David P. Baldwin, Ph.D.

Manager, Nonproliferation Testing and Evaluation

Special technologies Laboratory

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"To Examine the State of Forensic Science in the United States"

Good morning. I want talk to you today about the need for a wide range of research and development in the field of forensic science. I am telling you this based on almost 20 years of working with the forensic science practitioner community to understand the difficulties that community faces in delivering the best scientific analyses they can for our legal system. I have worked with these practitioners in partnerships on research projects, in developing and delivering new training courses requested by them and designed and delivered with their input, in building partnerships with universities to improve forensic education for the next generation of practitioners, in collaborating with lab directors to find better business and operations methods to do more with less, and in participating in the community's standards-setting organizations to raise the level of practice for themselves and their peers.

My perspectives on research needs in this field have come from the community's critical introspection, as well as the aspiration of these professionals to advance their field.

Some of the most topical and timely research needs relate to studies to better understand the reliability, and therefore the value, of forensic science analyses. My particular interests are research for the pattern evidence fields of firearms, documents, friction ridge, bloodstains, and footwear and tire tracks. Many of these same issues and areas apply more broadly across all of forensic science.

In order to communicate the proper weight and value to give to a particular scientific analysis, it is important to have an idea of the reliability of the evaluation. Some of these studies, sometimes called blackbox studies, have been performed and more are anticipated. In my opinion an important aspect of this work is to also find ways to digitize and capture measurable quantities related to these types of evidence. These digital records can be used to provide objective measures of data quality. They also enable the development of software-based tools to assist examiners in evaluating the quality of the evidence and its value in a particular comparison or interpretation. Other

related research needs to be carried out that gives examiners more information about the persistence of features used in examinations over time and through wear and tear.

Given my prior experience in designing and executing a reliability study of this sort for firearms analysis of cartridge cases, I am convinced that research is needed to come up with 3D imaging technologies that preserve evidence and present it in a way that can be used by examiners for comparisons. There are several reasons and benefits to this development, but the most immediate has to do with the issues associated with assembling one of these studies. Firearms examiners make very few errors. When you design an experiment to measure a very small error rate accurately, you need a large sample set with lots of materials, lots of examinations, and many participants. There are a finite number of examiners who can participate in these studies. For firearms the number of participants is between 200 and 300 in the US. Of those who can and are willing, even they have limited time to be away from analyzing real casework evidence. You also can't afford to make any mistakes in preparing and distributing samples for all of those tests. Instead of collecting tens of thousands of bullets or cartridge cases, if we could instead collect 3D images of a smaller number of samples, distribute them digitally, and have examiners look at the same images, rather than different samples from the same source. With this change we would have more affordable, easier to assemble experiments. Of course one of the first experiments needed is to see whether examiners can perform as well with 3D images as they do with their current microscopic examination methods. This is an extremely important experiment in its own right.

Follow-on benefits of this digital change in forensic experimentation are: the availability of shared training materials for all, easily accessible databases for development of algorithms to help evaluate evidence quality and to assist in searching real world casework databases, common test materials for proficiency and certification, better documentation of examinations, and a validated format for sharing data for remote validation of examinations.

Along with these reliability studies other important areas of research that need to be tackled include the evaluating the potential influence of different forms of bias and the efficacy of various possible control measures; quality assurance methods and the efficacy of validation and review; improved biometric capture methods and means of comparison of collected media to databases; the application of physical experiments and models to understand complex crime scene phenomena like bloodstain deposition or fire and explosion debris; the effect of mixed, partially obscured, or damaged evidence on examinations and interpretations; digital evidence tools, attribution, extraction and search tools for computers and networks; better ways to document examinations and comparisons as well as better ways to communicate those examinations to the legal community and the public.

All of these areas are identified by the current practitioner community as vital needs. All of them require the participation of the broader academic and scientific establishment to address, in partnership with practitioners who understand the needs and the applications.

A lot of this research has begun at some level. The current environment for forensic science research includes resources managed by the National Institute of Justice, the FBI, the National Institute of Standards and Technology, the National Science Foundation, the Defense Forensic Science Center, and at a smaller scale by other stakeholder agencies within DHS, DoD, and DOJ.

It is important to understand that forensic science is still developing as a field of research and development. To encourage that development, the field needs more than a handful of studies and a few more practitioners. To get comprehensive and continuing improvement in a field of science, there needs to be sustained fundamental, basic, and applied research, advanced engineering, and robust testing and evaluation. There need to be reasons for faculty and laboratory researchers to specialize in solving the ongoing problems related to advancing forensic science. There need to be undergraduate and graduate students who see a future in dedicating their careers to

solving these challenges. This will take a sustained application of resources and a coordinated vision directing and encourraging all of these levels of activity.

Discoveries and developments need to get into the hands and minds of the practitioners as well and that will take technology transfer and training programs coordinated with the R&D efforts. Elements of these exist or have periodically been addressed in the past, but sustained vision and coordination is required. The NIJ has a center of excellence dedicated to technology transfer from its R&D program and has had training programs in the past.

Over the past 20 years I have established programs to partner with crime laboratories to develop and provide resources to satisfy a wide range of needs. During my time working at the US Department of Energy's Ames Laboratory and Iowa State University, I and my colleagues developed a strong partnership with federal, state and local crime laboratories in 16 states to provide access and a means to develop resources for forensic science. It was called the Midwest Forensic Resource Center or MFRC. The goals of the center, developed with our stakeholder partners, was to provide access to experts and unique instrumentation, develop and deliver shared training, to improve the level of interaction between crime labs and forensic science educational programs, to perform research in collaboration with crime laboratories, and to test and evaluate new business and infrastructure methods for public laboratories to operate more effectively and efficiently.

The regional model that the MFRC established worked extremely well in establishing the link between the needs of the community and provision of resources by making that a partnership at all levels. The MFRC brought partner involvement throughout the process from ideas to practice.

I recently moved from that job at an academic research institution and the federal Ames Lab that is operated by that university. I working as a R&D manager at the Special Technologies Laboratory. STL is a division of National Security Technologies (NSTec) and is an NNSA-owned research facility. In this new institution I am working with some of

my old partners from the MFRC, such as Director Gamette of Idaho, to establish a new resource center at NSTec for the western states region. This new center is built around the resources of STL in California and the Nevada National Security Site and the Remote Sensing Laboratory in Nevada. This effort has begun this fiscal year with a business development investment by NSTec in FY17 to plan pilot projects for the new center. We hope to establish a new partnership with the community in the western states region. We believe that this partnership will continue to find effective ways of developing and delivering resources to improve forensic science.

From experience I know that building an infrastructure for effective partnerships with the crime laboratory and broader forensic science community is vital to a sustained and successful effort to improve forensic science. The provision of resources needs to be both a push and pull proposition and from my experience that is best done by establishing partnerships for transitioning ideas to practice.

I want to thank you for the opportunity to speak with you today and share my vision of what needs to be done to move forensic science forward.