B125 XRF Results From the Rapid Analysis of Crime Scene Evidence as a Real-Time Investigative Aid

Brian J. Gestring, MS, Pace University, 1 Pace Plaza, Room Y23, New York, NY 10038-1502; Carl M. Selavka, PhD*, Massachusetts State Police, 59 Horse Pond Road, Sudbury, MA 01776; Jeff Schweitzer, PhD, University of Connecticut, East Main Street, Waterbury, CT 06702; Jacob Trombka, PhD, NASA, Goddard Space Flight Center, Code 691, Greenbelt, MD 20771; Gerald M. Zeosky, MA, New York State Police, 1220 Washington Street, Building 30, Albany, NY 12226; Samuel Floyd, MS, and Timothy McClanahan, MS, NASA, Goddard Space Flight Center, Code 691, Greenbelt, MD 20771*

The goal of this presentation is to serve as an update on the progress made in establishing a portable X-Ray fluorescence (XRF) unit for the non-destructive characterization of evidence at crime scenes.

Much as DNA testing and databases revolutionized how forensic science impacted criminal investigations in the last decade, this presentation will impact the forensic community and/or humanity by demonstrating how rapid characterization of crime scene evidence has the potential to do this – and more – for the next decade.

Unintended consequences of enhanced analytical power (sensitivity and selectivity) include increased sophistication of forensic science methods and longer, more complicated analysis. While these analyses ultimately lead to more probative information, the information is not available to the investigator at the scene during the critical first stages of a case. Unlike common television depictions, the results of most forensic analyses often are not available for months, rendering them virtually useless to the investigation. Right after an incident, suspects are "off balance" and have not had sufficient time to evaluate their circumstances. The ability to refute specific claims scientifically would give investigators the necessary leverage during interrogation.

Over the past 8 years, significant progress has been made to address this. A unique partnership developed between NASA's Goddard Space Flight Center, forensic scientists, law enforcement personnel, academicians, and prosecuting attorneys to adapt space exploration technology developed by Goddard to problems encountered at the crime scene. The concept of civilians who can benefit from technology developed for space exploration is not a new one. The notion of "dual use" began under President Reagan, and has continued as a key strategic focal area for NASA ever since. As a result of this partnership, a small, portable X-Ray fluorescence (XRF) unit has been developed. XRF as a forensic tool in general, and in alpha and beta tests performed by the team, has been applied in multiple laboratory settings to characterize various forms of trace evidence.

Much as DNA testing and databases revolutionized how forensic science impacted criminal investigations in the last decade, rapid characterization of crime scene evidence has the potential to do this – and more – for the next decade. As the investigative power of DNA testing and DNA database searching is fully realized, significant efforts by others are underway to extend this DNA technology to crime scene applications. A portable XRF unit will serve as one of the tools that will allow investigators to extend this potential enhancement of investigative timeliness to not just biological evidence, but all of the evidence found at crime scenes. This will allow scene personnel to focus investigative efforts on those areas and items at the scene that are most likely to yield probative information needed, and resolve violent crimes as quickly as possible. This lowers recidivism rates both in theory and in every conceivable practical sense.

Beta testing of the portable XRF prototype has demonstrated the ability to characterize various forms of physical evidence. Advanced spectral analysis software allows complex spectra to be analyzed quickly. Through the application of special NASA expertise, software such as PENELOPE allows forward Monte Carlo modeling of spectra for materials that could be encountered at scenes, but might not occur in existing XRF databases.

The unique XRF instrument has been designed with a rugged, adjustable voltage, X-Ray generator. A virtually mass-less sample support combined with an effectively designed beam catcher have resulted in drastic reduction of background from coherent scattering. The use of a Shottky Cadmium/Telluride detector allows for higher efficiencies for detecting the more energetic photons.

The design of an affordable and effective method of real-time elemental analysis has the potential to revolutionize the information retrieved from crime scenes and increase the information available to investigators before they even leave the crime scene. This presentation will provide a short history of the portable XRF program, specific findings related to the application of XRF to various types of trace residua commonly encountered during violent crime investigations, and a summary of potential strategies underway for commercialization of this analytical tool by the Federal government agencies involved.

Elemental Analysis, Crime Scene, Trace Evidence

 ** Presenting Author*