Detection of Air Gun Pellet Wipe Using Digital Infrared Photography[1]

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After attending this presentation, attendees will understand: (1) a procedure for recording digital infrared images of air gun pellet wipe patterns on dark and multi-colored fabric, and (2) the advantages and disadvantages of using digital infrared photography to enhance pellet wipe images.

The purpose of this presentation is to present the results of a study for recording digital infrared images of air gun pellet wipe patterns on dark and multicolored fabrics. When lead or lead alloyed air gun pellets perforate fabric, they produce a discolored area around the pellet hole margin. The discoloration is similar to bullet wipe; however; pellet wipe does not contain any cartridge components such as propellant residue, prima residue, soot, or bullet lubricant compounds. Pellet wipe produced from air guns discolors fabric with residue from traces of the pellet and oil residue from the pellet gun barrel. With an estimated 3.2 million air guns purchased annually in the United States, the media reports an increasing number of incidents involving air guns. Approximately 50% of these air guns have a muzzle velocity between 500 and 930 fps. Air guns with these muzzle velocities in this range have the potential to cause tissue damage and in some cases serious injuries or death. Understanding pellet wipe patterns can assist investigators in analyzing and reconstructing events in accidental or intentional pellet gun discharges. Investigators can evaluate the pellet wipe pattern to determine if the pattern is consistent with other physical crime scene evidence and statements from witnesses.

A study was conducted to evaluate the consistency of pellet wipe patterns when pellets are fired perpendicular into fabric targets at a known distance. A Winchester model 600X air rifle was used to conduct the test on twenty-five fabric samples. The Winchester air rifle is a spring piston type air rifle with an overall length of 105 cm (41.5 in), barrel length 45 cm (17.7 in), and weight 2.7 kg (5.9 lbs). The air rifle manual reports the muzzle velocity at 600 fps with 6.2 ft lbs of muzzle energy. A chronograph was used to test the muzzle velocity based on 10 shots. The average velocity was 600 feet per second. The range of velocity was 595 to 605 feet per second. Ten fabric samples were 100% cotton fabric, nine were 100% polyester, and six were 70% wool and 30% nylon blend.

Pellets used in the study were .177 (4.5 mm) caliber Benjamin Sheridan domed diabolo styled lead pellets. The average pellet weight was 7.8 grains based on a sample of 20 pellets. The pellet weights ranged from 7.5 grains to 8.0 grains. Square cardboard targets approximately 11.43 cm by 11.43 cm (4.5 in x 4.5 in) in size and .64 cm (.25 in) thick were prepared and covered with fabric. The pellets were fired into the samples at a distance of 1.52 m (5 ft). One target covered in white fabric was used as a standard for detecting a visible pellet wipe pattern. Digital infrared images were photographed with a 35 mm Nikon D-70 camera with an 18-70 mm f 3.5 – 4.5 G ED-IF AF – S DX Nikkor lens and a 67 mm #87 infrared Tiffen filter. The lens to object distance was 22.86 cm (9 in). The average exposure time was 8 seconds. Pellet wipe was visible in 22 (88%) of the twenty-five fabric samples. Of the 100% cotton samples, pellet wipe was visible in 7 out of 10 samples, and in the 100% polyester samples, pellet wipe was visible in 9 out of 10 samples. Pellet wipe was visible in all of the samples of the blends of 70% wool and 30% nylon. Recording a digital infrared image is an effective method to enhance pellet wipe patterns on dark and multi-colored fabrics. It does not alter the pellet wipe pattern and results

are obtained right away. When infrared images fail to produce pellet wipe patterns, sodium rhodizonate, a chemically specific test for lead, can be used to test the margin for lead or lead alloyed particles around the pellet holes.

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