The presentation will briefly cover these topics.

An Amazing Adventure in Taiwan

Presenter: Michael Haag, Forensic Science Consultants, 5229 Painted Pony Dr., NW, Albuquerque, NM 87120, Michael.haag@comcast.net.

In 2004, on the eve of the Taiwan Presidential election, while trailing several points in the polls, incumbent President Chen Shui-ban was traveling in a motorcade when he and the Vice President were shot. Both survived, and President Chen Shui-ban went on to win the election the next day by a narrow margin. Political parties suggested that the shooting was a "set up" to win a sympathy vote. At the request of persons in Taiwan, Dr. Henry Lee assembled a team of three Forensic Scientists to travel immediately to Taiwan to assess the validity of this claim. This paper covers some history of Taiwan, and how it led up to the suspected shooting at a very pivotal political moment.

The Recovery of DNA from Biological Stains Submerged in Ocean Salt Water

Presenter: Elana Quinones, Long Beach Police Department, 1400 Canal St., Long Beach, CA 90813, Elana_quinones@longbeach.gov, Contributing Author(s): Ashley Kowalski, Graduate Studies, Calif .State Univ., Los Angeles & Los Angeles County Sheriff Department, Kathryn Roberts, Calif. State Univ., Los Angeles Don Johnson, Calif. State Univ., Los Angeles, Gregory Wong – Los Angeles County Sheriff Department.

The focus of this study was to evaluate the recovery of nuclear and mitochondrial DNA from blood and semen stains submerged in an ocean salt water environment. Blood and semen were deposited onto denim, jeans, and cotton. Prior to DNA analysis, presumptive color tests were performed on the stains. The stains were extracted by Chelex. Stain extracts were then quantified by ABI Quantifiler. Mitochondrial DNA was typed by Roche Linear Array and nuclear STRs were typed using ABI's COfiler kit. Semen yielded STR profiles but not mito haplotypes and blood the opposite.

The Recovery, Development, and Individualization of Latent Fingerprints Submerged in Salt Water

Presenter: Elana Quinones, Long Beach Police Department, 1400 Canal St., Long Beach, CA 90813, Elana_quinones@longbeach.gov, Contributing Author(s): Carmen Mancure, Long Beach Police Department, Sarah Bernard, Long Beach Police Department.

The focus of this study was to evaluate the recovery capabilities, processing techniques and identification of latent prints deposited on common types of encountered evidence (firearms, knives, glass, plastic bags, and duct tape) that have been submerged in a saltwater environment. Fingerprints were composed of sweat and oil and were deposited upon the various substrates. All items were then completely submerged in saltwater. After designated time intervals, items were removed, evaluated, processed for latent prints, and comparisons performed. Latent prints were recoverable and identifiable.

Pool Tablets and Alcohol Don't Mix

Presenter: Donald J. Petka – Orange County Sheriff-Coroner Department, 550 N. Flower St., Santa Ana, CA 92703, Rd16104@fss.ocgov.com.

This presentation provides a unique combination of materials in a post-blast explosives case where ordinary household products were used to create an explosive devise. Traditionally pool chlorinators used calcium hypochlorite as the active ingredient.

Currently pool tablets manufacturers have replaced calcium hypochlorite with chlorinated isocyanurates. The reactivity of calcium hypochlorite with glycol containing products has been well documented but not the chlorinated isocyanurates. Additionally, the post reaction products of chlorinated isocyanurates have not been well known. This presentation will explore the post-blast reaction products with isocyanuric acid as the major constituent detected in one brand of pool tablet.

Legal and Policy Issues Related to DNA Databases

Presenter: William C. Thompson, Dept. of Criminology, Law & Society, University of California, Irvine, CA 92697, William.Thompson@uci.edu.

The continued expansion of DNA databases for the purpose of criminal identification raises some important social and legal issues. Although the potential crime solving benefits of databases are clear, there has been insufficient public discussion of such important questions as who should be in these databases, what risks they might pose to innocent persons, what negative social consequences might arise from racial and ethnic disparities in database membership, who should have access to information in the databases, and which governmental agencies should operate them. This presentation will analyze these questions from a legal and social perspective. Special attention will be given to the growth of local databases that exist outside the framework of state law, to recent litigation over defense access to databases, and to the shifting (and contradictory) positions of civil rights organizations on all of these questions.

Sexual Assault and the Forensic Nurse

Presenter: Malinda Wheeler, Forensic Nurse Specialists, 8111 E. Wardlow, PMB #11, Long Beach, CA 90808, Malinda@fnsinc.org.

The roll of the forensic nurse in sexual assault investigations will be presented. Injury detection and documentation and evidence collection techniques will be discussed. Two interesting and informative case scenarios will be presented.

Hurricane Katrina: Training Ground for the DNA Co-Op

Presenter: Juli Buckenberger, Orange County Sheriff-Coroner Department, 550 N. Flower St., Santa Ana, CA 92703, Rd2510@fss.ocgov.com.

In January of 2006, an e-mail was sent out to the US forensic DNA community from the Louisiana State Crime Lab Manager (DNA). Hurricane Katrina had come and gone, and Louisiana was faced with a mass casualty emergency. The e-mail was sent in search of forensic DNA scientists willing to volunteer their time and skills in an effort to help identify the remains of many of Katrina's victims. The devastation that Katrina left behind provided a training ground for scientists to gain first-hand experience working a mass fatality. With this training experience, these scientists would then be ideal candidates for recruitment to form a government supported DNA Co-Op. The DNA Co-Op is a vision modeled after the DMORT program; it would comprise teams of forensic DNA analysts with specialized mass fatality training, ready to mobilize at the scene of future mass casualties. This is my experience as one of the program's first participants.

Forensic aspects of TASER Device-Related Investigations

Presenter: Andrew Hinz, TASER, Int'l, 17800 N. 85th St., Scottsdale, AZ 85255, Andrew@taser.com.

The objective is to provide information, technical data, and evidence collection techniques for TASER device-related investigations. The information contained will mostly benefit forensic scientists, crime scene technicians, homicide investigators, internal affairs investigators, and administrators. This will include, but is not limited to: Instruction on how TASER devices record firing data, firing data analysis and troubleshooting, information on what evidence to collect, how to properly interpret and store TASER device evidence, TASER cartridge wire and probe analysis, and TASER device event reconstruction.

EZ1 Biorobot and ABI Real-Time Quantifiler Kit Internal Validation Studies Shed Light on Unusual Specimens

Presenter: Laura Silva – Oakland Police Department, 455 7th St. 6th Floor, Oakland, CA 94607, lauradlud@yahoo.com, Contributing Authors: Chani Sentiwany, Oakland PD, Walianna Wong – Oakland PD, Jennifer Mihalovich, Oakland PD.

The objective of the internal validation studies for the EZ1 robot and Quantifiler kits was to define parameters of

DNA detection and quantitation on unusual specimens. These specimens included mixed male/female DNA, cigarette butts and plucked hair. It is important to understand the true limitations of each instrument within a working crime laboratory with respect to these unusual specimens. Varying concentrations and ratios of male/female DNA were prepared, quantitated, and typed using Identifiler. The ability to detect male DNA in male/female mixtures depends more so on the total amount of male DNA present rather than an excess of female DNA as described in the developmental validation study for Quantifiler Human and Y kits. These results illustrate the importance of male/female DNA ratios within the context of total DNA and provide guidelines for DNA ratios that result in male DNA typing results when there is limited DNA. Cigarette butts and hairs were microscopically examined followed by DNA extraction and quantitation. Successful results were obtained from these specimens.

Partnering to Ensure Public Safety

Presenter: Frank Fitzpatrick, National Forensic Science Technology Center, 7881 114th Ave. North, Largo, FL 33773, David.Epstein@nfstc.org, Author: David Epstein, National Forensic Science Technology Center.

An overview of current and future products that are designed to assist the crime laboratory community will be presented. The NFSTC is a not-for-profit corporation that focuses on training, technical assistance, and quality systems support in furtherance of its mission.

Pharmaceutical Forensics – An Introduction

Presenter: Duane L. Mauzey, Forensic Science Program, National University, 28451 El Sur, Laguna Niguel, CA 92677 DLMauzey@aol.com.

Pharmaceutical forensics is the study of suspected counterfeit prescription drugs. Typically, the counterfeit prescription drugs include only high value drugs such as Lipitor™, Crestor™, and Viagra™. As both the drug product and the drug packaging are counterfeit, forensic examinations of questioned prescription drugs include the techniques of questioned document examination as well as both qualitative and quantitative drug analysis. International criminal organizations are involved in the trafficking of counterfeit drugs, including the Russian mafia and Latin American drug cartels. The total estimated dollar volume of this trafficking is in excess of $15 billion. Most counterfeit drugs originate in India or China, and are distributed world-wide. It is estimated that 1 to3 percent of US prescription drugs are counterfeit, but the number rises to 25% in Latin America, and 50% in Africa and parts of Asia. A number of deaths in the U.S. have been attributed to counterfeit drugs. It is not unlikely that a criminalist may encounter these counterfeit drugs in a death investigation where cause of death is not apparent. Examples of counterfeit drugs will be used to illustrate the analytical approach to demonstrating that a prescription drug is counterfeit. Resources will be described.

Brand Identification of Canister Smokeless Powders – Part 2: Using Morphology and GC/MS

Presenter: Wayne Moorehead, Orange Co. Sheriff-Coroner Dept., 320 N. Flower St., Santa Ana, CA 92703, rd131123@fss.ocgov.com, Contributing Author(s): Annie Tibbets, Intern, Orange Co. Sheriff Dept., Aletha Basconcillo – Intern, Orange Co. SD.

Smokeless powders are one of the most used low explosives in pipe bombs. When sufficient unexploded smokeless powder remains after rendering the explosive device safe or if powder is found without its original container, the powder may be able to be associated with a particular brand of smokeless powder or a small number of possible powders. Brand identification is useful in providing investigative information or for adjudication. This presentation, part two of a two part series, uses morphology and GC/MS to characterize 148 powders toward brand identification of unknown powders. After a morphological category is determined, three to ten kernels of powder are extracted with a solvent to obtain any soluble non-nitrocellulose components present in the powder. The GC/MS is used to characterize the extracted components and compared against like morphologies. A side-by-side comparison or micrometry (dimensional measurement of the intact kernels) may further help to resolve brand identification.

Recovering Trace DNA from Knives: a Comparison of Two Collection Techniques

Presenter: Melissa Mercurio, Graduate Studies, University of California Davis, Extension, 133 Research park Dr., Davis, CA 95616, mlmercurio@ucdavis.edu, Contributing Author(s): Robert Rice, Environ. Toxicology, Univ. of Calif., Davis, Theresa F. Spear, Forensic Sciences Program, Univ. of Calif., Davis.

The goals of this research were to: (1) compare the ability of two different swabbing techniques (dry sterile swabs versus swabs moistened with deionized water followed by a dry swab (double swab)) to recover typable amounts of DNA from pocket and kitchen knives, (2) determine how much DNA can be obtained from specific locations on these knives and (3) to evaluate the quality of the DNA profile obtained. Pairs of pocket knives were carried by study participants for 45 days and the knives were sampled for DNA. Pairs of kitchen knives were held by study participants for approximately 3 minutes and DNA samples were collected. The paired knife handles and blades were swabbed separately using the two techniques. Additional pocket knives were purchased and sampled for DNA using the double swab technique to determine if any DNA was present. Quantifiable amounts of DNA were detected for all pocket knife samples and most kitchen knife handles, and STR profiles were obtained for most samples. Complete STR profiles were obtained from the additional pocket knives tested, possibly contributing to the DNA collected during the experiment. In conclusion, the double swab technique should be used for collecting DNA from knives because it consistently generated a more complete profile of the last holder with less additional alleles from other sources.

Dedication Day: Hertzberg-Davis Forensic Science Center

While the CAC seminar in Garden Grove was underway, a celebration of a different sort was taking place a few miles north.

On May 11, 2007, the Los Angeles Regional Crime Laboratory Facility Authority dedicated the Hertzberg-Davis Forensic Science Center. "In opening the doors of this state-of-the-art criminal laboratory and education center, we are simultaneously providing criminal investigators the opportunity to apply decades of scientific advancement toward their investigations."

This facility will soon house the crime laboratories of the Los Angeles County Sheriff's Department and Los Angeles Police Department, as well as classrooms for the California State University, Los Angeles, School of Criminal Justice and Criminalistics, and the California Forensic Science Institute. It will also provide criminal laboratory services to numerous law enforcement agencies within Los Angeles, such as the District Attorney's Office, 46 police agencies, and the City Attorney's Office.

"The essential need to bridge the gap between modern science and outdated criminal laboratories was clearly visible in the facilities utilized by law enforcement agencies in Los Angeles County.

Outdated equipment, inadequate work space, and lack of personnel plagued the old labs. "Cold case" files lay unsolved year after year, while crimes continued to occur. Many of these cases held clues within them encrypted in forensic evidence with no means to find them. The need to bring criminal laboratories into the 21st century became crucial to solve crimes and protect the public.

From this need a partnership developed between the Los Angeles County Sheriff's Department and the Los Angeles Police Department.

The concept to build a joint-agency crime lab, which also housed a university, soon took form. Former California Governor Gray Davis, Speaker of the Assembly Robert Hertzberg and Los Angeles County Supervisor Edmund D. Edelman were instrumental in the final triumph:$96 million in funding to build a multi-jurisdictional crime lab in Los Angeles."

This article was prepared from Hertzberg-Davis opening day promotional materials, supplied courtesy of Katherine Roberts.

Jaime Lopez, LASD

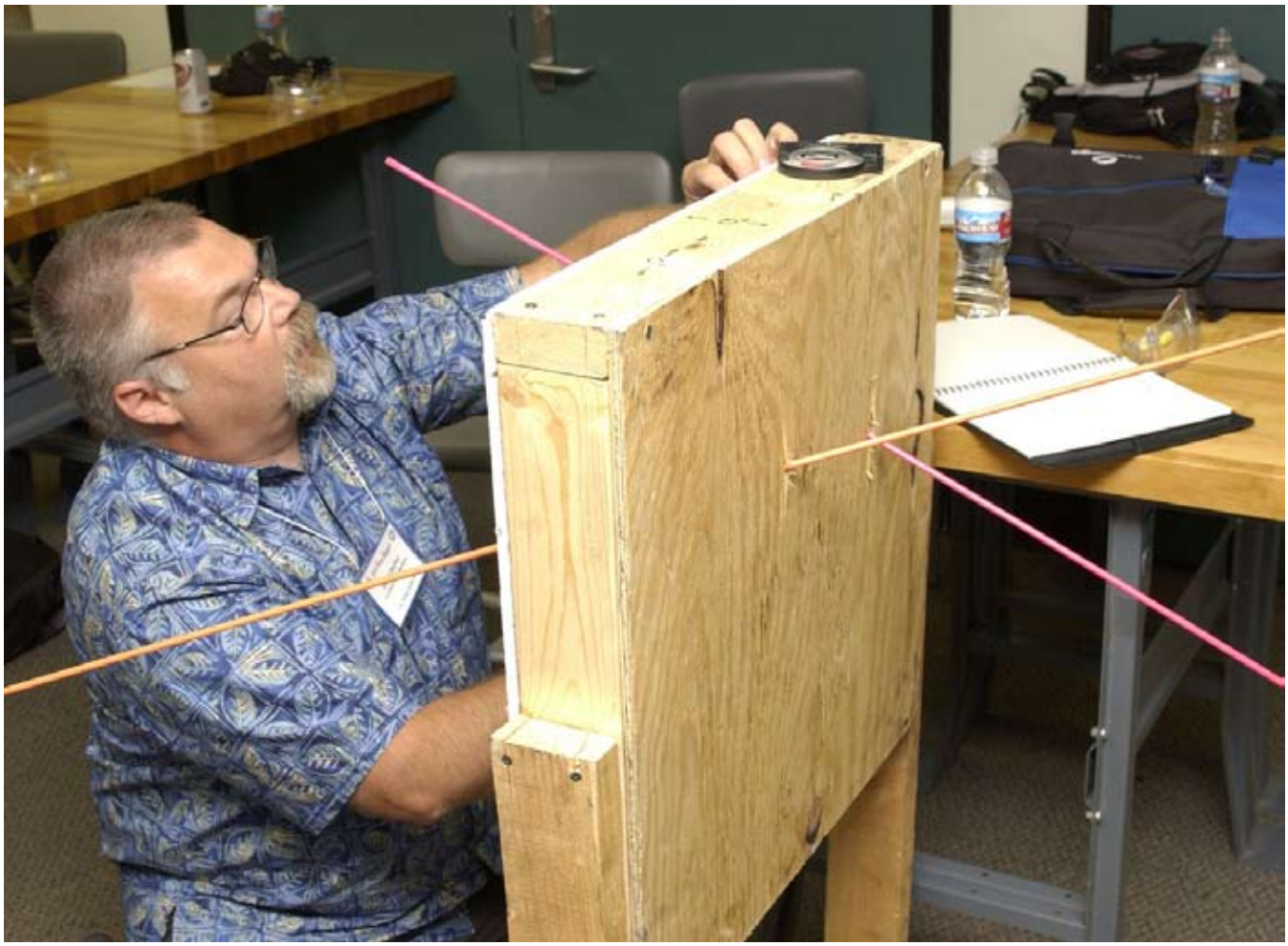
Southern Spring

"It's a small world" may have been the theme, but the meeting's heart was big, as the Orange County Sheriff-Coroner's lab hosted the Spring CAC Seminar in Garden Grove. That's right—*spring!* The switch from northern spring meetings to southern happened with this very seminar. The passing of the gavel to the new president, as well as many of the awards presentations always occurs in the spring, so to give our fellow members in the south a chance to participate, the CAC seminars will now be north for the fall, and south for the spring.

Held at Disneyland's very doorstep, this meeting was attended by over 100 members and interested parties each day, beginning with three workshops: Bullet trajectory, DRE and DNA. Featured among the many excellent presentations was a panel of seasoned criminalists, Peter Barnett, Peter DeForest, John DeHaan, Fred Tulleners and Dean Gialamas, who offered their impressions of recent rountable discussions between the judiciary and forensic scientists.

Winding up the meeting was the induction of dozens of new members, warmly welcomed by Raymond Davis and several other former board members, then off to the sumptuous banquet where attendees and their dates were entertained by feats of prestidigitation performed by Tim Mannix.

The bullet trajectory class, taught by Mike Haag (facing page) was held at the Orange County Sheriff's range. Even though the mercury hit about 98 that day, the students were calculating angles and recalling their high school trig before heading out to see live firing examples of their class exercises. A variety of firearms and ammunition were demonstrated, with particular emphasis on ricochets off yielding and unyielding surfaces.



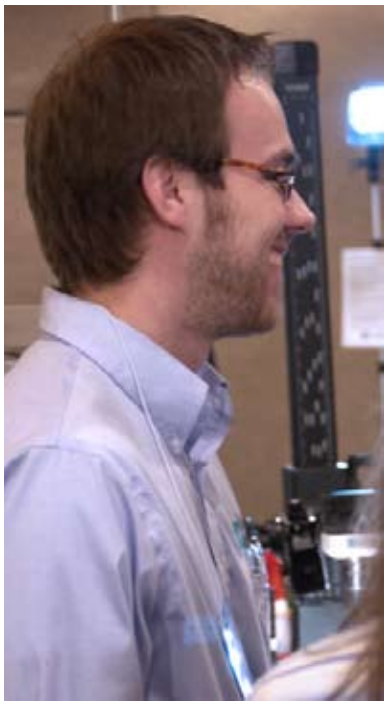

GELLAN

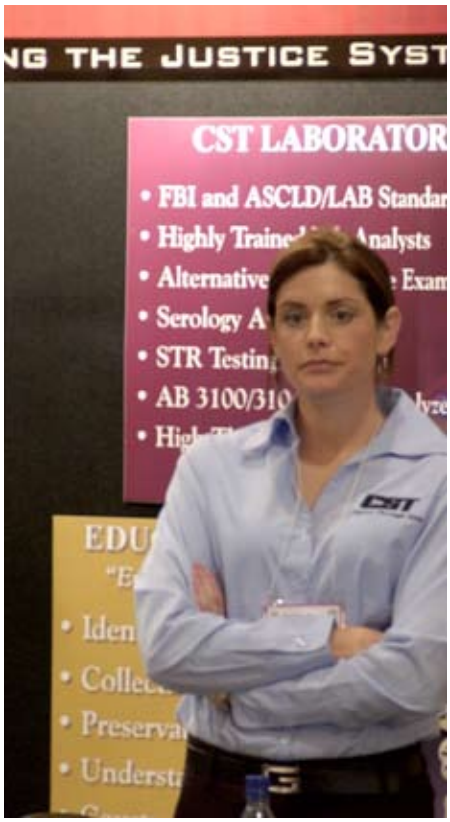

SNOW CRASH
Applied Biosystems


HUMAN IDENTIFICATION TECHNOLOGIES, INC.

A lively panel discussion on recent judicial/scientific roundtables was staffed by (bottom l-r) Peter DeForest, Peter Barnett, John DeHaan, Dean Gialamas and Fred Tulleners.


Overview of Hair Growth Stage
Anagen roots: Characteristics
– Hairs are forcibly removed (pulling, stroking, combing)
– Adhering root sheath tissue is likely to be present
– Root bulb heavily pigmented

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The Urban Myths & Conventional Wisdom of Transfer: DNA as Trace Evidence

SITTING AT WHAT HAS BECOME OUR NEW OFFICE away from office, Astaria restaurant in San Mateo, we mull over possible topics for this quarter's diatribe. Both of us have increasingly begun to receive cases involving contact DNA – low level, often multiple contributor, DNA profiles for which the physiological source is both unknown and unknowable. This terrifying trilogy has become the subject of many a recent court battle. Multiple issues are associated with these types of samples, and we decide to address only one of them in this discussion, saving the other topics for future columns. Because Norah has recently researched the literature on DNA transfer for a presentation, we decide to share and comment on that information at this time. We opt to conveniently ignore other issues, such as RFU thresholds and statistical calculations, for the present discussion. We satisfy our hovering waiter with food and wine selections and proceed to the subject at hand.

Before proceeding, we outline what appears to be the rationale for this analysis. In our experience, the most frequently cited purposes (and the accompanying belief system) for examining contact DNA include:

1. Habitual wearer DNA—the idea being that the DNA of the person most often wearing a particular item of clothing will be detected. Items examined include masks (worn during robberies), caps and hats, sweatshirts and jackets, and even shoes (yes, in one case left behind at a crime scene in Hawaii and in another planted in the trash to frame a suspect in Florida!)

2. Handler DNA—the idea being that the dominant DNA type will originate from the last person to have touched or handled the item in question. Items examined for this purpose are primarily weapons, including firearms, knives, and blunt force weapons, such as pipes, axe handles, concrete and anything else that can be wielded by hand to destroy another's body. Other popular items are the steering wheel, gear shift and other driver-side controls of a vehicle, to determine who last drove the car.

One unarticulated assumption for this analysis is that the presence of your DNA infers your personal presence; in other words, if your DNA is detected, you personally placed it there. Secondary transfer is rarely explicitly stated as a potential mechanism for DNA transfer. Additional assumptions, such as time of deposition, relevance to the crime event, and physiological origin of the DNA are also rarely addressed.

With these purposes in mind, we trace the evolution of the analysis of "contact" DNA—DNA present at a relatively low level and for which a physiological origin cannot be determined.

DNA fingerprints from fingerprints

The paper that brought the topic of DNA transfer to the fore was a short letter to the journal *Nature* by van Oorshot and Jones (1997), a couple of forensic scientists from "down under." The title of their letter, *DNA Fingerprints from Fingerprints* challenged an unspoken assumption among the forensic DNA community, that simply touching an object, or even another person, would leave no typeable DNA. While that may have been a convenient truism in the days of RFLP analysis, or even for early sequence-based PCR typing systems with relatively low discrimination (e.g. PM+DQA1), the increased sensitivity and discrimination potential of multiplex and megaplex STR typing systems changed our understanding of the levels of DNA that can be successfully typed. We now struggle with understanding what detecting a few cells worth of DNA means for any specific case circumstance.

The short communication even mentions the detection of DNA from previous handlers and secondary transfer. Perhaps because the adaptation of DNA typing for forensic use burst on the scene so quickly and with so much fanfare and promise, many of us forget that DNA evidence, and in fact all biological evidence, is just another form of trace evidence transferred between a source and a target (Locard, 1920). And while biological evidence (in particular blood and semen) has historically assumed greater significance than non-biological evidence because it is infers violent or intimate contact, the detection of trace DNA from an unspecified physiological or cellular source reduces this normally high relevance to the crime event.

Van Oorshot and Jones cite both cautions and potential uses of this newly-recognized sensitivity of DNA testing. The reaction of the forensic community to their study (also see 1999) was decidedly mixed; the anticipation of using DNA technology to investigate a wider variety of samples and crimes was welcome, but also tempered with concern about the meaning of trace results in the context of the case, and increased anxiety about contamination.

The disbelievers

So it is not surprising that one of the first papers to follow the initial report concentrated on addressing the concerns rather than the capabilities of typing contact DNA samples.[1] Ladd et al. (1999) also performed some experiments to inves-

[1] We purposely avoid the term "low copy number" (LCN) DNA typing in this discussion for the reason that it has become a loaded buzzword, devoid of specific scientific meaning. While we obviously discuss low level DNA samples, we do not specifically address additional issues that come with performing extra PCR cycles during the amplification of the DNA sample.

tigate the detection of primary and secondary transfer of contact DNA. However, these authors concentrate on imposing interpretational restraints to avoid what they consider to be potential "problems." This is epitomized by their main conclusion, *"Our data do not support the conclusion that secondary transfer will compromise DNA typing results under forensic conditions."* A perusal of the paper reveals that this is accomplished mostly by limiting reported results to full profiles above a particular threshold, whether that be a "C" or "S" dot in the old PM+DQA1 system, or an RFU threshold in STR typing systems. They note that *"Most significantly, in no instance was the profile of the second individual detected by AmpliType PM + DQA1."* This conclusion is telling in that the first generation PCR-based "blue dot" typing system was notoriously poor for mixture interpretation.

It is also interesting that Ladd et al. report recovering much less DNA from similar samples, a factor that would obviously affect their typing sensitivity and ability to observe minor profiles. *"On average, we recovered 1–15 ng of human DNA from the tested samples, considerably less than the 2–150 ng reported by van Oorschot and Jones."* Differential DNA recovery, as well as other procedural differences, may explain the apparently discordant results of a number of the papers we will discuss. Of course, ignoring data does not make it go away. And as any working DNA analyst is only too aware, partial profiles are routinely reported today, a practice which has in turn led to much discussion about the appropriate statistics to apply.

As evidenced by the papers that follow, the worldwide forensic DNA community took the lead of our Aussie colleagues and pursued extending the interpretational limits of the technology rather than constraining themselves, as cautioned by workers in the Connecticut laboratory.

(Figure 1)

	Collection Method							
	Friction Swab				Pillbox Swab			
Item type/ID	# of donors[1]	Source of DNA		DNA (ng)	# of donors[1]	Source of DNA		DNA (ng)
		Major	Minor			Major	Minor	
T-Shirt								
1	2	Wearer	Spouse	20.55	2+	Wearer	Spouse	100.55
3	3	Wearer	Spouse, unknown	<1.55	1+	Wearer	—	20.55
7	1	Wearer	—	2.55	1+	Wearer	—	40.55
10	1	Wearer	—	2.55	2+	Wearer	Spouse	20.55
Average/T-shirt				6.25	Average/pillbox			45.55
Hosiery								
2	3	Wearer, Spouse	Unknown	2.55	1+	Wearer	—	20.55
4	2	Wearer	Spouse	2.55	2+	Wearer	Spouse	20.55
Knee-highs								
5	3	Wearer	Spouse, unknown	1.55	Insufficient profile			
6	4+	Wearer	Spouse, unknown	<1.55	3+	Wearer	Spouse, unknown	<1.55
8	3+	Wearer	Spouse, children?[2]	4.55	3+	Wearer	Spouse, children?[2]	1.55
Hosiery								
9	1	Wearer	—	2.55	1+	Wearer	—	10.55
11	2	Wearer	Unknown	2.55	1+	Wearer	—	4.55
Average/Hosiery				8.55	Average/pillbox			2.55
Average for friction swab collection				**8.55**	**Average for pillbox swab collection**			**21.45**

[1]Number of donors determined by number of alleles per locus. Peak height (in relative fluorescence units) also used.

[2]Although the spouse and children cannot be excluded as potential contributors to these mixtures, they cannot account for all the non-wearer's DNA present.

Reproduced from: Stouder, S.L., Reubush, K.J., Hobson, D.L., Smith, J.L., Trace evidence scrapings, a valuable source of DNA?, Forensic Sci. Comm. *3(4), 2001.*

The accidental believers

It was several years later that a little-known paper was published by the FBI DNA unit (Stouder *et al.*, 2001). The aim of this paper was to compare recovery and typeability of habitual wearer DNA using swabbing and scraping techniques. Using new or freshly laundered garments, and pressing into service their own employees, researchers found a surprisingly high number of mixed profiles, some identifiable, some not. (Figure 1) Because it was not the main purpose of the paper, the source and nature of transfer of the unknown additional profiles was not pursued. Nevertheless, the results of this study reinforce our understanding of the world as a predictably dirty place.

Shedders across the pond

The term "shedder," now instilled in the vocabulary of forensic biology, was initially coined by Lowe et al. in 2002. In that particular study, our colleagues across the pond reconfirmed yet again not only that transfer of DNA happens, but that secondary transfer of DNA also occurs. Indeed, they report an instance of detection where the secondary component is the only detected contributor. (see section 3.1.2) Think about the implications of that one. The concept of a "shedder" is introduced as an individual with an apparently increased propensity to shed DNA-containing cells relative to the general population.

However, subsequent studies were unable to reproduce those results. Balogh et al. (2003) notes that differential shedding was not observed in their experiments. And although Petricevic and Bright (2004) report observing individuals they categorize as good shedders, Petricevic working with Phipps (2007) produced contradictory information. In the 2007 paper, these workers performed a large scale experiment to specifically reinvestigate the notion of good and bad shedders. They report observing as much individual variation, depending on circumstances, as between persons. Interestingly, their most conclusive results were that for "dirty" hands, the dominant hand was the better shedder, whereas for "clean" hands, the non-dominant hand was the better shedder.

It may be that more predictable variation exists due to personal circumstances at any given time than between people. We also note that the multitude of variables impacting the final detection of a DNA profile outweighs the potential contribution of shedding characteristics of a putative source. (Figure 2)

Every contact does leave a trace

Wickenheiser (2002), inspired to investigate the capabilities rather than the consequences of contact DNA, performed a large scale study of recovery from various substrates. He did indeed empirically confirm that contact DNA can be recov-

Figure 2
Transfer paradigm

Transfer	Persistance	Detection
Quantity how much	Preservation temperature humidity (liquid) microorganisms	Collection mechanics (swab, cut, scrape) medium (wet, dry, double swab)
State wet or dry	Actions mechanics reduction replacement	Laboratory analysis system efficiency of extraction efficiency of amplification genetic system sensitivity of detection threshold of detection
Substrate smooth or rough		
Mechanics friction		
Personal characteristics shedders??? personal hygiene		

ered and typed under a variety of circumstances. He also provides numerous case examples where the profiles obtained from various evidence items proved useful in solving a case. Disappointingly, however, he then proceeds to speculate that "detectable secondary transfer is very unlikely," and that in the unusual instance that it did occur, the person acting as the vector would requisitely be detected as the major type. Both suppositions are refuted by Lowe et al. (2002) and the prior, as well, by Phipps and Petricevic (2007), who report experimental observations of secondary transfer. And on a related topic, Balogh et al. (2003) contradict the urban myth that the last contact will always be preferentially detected.

To re-visit the conventional *raison d'être* for interpreting low-level DNA profiles to inter contact, the literature so far indicates that:

1. Where there is a known single habitual wearer, that person tends to be detected as the major source of DNA on a garment; minor profiles may also be detected from individuals with whom the habitual wearer has had close contact as well as from unknown sources.

2. The examination of evidence for handler DNA can reveal DNA of people who have, or have not, handled the item; the stronger profile may, or may not, be the person who last handled the item; An inference of direct contact between an individual and the item may or may not be supportable, depending on the circumstances of the case.

The world is a dirty place

The brief review of DNA transfer literature here is not meant to be comprehensive nor authoritative. Rather, we hope to inspire the reader to obtain and review the papers listed in the bibliography at the end of this piece. We suspect that the careful and open-minded scientist will find a quite different order of things than has become embedded as conventional wisdom or urban myth. We remind ourselves that DNA comes from biological evidence, and minute amounts of biological evidence share the same interpretational challenges as trace evidence of any kind. When knowledge of the physiological origin of the DNA is lacking, then simply postulating an individual "source" for the DNA loses significance. The relevant case-specific issues shift toward "contact;" how did it get there? when did it get there? These questions are

DNA TERMINOLOGY

PM+DQA1—Polymarker plus DQA1 typing kit. A single nucleotide polymorphism system colloquially known as "the blue dots." The first PCR-based system to become available for forensic typing, it had a relatively low power of discrimination and was particularly poor for mixture interpretation.

"C" dot—In the DQA1 system, a marker of known composition and quantity that marked the threshold intensity below which a single source sample should not fall. It was never intended to be used as an absolute threshold for mixture interpretation.

"S" dot—In the Polymarker system, a marker of known composition and quantity that marked the threshold intensity below which a single source sample should not fall. It was never intended to be used as an absolute threshold for mixture interpretation

RFU—Relative fluorescence units. The unit of peak height used in relation to the electropherograms (print-out of DNA data as peaks) produced in STR typing.
RFU threshold—A point threshold imposed by the laboratory, above which any peak that cannot otherwise be characterized as art factual is called as an authentic DNA type, and below which the lab will typically not call DNA types.

RFLP—The first DNA typing system. It was a length-based system and required a relatively large sample of biological material, typically collected because it was visible. The signal was amplified only by radioactive or chemiluminescent tags. The only DNA available for typing was that originally contained in the collected sample.

STR—Short Tandem Repeat. The PCR DNA typing system used in forensic DNA laboratories today. It is length-based and derives its high power of discrimination from the large number of loci (DNA locations) typed using commercial megaplexes.

A complete forensic DNA glossary can be found at http://www.forensicdna.com/emailforms/DNAGlossary.html

typically more difficult to answer in a definitive fashion, but are more relevant to the triers of fact – welcome to forensic science. And here we have much to learn from our trace evidence colleagues.

The cappuccino mustaches having been licked from our lips, and our shared dessert plate scraped clean, we feel fortified and ready to head back to struggle with those contact DNA cases.

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Muzzle Flash:One Witness Sees It, the Other Does Not

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Keywords: muzzle flash, eye witness accounts, light as evidence, eye blink duration

Abstract

Muzzle flash occurs when the fuel-rich effluent from the muzzle of a firearm adequately mixes with oxygen in the atmosphere and is ignited. The size, character and color of muzzle flash can vary greatly ranging from virtually no visible light at the muzzle to a very large fireball. The color can likewise vary from nearly white to bluish-white to lavender to orange and red. With some gun-propellant combinations, sparks or streamers from burning propellant particles or primer constituents constitute a noticeable portion of the muzzle flash.

The factors dictating the presence or absence of muzzle flash and its character when present include barrel length, propellant type and chemical composition, flame temperature, muzzle pressure, gas volume generated by the propellant, exhaust gas products and by-products, projectile type, primer composition and the physical characteristics and behavior of the propellant grains during the discharge process.

The duration of the muzzle flash from a handgun discharge can be substantially less than the duration of the normal, involuntary blinking of the eyes consequently a person looking in the direction of a nighttime gunshot may fail to see the muzzle flash while one or more other witnesses looking in the same direction see it without difficulty.

Introduction

The genesis for this work arose from a case in which two eye witnesses were both looking in the direction of an audible gunshot but only one of them described seeing a muzzle flash. This disparity in observation became an issue in the case with the obvious suggestion that one of the witnesses had to be in error regarding the location of the shooter at the moment of discharge.

Subsequent testing of the gun and ammunition combination revealed that it produced a very noticeable muzzle flash shot after shot. At the time, this writer did nothing beyond demonstrating this fact using open shutter photography with a 35mm film camera. This, in part, resulted in an article published in the October 1991 AFTE Journal[1]. In this method, the camera acts as an accumulator adding up all of the visible light that reaches the camera's film. In this 1991 article, no time durations for muzzle flashes were provided nor could they be provided by the still camera technique. This remains true with modern digital cameras. Figure 1 provides an outstanding example of this point. The only source of light in this photograph taken 20 years ago of the author firing a .44 Magnum revolver was that produced by the muzzle flash. A more recent digital photograph [Figure 2] taken during the October 2006 Shooting Scene Reconstruction course by Jane Whitworth shows the discharge of a cap and ball revolver loaded with black powder. Fill flash was also used in this digital photograph just prior to the discharge of the .44 caliber revolver.

Olsen and Schneider in their discussion of muzzle flash[4,5] also used open shutter photography to capture muzzle flash from a variety of handguns, propellant types and loadings with each of the guns fired in an unlighted environment. Olsen, however, alludes to the possibility that the duration of a muzzle flash from a handgun may be shorter than that of a blink of the eyes (page 123, reference 4) but gives no data or reference.

More recently one of the authors (Haag) presented a paper at a combined meeting of the German LKAs (Landeskriminalämte) and the BKA (Bundeskriminalamt) held in Dresden, Germany that specifically addressed the duration of muzzle flashes for some typical handgun cartridges and guns and compared them to the duration of a typical, involuntary blinking of the eye lids[6]. The results presented here are largely excerpted from that presentation.

Testing Procedures and Results

Three common pistols (a Ruger, a Beretta and a SIG/Sauer) in 9 mmLuger, .40 S&W and .45 Automatic respectively were each mounted in a Ransom Rest and discharged in a semi-darkened indoor range with various popular brands of commercial and military ammunition. A variety of 9mm handloads were also assembled and fired in three makes and models of 9mm pistols (Ruger P85, Glock 17, Beretta 92FS) and a Marlin M9 carbine. Many of these shots were recorded with a Nikon D100 digital camera using the open shutter technique. Fill flash was used to record the set up and position of each pistol just prior to discharge. The setup for this is shown in Figure 3. This technique provided images similar to those in the 1991 AFTE article and allowed the maximum size of the muzzle flash to be recorded as well as its overall color. A Digital8 format Sony Model DRC-TRV350 digital video-camera was used to record selected shots for subsequent frame-by-frame inspection of the results. At a later date, some shots were recorded in an outdoor environment with a black drop cloth positioned just beyond the pistol. This was done to substantially shorter the shutter speed of the video-camera. Vegas 6.0 (Sony Media Software) was used to further reduce each frame to their respective fields. A video field in the NTSC format represents 1/60 of a second and is one-half of a video frame.

The ability of this video-camera to faithfully record flashes of very short duration was tested and verified with a General Instruments Model 1538A Stroboscope. The Sony video-camera was aimed directly at the stroboscope from a distance of about 10 feet. The stroboscope had been previously calibrated and set to produce 10 flashes per second of approximately two microseconds (0.00002 seconds) duration per flash. When the recorded video was viewed field by field, each stroboscopic flash could be seen in a single field.

Additionally, a device called "The Time Machine" (manufactured by Mumford Micro Systems) designed to measure the duration of the flash from photographic flash units, was used as an alternate means of measuring the duration of the muzzle flash for several selected ammunition types in .45 caliber when fired in the SIG/Sauer pistol. [See Table 1]

Presented at the Spring 2007 CAC Seminar - Anaheim, CA

It should be pointed out that the 1/60 second nominal time interval of a NTSC video field is not necessarily the same as a shutter speed of 1/60 of a second. Indeed shorter shutter speeds can (and were) manually set in an effort to gain more information regarding the duration of muzzle flashes from the primary pistol used in this study (the SIG/Sauer .45 Automatic). For example, a shutter speed of 1/250 second was used when the Sony digital video-camera was placed on the "Sports" setting for the outdoors testing. The Digital8 format automatically records the shutter speed and settings used by the camera and this data can be displayed during playback through the camera's menu. This information is of potential use and interest when viewing the resultant individual frames or fields depicting muzzle flash.

As for the behavior of the human eye, literature sources give somewhat varying time durations for the involuntary or spontaneous blinking of our eyes. The Ophthalmic Center in East Setauket, NY states that we blink our eyes about 15 times per minute and that the duration is about 0.3 to 0.4 seconds. Another medical source sets the duration between 0.1 and 0.4 seconds with minimum values around 0.1 seconds[3].

The same Sony video-camera was used to record spontaneous eye blinks of one of the authors (Haag) followed by an examination of the individual fields. This gave a minimum duration of 0.1 seconds. An example of this simple method for measuring the duration of an eye blink is shown in Figure 4. This sequential assembly of 10 video fields reveals that the author's pupils were covered by the eyelids for 6 fields. At 1/60 of a second per field, this amounts to 0.10 seconds- a value in good agreement with the lower time duration previously cited.

Table 1 gives the results from The Time Machine, mounted approximate 10 inches to the side of the muzzle of the SIG/Sauer pistol fired in an outdoor setting under a covered shooting stall and using standard Fiocchi ball ammunition and Speer Clean-Fire ammunition loaded with 230-gr. TMJ bullets. Both of these cartridges produced a pronounced muzzle flash when fired in the P220 pistol.

The military ammunition tested and several brands of commercial ammunition produced very little to no visible muzzle flash. This was as expected for the military ammunition where flash suppressants are typically added to the propellant. Other sources of ammunition were more dramatic in both the appearance of muzzle flash, the consistency and reproducibility of the muzzle flash and the color(s) of the flash. Representative examples are shown in Figure 5 through Figure 7. *Note: AFTE members can view the original color versions of these images by going to the AFTE website,* www.AFTE.org.

The usual appearance of a muzzle flash with common handgun ammunition and jacketed bullets ranges from a bright yellow-red to red-orange to a dull red color. Two brands of .45 Automatic ammunition tested were unusual and noteworthy for their atypical colors. These were Winchester's WinClean and Speer's Clean-Fire ammunition both of which use lead-free primer compositions. The muzzle flash from the WinClean ammunition consistently produced a lavender color attributed to the ionization of potassium from the potassium nitrate in its primer mixture. The Clean-Fire ammunition produced a bright red fireball with a red color similar to that of roadside flares used by law enforcement agencies after a traffic accident. This conspicuous red color for the Clean-Fire shots was attributed to the ionization of strontium from the strontium nitrate used in its primer formulation.

Since the Clean-Fire ammunition produced the largest fireball of the commercial ammunition tested, it was thought the most likely to have the longest duration. An inspection of Table 1 reveals this not to be true. Nonetheless because of its large fireball, two shots with this ammunition have been used to illustrate the use of a modern digital video camera to establish some idea of muzzle flash durations. [See Figure 8A and 8B]

The same outcome occurred for all the other sources of ammunition tested that produced a muzzle flash, i.e., the flashes only occupied one field in the video recordings.

Summary and Conclusions

Contemporary handguns and ammunition can produce noticeable and visible muzzle flash particularly when discharged in low light conditions. Depending on the gun-ammunition combination, muzzle flash can be quite reproducible in size and color and therefore has potential forensic value in certain circumstances. This latter property (color) can vary from a blue-white to a bright red color with the most common color being a dull red to yellow-red flash.

Revolvers typically emit a visible flash from the cylinder gap in addition to the area in front of the muzzle.

The duration of the visible discharges from handguns firing modern ammunition can be very short (far less than 1/60 of a second). Such brief time intervals are substantially less that the time duration of a spontaneous blinking of the eyes (0.10 to 0.40 seconds) consequently it is quite possible that a witness who spontaneously blinked at the instant a firearm was discharged would not see the muzzle flash.

This can be effectively demonstrated by videotaping the discharge of any particular gun-ammunition combination in a low light environment and subsequently locating and counting the number of frames or fields containing the muzzle flash. This technique will typically reveal that the muzzle flash is contained within a single field and its duration is therefore equal to or less than 1/60 (0.017 seconds).

Investigators interviewing one or more witnesses claiming to have seen a muzzle flash should consider posing the following questions to such witnesses:

Do you have normal color vision?

Do you recall the flash that you observed having a particular color?

If "Yes"- Please describe the color of the flash as you remember it.

Please describe its general appearance or character (a bright flash, a dull flash, fireball, an elongated tongue of flame, a shower of sparks, etc.).

(See color photos at www.cacnews.org —Ed.)

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Table 1
Muzzle Flash Duration Using "The Time Machine"

Fiocchi 230-gr. FMJ	Speer *Clean-Fire* 230-gr. TMJ
0.000620 sec.	0.000125 sec.
0.000629	0.000143
0.000643	0.000139
0.000635	0.000166
0.000632 ± 0.000010	0.000143 ± 0.000017

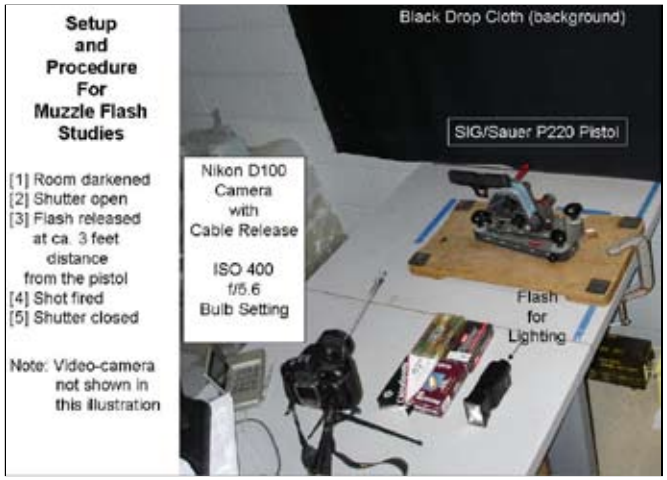

Figure 3

Figure 1
Open Shutter Nighttime Photograph of a .44Magnum Discharge. Note the two locations of flash from this revolver.

Figure 4
Open Shutter Digital Photographs of Four Consecutive Shots

Figure 2
Open Shutter Photograph of a Black Powder Discharge. Note: fill-flash used to just prior to the shot to record the shooter (Michael Haag) and revolver. *Digital photo by Jane Whitworth.*

Figure 5
Open Shutter Digital Photographs of Three Consecutive Shots

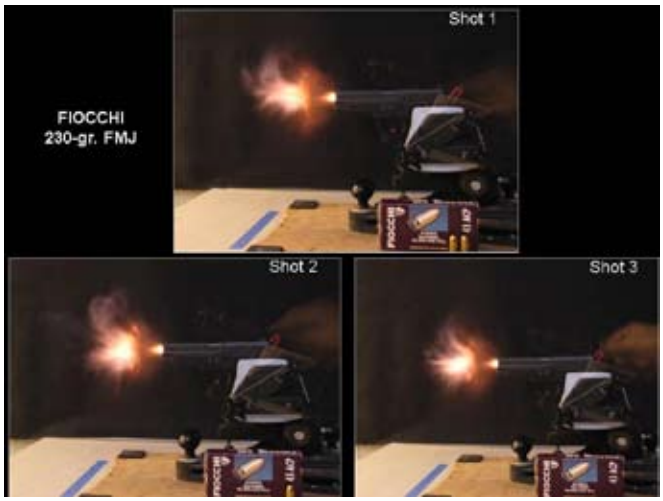

Figure 6
Open Shutter Digital Photographs of Three Consecutive Shots

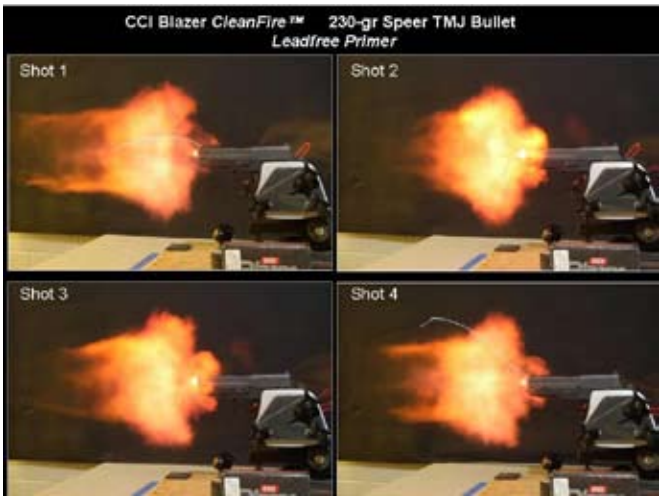

Figure 7
Open Shutter Digital Photographs of Four Consecutive Shots

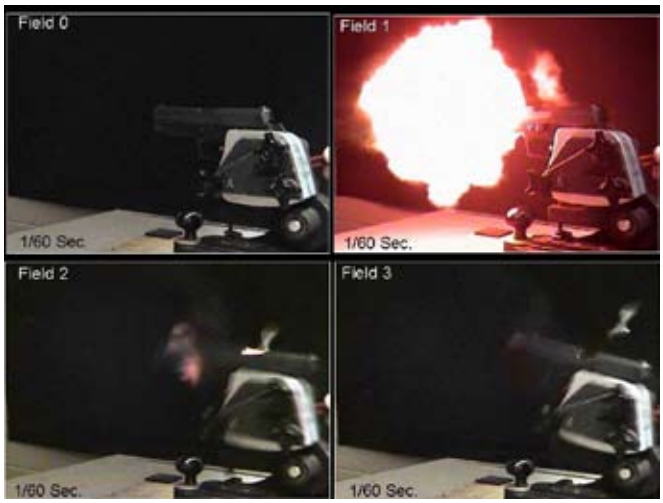

Figure 8A
Four Consecutive Video Fields of a .45Auto Speer Clean-Fire Discharge

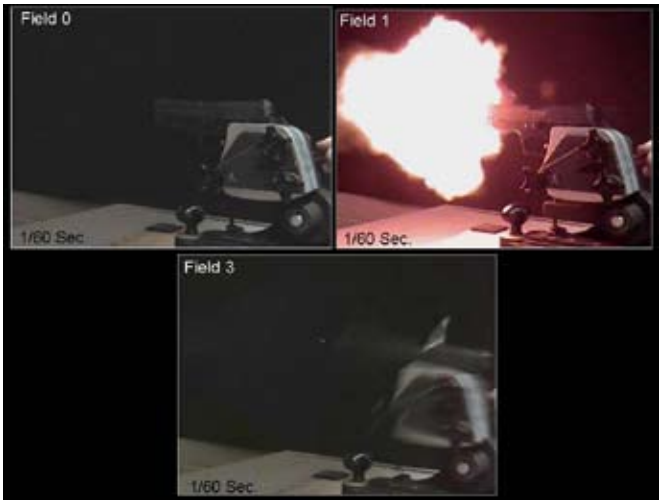

Figure 8B
Three Consecutive Video Fields of a .45Auto Speer Clean-Fire Discharge

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Evaluation and Application of Polynomial Texture Mapping in the Area of Shoe and Impression Evidence

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Abstract This polynomial texture mapping (PTM) project explores the use of the PTM technology in forensic shoe and tire impression evidence, including the use of a smaller, more portable unit for field use. The research evaluates the usefulness of PTM images by comparing them to conventional sidelight and casting techniques of the same impressions. This technology in the forensic field could significantly reduce the overhead for already extended public resources while improving the quality of the data leading to more definitive information from the scene evidence. The use of the PTM technology has the potential for better resolved images for the comparison of known shoe soles or tire treads to impressions left at crime scenes.

Introduction A shoe or tire has to have some unique characteristics that are transferred to impressions for successful comparisons. These characteristics are acquired through use or abuse. Small cuts, tears, and abrasions appear on the soles of shoes or the treads of tires as they travel in different environments or situations. These unique characteristics must have significant detail and be transferred to a corresponding impression. The unique characteristics transferred to the impression must then be captured through photography or other collection techniques. The ability to capture this unique detail in a crime scene impression is critical to the successful comparison to a known shoe or tire [1, 2].

The documentation of footwear and tire impressions at crime scenes is primarily performed through the use of photography. Other than improvements in film resolution, photographic documentation techniques have remained virtually unchanged. This method of capturing the detail left by a particular shoe or tire uses images taken with oblique lighting from various directions. The setup and photography of multiple obliquely lit impressions is a time-consuming process. Traditional photography of footwear and tire impressions does not always capture the unique characteristics present in an impression. When the unique characteristics in a footwear or tire impression from a crime scene are not adequately documented, comparisons to a suspect's shoe or tire will result in inconclusive findings.

Polynomial Texture Mapping Tom Malzbender of Hewlett Packard Laboratories developed polynomial texture mapping (PTM) software. This software was designed to improve the photorealism of texture maps [3]. The software is able to map light values from digital images taken with multiple light sources and create a light space model in a single image [4, 5]. The light direction in this image can be changed in real time, allowing an unlimited variation of the light angle.

PTM technology has been used in art galleries and for the display and enhancement of ancient clay tablets and fossil remains for several years [6, 7]. The enhancement of detail observed when applying these techniques to the fossils or clay tablets has led to better interpretations of these objects. The images are remarkable and led to our proposal to test this technique in a forensic science application. PTM has the potential of yielding much more information from impressions than the current techniques of single image oblique lighting and casting with dental stone.

The goals of this project were to determine whether the PTM technique would enhance the forensic impression evidence comparisons and to create a PTM unit that is portable for field use.

Project Description The authors were awarded a National Institute of Justice research grant to evaluate the PTM imaging technique for use with forensic footwear and tire impression evidence comparisons and to develop a portable unit for use at crime scenes. The first part of the project was dedicated to constructing a laboratory-based PTM dome, purchasing and testing camera equipment, and developing software to synchronize the digital camera control (image capture) with the flash sequence. The second part of the project consisted of testing the PTM technique with several different types of impression evidence. The impressions captured with the PTM method were compared to traditional techniques to determine any advantages or disadvantages with the PTM method. The third part of the project was designing and constructing the portable field unit, including evaluating the various flash units (strobes) for use with this device. The field unit was constructed and then tested in field conditions.

The PTM software has two main components: a fitter program and a viewer program. The PTM fitter program creates the PTM file using the biquadratic polynomial coefficients and a light position file. The fitter program recognizes image files with the JPEG (.jpg) file extension [8]. Image files with TIFF (.tiff) and RAW (.raw) file extensions cannot be converted into PTM files `9]. The light position file describes the vector light value and location of each strobe and matches this information to the image captured when this strobe was fired. The light position file is specific to each dome constructed. Once the fitter program has created the PTM file, the viewer program is used to view the images (Figure 1). A single PTM file provides views using multiple different lighting angles with interactive controls (Figure 2). The software also provides image enhancement methods (specular enhancement and diffuse gain) to modify the appearance of the image and improve readability.

2 The PTM fitter and viewer programs can be downloaded from www.hpl.hp.com/research/ptm/downloads/download.html.

Winner, Al Biasotti Award for the Most Outstanding Paper, CAC Seminar, Fall 2006, Temecula. Reprinted by permsission from the Journal of Forensic Identification, 414 / 57 (3), 2007

Equipment The equipment needed to utilize the PTM software can be relatively simple. The minimum requirements are a fixed camera position and repeatable lighting positions (LP) with known coordinates in three-dimensional space (X, Y, and Z positions). The positions of the camera and lights are used to create the LP file used by the fitter program that produces the PTM file. The light positions need to be repeatable or you have to create a new LP file for each set of images. The lights only need to be turned on and off in a designated sequence for each image. The sequencing of the lights and images can be accomplished manually. For example, Light 1 is turned on and an image (Image 1) is captured. Then Light 1 is turned off and Light 2 is turned on and an image (Image 2) is captured. This process continues until images have been taken with all of the light positions. The vector position value for Light 1 in the LP file must correspond to Image 1 and Light 2 to Image 2, and so forth. The PTM fitter uses the images and the corresponding vector locations from the LP file to create the PTM file.

The coordinates of the fixed lighting positions are critical in calculating the light space in between each LP. This lighting model is the basis of the PTM technique.

Cameras The researchers started the project by evaluating different digital cameras for use with the PTM dome. The Canon EOS 1Ds Mark II 16.7 MP and Canon EOS 20D 8.2 MP cameras were purchased for resolution comparison to 35 mm film. The Canon digital cameras were evaluated using Canon EF 24-85 mm, Canon EFS 17-85 mm, and Canon EF 24-105 mm lenses. The digital cameras were compared to the 35 mm Canon EOS Elan IIE using the same lenses. Other lenses may have better or worse resolving power. The evaluations and comparisons were performed using an Edmunds Scientific Resolving Power chart (stock # NT83-001).

Both cameras were set to give line resolutions equivalent to 35 mm film when capturing images for the PTM files. The higher resolution EOS 1Ds Mark II was not set at maximum resolution. This camera is capable of exceeding the line resolution of 35 mm film with the lenses tested. However, the higher resolution setting was not used because of the increased file size of both the captured images and the finished PTM file. Traditional impression photography predominantly uses 35 mm film, so this was set as the minimum benchmark in line resolution performance. All of the lenses met this benchmark with each camera and were effectively interchangeable. Measured differences in the line resolutions for the different camera/lens combinations were not included because the focus of this paper is the PTM technique, not the resolution of different camera systems. A more detailed discussion of the results for these cameras is available from the authors. The EOS 20D camera was used on the portable dome because it weighs less than the EOS 1Ds Mark II.

Computer Most modern computers are adequate for the PTM software. The minimum recommended random access memory (RAM) is one gigabyte (GB) and there must be adequate storage space for the digital camera images (approximately 2.5 to 7 megabytes per image) and the resultant PTM file. Each PTM file is approximately 75 to 100 megabytes (MB). These file sizes are dependent on the resolution setting of each captured image. We would recommend at least a 60 GB hard drive or other storage space. An increase in RAM improves the operation of the PTM software with large file sizes.

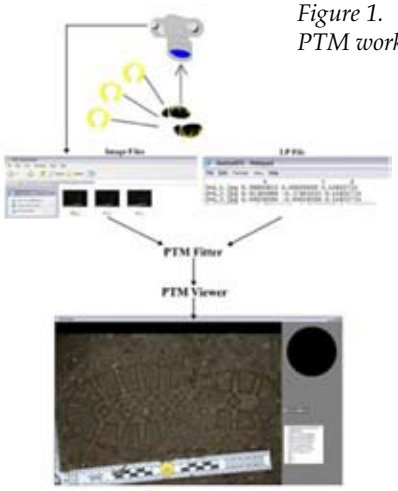


Figure 1. PTM workflow diagram.

Figure 2. The PTM file provides a view from an infinite number of lighting positions. The red arrows are examples of six of the light positions available in a PTM file.

PTM Dome A PTM dome was constructed based on the design used by Tom Malzbender of Hewlett Packard Research Laboratories. The prototype dome built by Malzbender used 50 strobe positions. These strobes were evenly distributed around the hemisphere and gave adequate light coverage for the object being documented. The PTM dome was used to document various impression samples (shoe impression casts, electrostatic dust lifts, etc.) for initial viability with forensic impression evidence. Malzbender indicated that additional strobe positions would provide smoother lighting transitions in the finished PTM file.

The shell of the dome is constructed of blow-molded plastic with a diameter of approximately 27 inches (Figure 3). The interior of the dome shell is painted flat black to reduce reflections within the hemisphere. Sixty-four strobes are attached to circuit boards and are mounted around the hemisphere of the dome. The power to the strobes and the sequence of firing are controlled through a controller box. The controller box uses 110-volt current, which is reduced through a transformer to the capacitors on the strobe boards. The capacitors on the strobe boards are charged in series through a ribbon cable attached to the controller box. Software development kits (available from the camera's manufacturer) for the digital cameras are used to synchronize the camera shutter with the firing of the strobes and the downloading of the images to an attached computer. The metal frame around the top of the dome has a polyacrylic plate used for mounting the camera. The lens of the camera is oriented through a hole at the top of the dome. The strobe positions in the dome were measured in three-di-

mensional space and the light vector values were calculated to create an LP file.

The object to be photographed is placed in the center of the lighting hemisphere. A single image is captured for each of the 64 strobe positions. This results in 64 separate digital images. Except for the angle of oblique light, each image is identical. Each image corresponds to the vector light direction of the strobe that was fired when the image was captured. With the vector light direction information, the software applies biquadratic polynomial coefficients to determine light values for each pixel of each image. These values are combined to create the PTM file, which is a model of the lighting hemisphere. The original 64 images are retained separately.

Portable PTM Unit The portable PTM unit (Figure 4) was designed after the dome structure was completed. A rotating 3-foot arc with eight light sources was fabricated. The arc can be manually stopped at eight different positions to mimic the 64 different light positions on our PTM dome. The portable unit requires more human intervention than does the PTM dome. Also, there is a potential weakness in capturing images with the portable unit during daylight hours. This can be overcome by the use of any opaque material for shading the impression.

The frame is constructed of square, tubular aluminum. The flash arc is constructed of 1/4" sheet aluminum with an 18" radius. The flashes used on this dome are modified Vivitar DF120 digital slave flashes. These flashes were selected because of their compact size and because the light output works well with the radius of the flash arc. The controller box for this dome uses a USB connection and is powered through the attached computer. Two AAA batteries power each of the flashes. The flash locations were measured and the light vector values were calculated to create another LP file. The camera mount is a polyacrylic plate mounted on square tubular cross members.

The portable PTM unit is 45" W x 53" L x 42" H in the open position. The camera mount frame and the swing arm fold flat, and one set of legs telescope inward for transport and storage. In this position, the unit is 45" x 50" x 11". There are six adjustable legs, which assist in leveling the unit over the impression and limit the unit's contact with the ground and impressions. The unit weighs approximately 50 pounds.

Testing and Results of PTM

Purpose The purpose of this testing was to compare the detail visualized in footwear impressions using traditional lighting techniques and the PTM process.

Procedure Test footwear impressions were produced using several different substrate materials and types of footwear. Test impressions were made in soil, mud, and blood with three types of footwear (an athletic shoe, a work boot, and a dress shoe). One shoe from each pair was used to make all of the impressions for evaluation. Additional impressions were made on cardboard, and a dust impression was created for collection with an electrostatic lifter.

These impressions were documented using the PTM dome system with the Canon EOS 1Ds Mark II camera with the 24-85 mm lens. Casts were made of the three dimensional impressions in soil and mud. These casts were photographed with the PTM system for evaluation.

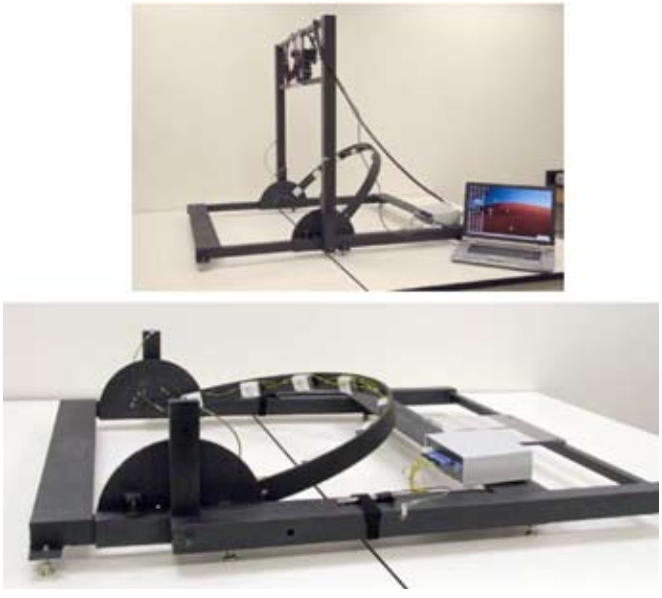
Four of the 64 images captured using the dome were selected for use as the traditional type impression photographs. These photographs were evaluated and compared to the test shoes using normal comparison techniques to document the unique detail that was visible using the traditional lighting methods. Using the PTM software, images were printed with light positions similar to the light positions used for the traditional photographs. These images were evaluated and compared to the test shoes using normal comparison techniques to document the unique detail visible using the PTM software to mimic traditional lighting. Finally, the images with traditional light positions were compared to the PTM images. The amount and quality of detail correspondence were recorded between the traditional and interactive PTM images.

Athletic Shoe The traditional photographs, the printed PTM images, and the interactive PTM file for the impressions made with blood were compared to the athletic shoe sole using normal comparison procedures. There was sufficient correspondence of unique detail in all of these images to identify the athletic shoe to the impressions in blood. Some improvement in the visibility of the impression detail was observed with the specular enhancement feature of the PTM software.

The traditional photographs, the printed PTM images, and the interactive PTM file for the impression made in soil were compared to the athletic shoe sole using normal com-

Figure 3. PTM laboratory dome.

Figure 4. Portable PTM unit.



parison procedures. In the traditional photographs and the printed PTM images, sufficient correspondence of unique detail was observed to conclude that the athletic shoe most likely made the impression in soil. However, the quality of the correspondence was insufficient for identification. When the soil impression was viewed using the interactive PTM file, additional clarity of unique detail was observed using the specular enhancement feature of the software. The additional clarity of the detail observed was sufficient to identify the athletic shoe to the impression in the soil.

The traditional photographs, the printed PTM images, and the interactive PTM file for the impression made in mud were compared to the athletic shoe sole using normal comparison procedures. In all of the images, some unique detail was observed. However, the correspondence of unique detail in this impression was insufficient for identification. Some additional clarity of detail was observed using the interactive PTM file and enhancement features. However, the additional clarity was not sufficient to change the examiner's conclusion.

Work Boot The traditional photographs, the printed PTM images, and the interactive PTM file for the impressions made with blood were compared to the work boot soles using normal comparison procedures. There was sufficient correspondence of unique detail in all of these images to identify the work boot to the impressions in blood. Some improvement in the visibility of the impression detail was observed with the specular enhancement feature of the PTM software.

The traditional photographs, the printed PTM images, and the interactive PTM file for the impressions made in soil (Figure 5) were compared to the work boot soles using normal comparison procedures. There was sufficient correspondence of unique detail in all of these images to identify the work boot to the impression in soil. Several additional areas of correspondence were observed in this soil impression using the specular enhancement feature of the PTM software. The defects were observed in the traditional photograph, but appeared to be soil artifacts, not unique detail transferred from the boot sole. The specular enhancement improved visualization of these features and allowed a clear correspondence to defects in the boot sole to be observed.

The traditional photographs, the printed PTM images, and the interactive PTM file for the impression made in mud were compared to the work boot soles using normal comparison procedures. In all of the images, sufficient correspondence of unique detail was observed to conclude the work boot most likely made the impressions in mud. However, the quality of the correspondence was insufficient for identification. Improvements in the clarity of some impression features were observed with the specular enhancement and diffuse gain features of the PTM software.

Dress Shoe The traditional photographs, the printed PTM images, and the interactive PTM file for the impressions made with blood (Figure 6) were compared to the dress shoe sole using normal comparison procedures. There was sufficient correspondence of unique detail in all of these images to identify the dress shoe to the impressions in blood. Additional clarity of the unique detail was visualized in the interactive PTM file using the diffuse gain and specular enhancement features.

The traditional photographs, the printed PTM images, and the interactive PTM file for the impression made in soil were compared to the dress shoe sole using normal comparison procedures. There was sufficient correspondence of unique detail in all of these images to identify the dress shoe to the impression in soil. Additional clarity of the unique detail was visualized in the interactive PTM file using the specular enhancement feature (Figure 7).

The traditional photographs, the printed PTM images, and the interactive PTM file for the impression made in mud were compared to the dress shoe sole using normal comparison procedures. In all of the images, sufficient correspondence of unique detail was observed to conclude the dress shoe most likely made the impression in mud. However, the quality of the

Figure 5. Traditional impression photograph vs the work boot vs a PTM enhanced image.

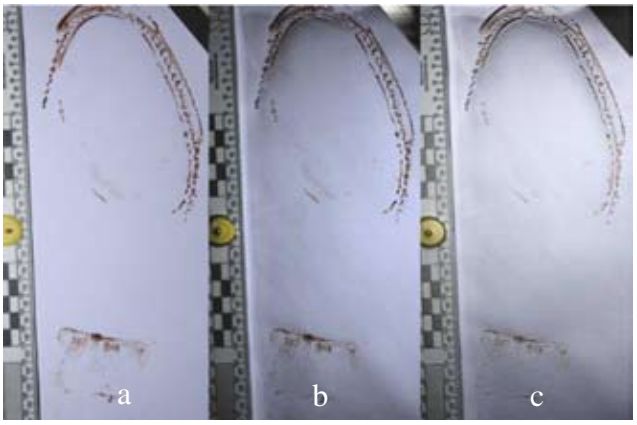


Figure 6. Dress shoe impression in blood: (a) traditional image, (b) diffuse gain, (c) specular enhancement.

Figure 7. Dress shoe in soil: (l) traditional image, (r) specular enhancement.

Figure 8. Improvement of unique detail visualization using the PTM technique: (a) traditional image, (b) work boot sole, (c) specular enhancement. This is an enlarged mid-sole of the work boot from Fig. 5.

correspondence was insufficient for identification. Some additional clarity of detail was observed using the interactive PTM file and enhancement features. However, the additional clarity was not sufficient to change the examiner's conclusion.

Casts The casts produced from the mud and soil impressions were photographed using the PTM technique. The interactive PTM file of these casts was evaluated. The clarity of the detail in the interactive PTM file for some of the casts was slightly improved using the diffuse gain and specular enhancement features of the software. The improved visibility of texture within the casts collected for this study was not significant. However, in a situation where poor photographs are received with a quality cast, the PTM technique may be beneficial.

Electrostatic Lift An electrostatic lift of a positive dust impression was collected for photography using the PTM technique. The interactive PTM file of this lift was unsuitable for use. The highly reflective surface of the Mylar sheet used for collection of the dust impression prevented the visualization of the impression on this lift. The PTM technique did not improve the visualization of impression characteristics on the electrostatic lift.

Cardboard An impression was made on cardboard using the work boot and photographed using the PTM technique. The cardboard was not expected to capture unique detail. This impression was evaluated for the class characteristics of the boot sole. By using the interactive PTM file, the general class characteristics of the boot sole were visible. The ability to freely move the light position allowed the examiner to quickly discern the shapes and general characteristics of the boot sole in the cardboard.

Testing and Results of the Portable PTM Unit

Purpose The purpose of this testing was to document tire impression evidence and to test the prototype portable PTM unit in a field environment.

Procedure The Canon EOS 20D camera with the EFS 17-85 mm lens was used for the portable PTM unit. A tire impression in soil was produced outdoors using one of the laboratory's vehicles. A section of this impression was documented with the PTM technique during daylight and at night for comparison to the responsible tire. Daylight documentation was performed with the impression in full light and in shade. The set of images with the best quality was selected for final comparison to the responsible tire. The same comparisons performed for the testing of the laboratory-based dome were performed for the comparison of this tire impression.

The images of the tire impression taken during daylight showed reduced contrast and weak shadows, using the portable unit. This effect is typical of impression photography when oblique lighting is used during daylight. The image quality was improved when the impression was shaded prior to taking the images.

The images captured at night had the best contrast and visibility for comparison and were used for the comparison to the tire. Comparisons were performed in the same manner as the comparisons for the footwear impressions tested with the laboratory PTM dome.

The traditional photographs, the printed PTM images, and the interactive PTM file for the impression made in soil were compared to the tire tread section using normal comparison procedures. There was sufficient correspondence of unique detail in all of these images to identify the tire tread section to the impression in soil. Some improvement in the clarity of the detail in the tire impression was observed. However, additional areas of unique correspondence were not observed.

Discussion Two digital cameras were tested for use with the PTM technology. The evaluations compared the resolution of 35 mm photographs to the digital images. The research indicates that a minimum sensor resolution is needed for resolution equivalent to 35 mm resolution. For the Canon cameras tested, this was approximately 8 megapixels using the JPEG file format in various compression settings. This will vary with different manufacturers and models of digital cameras and each should be evaluated prior to use for forensic work. The PTM software utilizes JPEG file format. The JPEG compression did not affect the images significantly and RAW or TIFF file formats can be saved prior to a conversion to the JPEG format.

The PTM files assisted in the comparisons of the footwear impressions. When using the PTM file for comparisons, the adjustable light position was very useful for highlighting texture information in an area of interest. In some comparisons, the enhancement features in the software (specular and diffuse gain) improved the visibility of unique detail in an area of interest (Figure 8). The PTM image and enhancements improved the visibility of detail in some of the impressions. When compared to traditional obliquely lit impressions, the shadows in the PTM file were slightly soft compared to the hard-edged shadows in the traditional photographs. Malzbender indicated this effect is caused by the simplicity of the polynomial equation used to map the light values. He also indicated a more complete equation could be developed. However, the size of the PTM files would become prohibitively large. The PTM files used during this study were approximately 75 MB. PTM file sizes in the 400 to 500 MB range were estimated if a more complete equation were developed. The soft shadows did not significantly affect the quality of the comparisons performed during this study. Additionally, 64 images of the traditionally lit impression with the hard-edged shadows are captured during this process and are available for use in comparisons. For these reasons, the development of a more complete equation is not warranted.

When compared to traditional photography techniques, the PTM technique improved the visualization of unique characteristics in several of the impressions captured during testing. Many of the areas of unique detail that improved with the PTM technique were visible in the traditional photographs, but the shape of the detail was not as well defined. The PTM technique improved the detail shape in these ar-

eas, allowing the examiner to confirm the correspondence of the detail in the impression to a unique characteristic in the shoe. However, the use of the PTM technique did not improve the visualization of texture in all of the impressions captured when compared to traditional photography techniques.

The PTM file did not show improvement in some analyses because of the photographer's ability to capture the unique detail. If the unique detail is captured on single images, then it leads to very favorable analyses. However, the PTM technique gives the analyst a better chance at capturing all unique detail because of the coverage of the surface area using the PTM technique versus traditional single images. Additionally, the PTM file has "soft" edges because of the program's need to save file space. The "harsh" edge of impression evidence captured by single images may provide a better comparison sample when evaluating unique detail on an edge of an impression.

The PTM technique has several advantages for the documentation of footwear and tire impressions. This system is synchronized and controlled through a computer interface and allows these images to be captured in a fraction of the time required for traditional photography techniques (2 to 3 minutes for 64 images versus up to an hour with traditional photography). The software creates a light space model using calculated light values from the captured images. The photographed impression can be viewed through the software with infinite light positions in a hemisphere over the impression. This software allows the examiner to fine tune the light position for any area of an impression during a comparison and gives the examiner the ability to maximize the visualization of the texture in an impression. This software also has enhancement techniques (specular and diffuse gain) that can further improve the visualization of texture detail in an impression. The use of the PTM technique allows for more thorough and better documentation of impressions left at the crime scenes. The fixed lighting positions required for the PTM technique improves the consistency of impression documentation. The use of the PTM technique improved the quality of some comparisons to known shoe soles or tire treads.

Conclusion The testing performed with the fixed dome determined that the PTM software could improve the visualization of texture within a shoe or tire impression when compared to traditional photography techniques. The PTM technique offers a dramatic improvement in the documentation of footwear and tire impressions compared to traditional techniques and saves significant time in the documentation process. This technique gives the examiner the best opportunity for visualizing unique characteristics in impression evidence. The additional software enhancements (specular and diffuse gain) further assist in the texture visualization and can improve the quality of comparisons to shoes and tires.

This improvement in the visualization of detail in impressions, improvement in documentation, and the reduction in collection time also apply to the portable version of the PTM dome.

Overall, the research indicates that the use of PTM technology for documentation and evaluation of impression evidence improves the quality of the analysis. The PTM technique saves a tremendous amount of time in capturing different obliquely lit images of an impression. The analysis of different detail in an impression is much easier using one PTM file versus multiple 35 mm photographs. The PTM technique provides examiners with an infinite number of images from different lighting positions for their comparisons. The PTM technique has several advantages for the documentation of footwear and tire impressions.

Future Research Although the current version of the portable field unit is large (approximately 4 feet), it is hoped that future research into light technology could reduce the size by one half. Different light sources, including LED and fiber optic systems, should be evaluated for use with the portable PTM unit. The future design could also incorporate an automated (motorized) sweep of the light positions rather than the current manual movement to eight different positions.

The use of the PTM technique in forensic sciences can be varied and the technique should be evaluated for other types of comparative evidence such as latent prints and questioned documents. The size of the dome could be varied, based on the intended application.

Acknowledgments This research was funded through a National Institute of Justice grant (NIJ Grant# 2004-IJ-CX-K008). This research would not have been possible without the support and hard work of many people. We would like to thank Bill Lockyer (California Attorney General) and the Bureau of Forensic Services for their support and encouragement; Mr. Malzbender and Mr. Gelb, developers of the PTM technique, who introduced this technology to the forensic community and whose assistance with this research was indispensable; Mr. Michael Cavallo, who built the PTM dome and electronic components of the portable dome; and Mr. Robert Kuta and Allied Engineering and Production Corporation for the final design and fabrication of the frame for the portable PTM. The testing of this technology would not have been possible without the hard work and dedication of the Bureau of Forensic Services - Central Valley Laboratory staff, especially Criminalists Sarah Yoshida, Elizabeth Schreiber, John Brogden, Nicole Snodgrass, and Scott Bauer.

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I can't tell you how many times I've tried to access and old website and received an error message. In fact, if I go down through the list of my "favorites" that I have saved on my hard drive, I'll likely get that error message for close to 10% of them. Well today I found there is a way that these old, removed websites can be recovered.

First, notice that with virtually all peer-reviewed scientific publications that if you (the author) cite a webpage, the editor will ask that you also cite the date that it was accessed. I now know the reason for this.

Back in February I was in San Antonio to attend the annual meeting of the American Academy of Forensic Sciences (AAFS). Outstanding meeting

First, there is an Internet website designed just for this purpose. It's called "The Wayback Machine." Go to: www.archive.org/web/web/.php

with many interesting presentations and posters, and thanks to Peter de Forest the food at the criminalistics section luncheon and evening reception was truly outstanding!

One of the more interesting posters was B10, "Combating the illegal gold trade using elemental and isotopic profiling." [To see the abstract for this poster go to www.aafs.org Along the top put your cursor on RESOURCES and from the drop down menu click on Proceedings. Scroll down and click on the 2007 meeting (Volume 13).] Standing at the poster was Henriette Ueckermann, an analytical geochemist and authority on mass spectrometry. I engaged her in conversation and although the situation in her poster was quite different, it triggered in my memory a PowerPoint presentation that was given at a past meeting of the Midwestern Association of Forensic Scientists and was about the investigation of a theft of placer gold. I had seen this PowerPoint presentation on the MAFS website several years ago. Henriette gave me her card and I promised that I would email to her the website address where she could find this presentation.

When I returned home I went to the MAFS website, but I couldn't find that presentation. I hadn't saved the presentation on my hard drive, but in my correspondence I did have the old Internet address where I had found it:

mafs.net/dalelaux/Meeting%20Presentations/trace/Munroe/Ghana%20Presentation2.pdf

Entering this in my browser just gave me an error message. I contacted the webmaster for the MAFS site and he couldn't find it. I then contacted Glenn Schubert, current president of MAFS. He eventually found someone who had a copy of that presentation, but I now know there is a much easier way. In fact, I just used it to find that PowerPoint presentation. Let me use it as an example and talk you through the various steps.

First, there is an Internet website designed just for this purpose. It's called "The Wayback Machine."

Go to: www.archive.org/web/web/.php

You will find instructions on that page, but I found them confusing. When I simply entered the old MAFS address for that presentation in the search engine it didn't work. I just got an error message. So I clicked on "Advanced Search" and skimmed the instructions there. It seemed like you first had to enter:

http://web.archive.org/

And directly after (no space) enter:

http://mafs.net/dalelaux/Meeting%20Presentations/trace/Munroe/Ghana%20Presentation2.pdf

When I hit return it took awhile (my computer is much like a government employee: very slow; grumbles a lot; but with sufficient prodding eventually gets the job done), but finally the entire PowerPoint program came up on the screen. The program does ask you for a date window. You don't have to enter anything, but it greatly speeds up the search if you can. When I entered no dates it didn't work on my tired, old computer, but when I said just search between 2000 and 2001 (the meeting was in 2000) the PowerPoint program came right up. The archive dates back to 1996.

Bob Blackledge

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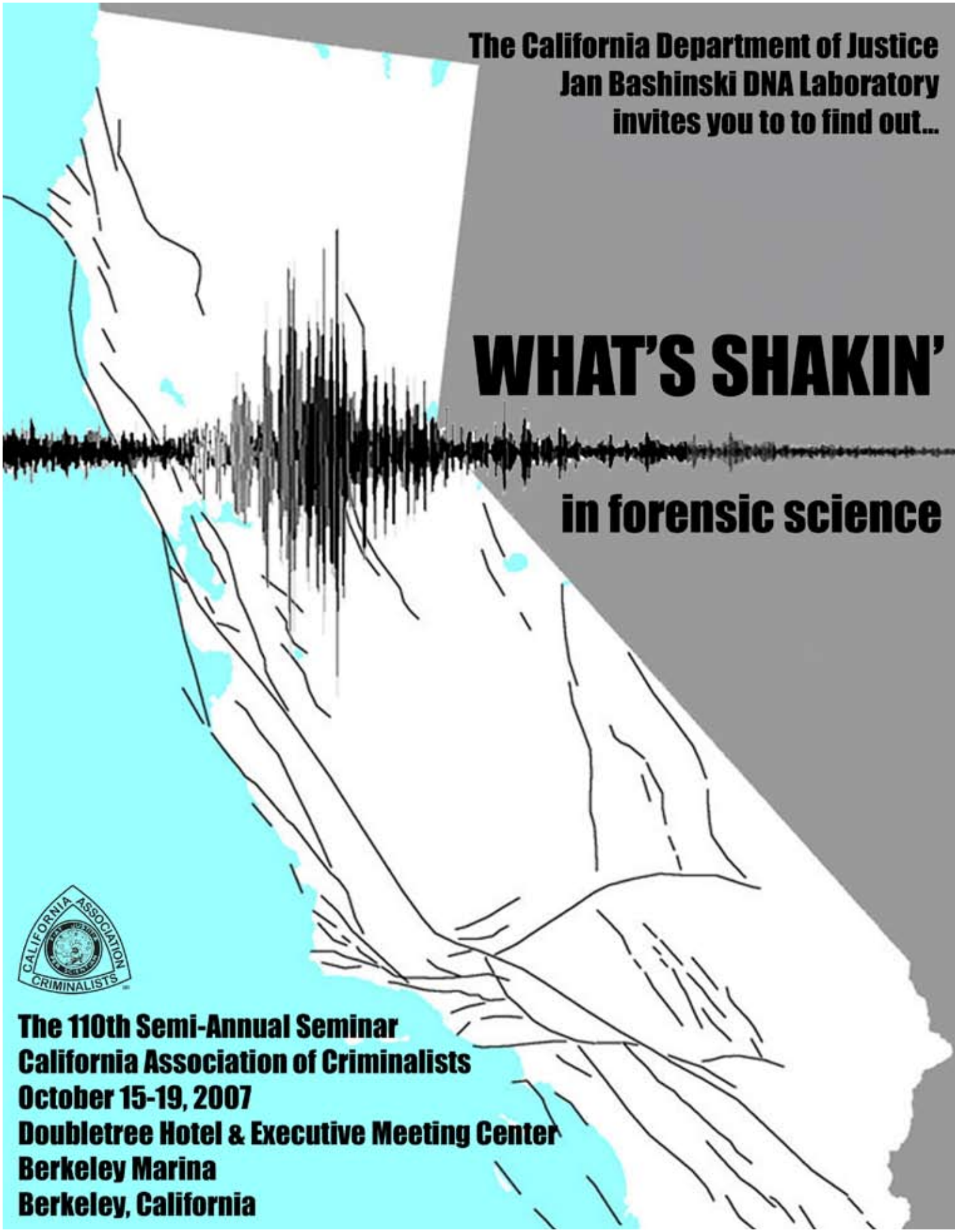
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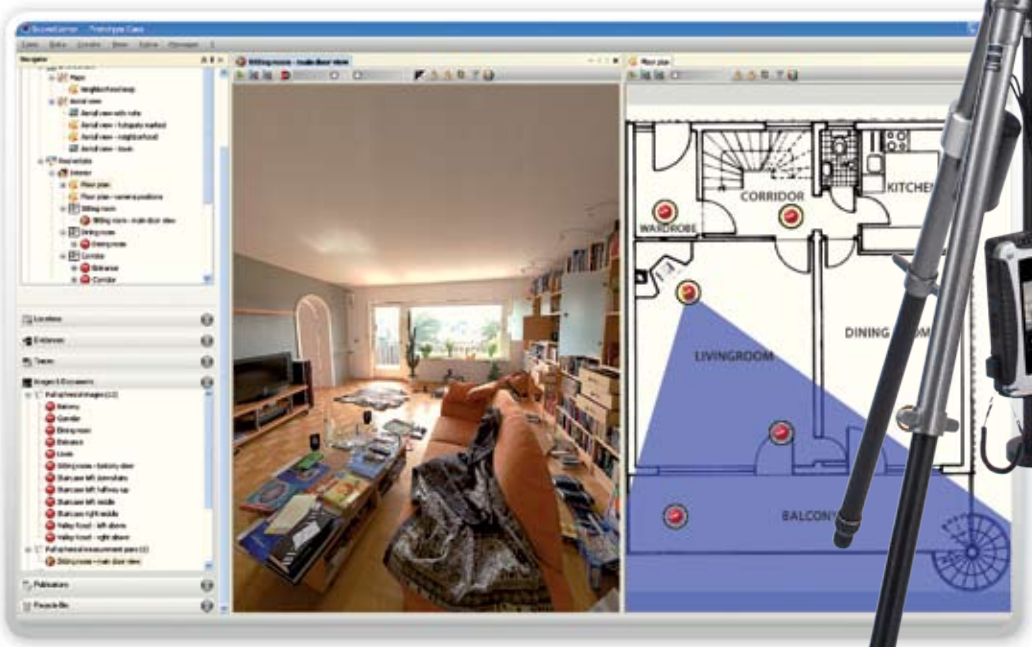

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