

# NASA TECH BRIEF

## NASA Pasadena Office



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### Laser-Scanning Techniques for Rapid Ballistics Identification

#### The problem:

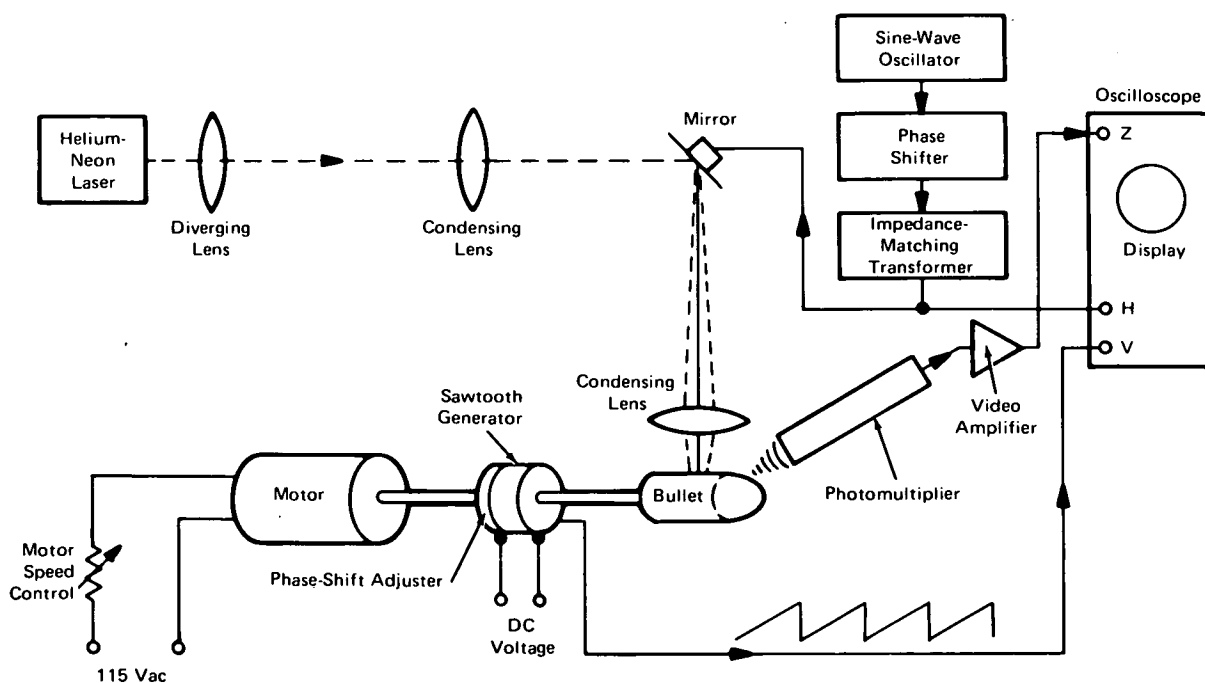
Firearms involved in a crime are identified by standard ballistics tests. In this procedure, a test bullet fired in the laboratory is compared to the one under investigation to see if their markings are identical. Since every rifled bore has unique irregularities, bullets fired from the same gun will have the same marks. The markings are compared with a microscope. This method normally takes from half hour to as long as several hours and results in significant findings only 70 percent of the time.

#### The solution:

Bullets are compared faster and more accurately using either one of two newly-developed laser techniques.

#### How it's done:

The apparatus used is very similar in both methods except different laser-scanning methods are utilized. In each case the scanned cylindrical bullet surface is displayed "unwrapped" on an oscilloscope screen. Two bullets are compared by photographing each display and superimposing the negatives of the two images.



Laser Scanning Apparatus

(continued overleaf)

With some modifications in the apparatus, two bullets can be scanned and compared by superimposing their images on the screen of a dual-beam oscilloscope.

The apparatus, in which an electric motor is used to rotate a bullet through a single laser scan, is illustrated in the figure. A helium-neon laser beam that is expanded through the diverging lens and condensed by the other two lenses illuminates the surface of the bullet. The laser beam is deflected horizontally by a piezoelectrically driven mirror at a 2-kHz rate controlled by a sine-wave oscillator. The oscillator signal is also fed into the horizontal sweep terminal of the oscilloscope.

The bullet is rotated by an ac motor. The rotating shaft of the motor is coupled to a sawtooth waveform generator, which includes a phase-shifting network to synchronize the horizontal laser sweep with the oscilloscope scan. The sawtooth generator produces one sawtooth signal for each motor shaft rotation.

The scattered laser beam from the bullet surface is collected by a photomultiplier, which feeds video signals through a video amplifier into the oscilloscope. The scanned bullet surface is displayed on a storage-type cathode-ray-tube (CRT) screen.

A similar display is obtained in a raster scan arrangement. The apparatus is similar to the one described except that the bullet is not rotated. Instead it is scanned using two piezoelectrically driven mirrors, one driven horizontally at 2 kHz and the other driven vertically at 50 Hz.

**Notes:**

1. Both firearm identification methods may be of interest to law enforcement agencies.
2. Requests for further information may be directed to:  
Technology Utilization Officer  
NASA Pasadena Office  
4800 Oak Grove Drive  
Pasadena, California 91103  
Reference: TSP74-10102

**Patent status:**

This invention has been patented by NASA (U.S. Patent No. 3,800,074). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

Patent Counsel  
NASA Pasadena Office  
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