

Abstract Submitted
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Full-scale high-speed “Edgerton” retroreflective shadowgraphy of gunshots GARY SETTLES, Penn State Univ. — Almost 1/2 century ago, H. E. “Doc” Edgerton demonstrated a simple and elegant direct-shadowgraph technique for imaging large-scale events like explosions and gunshots. Only a retroreflective screen, flashlamp illumination, and an ordinary view camera were required. Retroreflective shadowgraphy has seen occasional use since then, but its unique combination of large scale, simplicity and portability has barely been tapped. It functions well in environments hostile to most optical diagnostics, such as full-scale outdoor daylight ballistics and explosives testing. Here, shadowgrams cast upon a 2.4 m square retroreflective screen are imaged by a Photron Fastcam APX-RS digital camera that is capable of megapixel image resolution at 3000 frames/sec up to 250,000 frames/sec at lower resolution. Microsecond frame exposures are used to examine the external ballistics of several firearms, including a high-powered rifle, an AK-47 submachine gun, and several pistols and revolvers. Muzzle blast phenomena and the mechanism of gunpowder residue deposition on the shooter’s hands are clearly visualized. In particular, observing the firing of a pistol with and without a silencer (suppressor) suggests that some of the muzzle blast energy is converted by the silencer into supersonic jet noise.

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