D28 The Use of Infrared Imaging to Facilitate Fired Cartridge Case and Bullet Comparisons

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After attending this presentation, the attendees will have an overview of different image acquisition techniques for cartridge cases and bullets. A near-infrared (IR) camera connected to a stereomicroscope that is capable of acquiring IR images of fired evidence will be demonstrated in this presentation.

This presentation will impact the forensic science community by exploring the microscopic capabilities of IR research as applied to the comparison of fired bullets and cartridge cases. IR has been extensively used for night-vision, search-and-rescue operations, navigation, astronomy, and medical body scans. Current forensic use of near-IR involves detecting gunshot residue and biological stains. This research explores the microscopic capabilities of near-IR research as applied to the comparison of fired bullets and cartridge cases. Advanced machine

After attending this presentation, attendees will gain an appreciation for the effect that metal bore brushes commonly marketed and sold in retail firearm stores for cleaning have on the striations in a bullet's land impression and the need for care when analyzing firearms that are subject to frequent cleaning.

This presentation will impact the forensics science community by demonstrating the susceptibility of changing land impressions that are frequently cleaned with bronze or steel bore brushes over the long term. It will also encourage firearms examiners to be cautious when comparing firearms likely to have been cleaned after a shooting incident, either through an extended lapse of time or through recovery of such cleaning brushes along with evidence firearms.

Although it is considered common knowledge that using steel bore brushes to clean firearm barrels may have potential to change the pattern individual characteristics, no documentation of the effect is to be found in the literature. In an effort to confirm this effect, several 9mm semiautomatic pistols were field-stripped and their barrels subjected to a simulation of long-term use of various bore brushes. Using Hoppe's No.
9 Solvent as a cleaning solution, bore cleaning brushes of various compositions (nylon, bronze, or steel) were passed through the barrels 1,000 times using a standard cleaning technique. Test groups of three bullets each were fired before cleaning began and at varying intervals during the process, and the bullets of each test group were compared to each other and earlier test groups.

learning technology can also be easily implemented with the IR images. Time saved will enable examiners to reduce backlog by efficiently and effectively comparing firearms related evidence.

Lighting is a common problem faced by firearms examiners when comparing cartridge cases and bullets. Visible light interacts with the surface texture of these items resulting in the production of shadows. These shadows are key for comparing and identifying striations and impressions on evidence fired from the same firearm. However, if the lighting is not exactly the same for the two items being compared, differences in the shadows may be created, which could make an evaluation of the items more difficult. Other problems related to the use of visible light for cartridge case and bullet imaging include reflected light issues, glare, and the incident angle of oblique lighting. Image acquisition techniques such as 2D and 3D laser imaging, scanning electron microscopy, and thermal infrared microscopy will be reviewed and compared.

In this work, a digital SLR camera with IR capabilities will be fitted with an IR filter, mounted to a stereomicroscope, and used to capture images of cartridge cases and bullets. Different light sources will be compared for use with the camera. Test fired cartridge cases and bullets from multiple makes and models of firearms will be photographed using both near-IR and visible light. Both faint and exaggerated striations and impressions will be photographed in order to determine the sensitivity of using near-IR for imaging this type of evidence.

The difference between this work and other related research is that near-IR imaging will be used to facilitate manual comparison of firearms-related evidence by examiners. IR images produced by near-IR light are expected to reveal more detail than visible light microscopy, resulting in a detailed image that is suitable to assist forensic firearms examiners in their evaluation of fired cartridge cases and bullets. It will be shown that the connection of a near-IR camera and a stereomicroscope is an affordable, efficient, and useful adjunct to visible light microscopy for crime labs.

This research will evaluate the use of near-IR light to examine fired bullets and cartridge cases using a comparison microscope. Forensic firearms examiners will compare bullet and cartridge case images captured with near-IR light and visible light. The benefit of using near- IR light will be determined. It is anticipated that this new way of microscopic image acquisition will facilitate forensic firearms examinations.

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