

## THE USE OF HAND-HELD LASER POINTERS IN THE RECONSTRUCTION OF EVENTS AT CRIME SCENES

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**INTRODUCTION:** The crime reconstructionist has a variety of techniques available for assistance in determining bullet trajectories, locating the position of a shooter, determining ricochet angle, and making various other measurements and determinations in crime scene examinations. These techniques have been described in the literature and range from the use of sophisticated instrumentation such as a laser theodolite system<sup>1</sup>, to simple devices which may either be constructed by the examiner, such as a device for measuring ricochet angles<sup>2</sup>, or purchased at a nominal cost, such as a line level<sup>3</sup>, or an angle gauge<sup>4</sup>. The use of a laser for shooting scene reconstructions has, likewise, been previously described<sup>4,5,6</sup>, although these applications have centered on the use of larger, bulkier laser units of the type commonly used by contractors and land surveyors. The introduction of hand-held laser pointers has, however, provided a viable alternative to the larger laser units for use at shooting scenes as well as crime scenes in general.

**EQUIPMENT:** Any hand-held laser pointer will work for these and other techniques. They are available from many office-supply firms for as little as \$100. These laser pointers operate at maximum output of under 5 mW and, thus, are not subject to registration and regulation. The point-

er utilized in the described techniques was marketed by Apollo Audio Visual, Ronkonkoma, NY, and operates in the 660-680 nm range. It uses two AAA batteries. It is 5-1/2" long, is 1/2" in diameter, and weighs just over 2 oz. with batteries.

**PRECAUTIONS:** As with any laser product, one should take care to avoid aiming the laser beam at persons or animals. While these laser pointers are low-wattage devices, they may damage eyes or sensitive skin.

**LIMITATIONS:** Low-wattage laser pointers are effective in nighttime conditions and in most indoor settings. In dark settings the beam is clearly visible for several hundred feet. At greater distances there is considerable diffusion of the beam, so that a sharp point will not result. The laser beam intensity is insufficient for most outdoor work in daylight; the laser point may be visible for use across distances of only a few yards.

When using the laser beam for bullet trajectory analysis, one must realize some further limitations. First, a fired bullet will drop under the influence of gravity, so that at some finite distance the laser beam will no longer adequately describe the true bullet trajectory. The bullet's muzzle velocity and ballistic coefficient will control the distance over which effective use of the laser beam may be appropriate. Further, when one considers the phenomenon of bullet ricochet, it must be realized that bullets do not undergo elastic collisions. Any attempt to quantitate the departure angle of the projectile

from a given surface will result in some indeterminate error.

**TECHNIQUES UTILIZING THE LASER POINTER:** Some applications are described below. Certainly this is but a sample and not a complete list of all techniques wherein the laser pointer can be useful.

1. Tracing bullet trajectories through holes: Locating two or more consecutive holes caused by a given projectile allows one to project the approximate trajectory both uprange and downrange. One may simply hold the pointer by hand and direct the laser beam through the center of the first hole, then move the pointer until the beam projects through the center of the next hole. Standing closer to this first hole facilitates the aiming process.

Greater stability and aiming ability can be gained by bracing the pointer, or even mounting it on a camera tripod. A simple mount may be fabricated from an aluminum block (drilled and tapped to accept the tripod bolt) with a small hose clamp attached (see Figure 1). A cast nylon block may also be used. A strip of adhesive-backed foam rubber is placed on the inner surface of the clamp after it has been bolted to the block. This prevents scratching the laser pointer and yet holds it securely in place. It is generally helpful to have another person hold a piece of white cardboard closely behind the second hole until the beam is successfully focused through both holes. This technique can also be used to improve the usable range for outdoor work in daylight. The assistant continues to hold the card-

board with the laser "spot" while moving progressively farther away from the source.

a. Downrange searches: When aligned through both holes, the laser should indicate the downrange trajectory of the projectile. It might be possible to find a bullet embedded in some downrange object, or at least to find further holes, ricochet creases, or spalls.

b. Uprange projection: When the laser is reversed, the continuing projection should approximate the direction to the shooter or to an intervening object. This technique can provide information about the elevation and angle of the firearm and about possible sight obstructions between the shooter and the target.

2. Approximation of trajectories away from ricochet creases: While the deformation of the projectile and of the surface it strikes cause the ricochet angle of departure to deviate significantly from the ideal, one can, nevertheless, gain some information by examining such an ideal trajectory. With a slight error caused by the thickness of the glass, one can project an ideal ricochet from a surface at the point of the ricochet crease. If the incident angle of the incoming bullet can be established or approximated, the path of the reflected beam will provide some general information about the departure trajectory of the projectile.

3. Line-of-sight determinations: One can simply aim the pointer to see if a clear line of sight is afforded the shooter in the purported firing location toward the target. The possibility of such a trajectory is often immediately apparent. It could be established, for example, that a shot could not have been fired from a given location because of some intervening object.

4. Determination of elevation differences: The laser can be

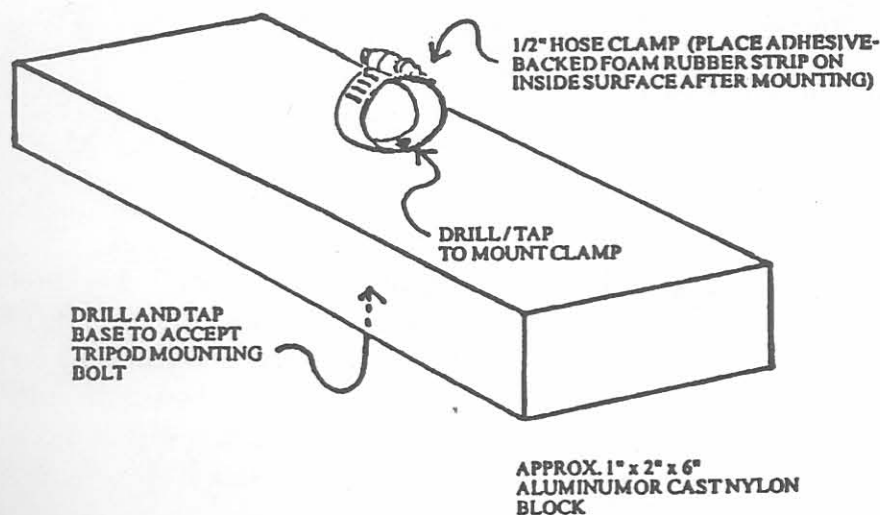
used to compare elevations of various items or planes in the crime scene setting. On a sloping terrain one can level the laser pointer at one spot and then measure the height of the beam at another location. For example, one might find that a porch is 6'3" higher than a sidewalk by laying the pointer level on the porch, focusing the beam on a board standing upright on the sidewalk, and measuring the height of the laser dot above the sidewalk.

5. Establishing a point of convergence for blood splatter: The laser beam can be used to determine a point of convergence for multiple well-formed, elongated blood splatters. The beam can be skimmed along the length of several blood droplets to approximate a point of convergence. The laser can then be positioned at the approximate point of convergence and directed to any number of droplets to see if they are congruent. Corrections can be made by hand until the point of convergence is clearly established.

**SUMMARY:** There are numerous techniques wherein one can employ a laser pointer in examining crime scenes, particularly those scenes involving firearms or medium-velocity blood splatter. The pointers are portable, rugged, affordable, very maneuverable, and easy to use.

**REFERENCES:**

1. Haag, L.C., "A Portable Laser Theodolite System for Use in Shooting Scene Reconstruction", *FTE Journal*, Vol. 23, No. 1, 1993, p.538.
2. Haag, L.C., "Bullet Ricochet: An Empirical Study and a Device for Measuring Ricochet Angle", *FTE Journal*, Vol. 21, No. 2, 1982, p.182.
3. Stone, R.S. "Calculation of Trajectory Angles Using a Line Level", *A-I-Journal*, Vol. 25, No. 1, 1993, p.21.
4. Hueske, E.E. "Calculation of Trajectory Angles Using an Inexpensive Angle Gauge", *AFTE Journal*, Vol. 25, No. 3, 1993, p.231.
5. Haag, L.C. "The Construction of an Inexpensive Portable Laser for Use in Shooting Reconstructions", *AFTE Journal*, Vol. 19, No. 2, 1987, p.175.



NOTE: NOT TO SCALE

**FIGURE 1. A TRIPOD MOUNT FOR A HAND-HELD LASER POINTER**