Amid growing police mistrust caused by an influx of nationally witnessed lethal police incidences, the need for non-lethal alternatives for law enforcement and home defense are now greater than ever. Currently non-lethal technologies are limited by short ranges, inaccuracy, and safety concerns, and introducing a more reliable non-lethal device into the arsenal of police officers, will reduce the risk and damages to the public image of law enforcement. One such technology is the PogoJet which provides an accurate, reliable system that enables officers to engage targets from a distance, while using conventional combat strategies. The design uses a laser rangefinder and an in-flight propulsion system to control the speed of the bullet in order to incapacitate the target without lethal results.

**Inflight Propulsion and Triggering System**

The PogoJet non-lethal weapon was designed by Jeffrey Widder and Christopher Perhala from the Battelle Memorial Institute. Their invention is a patented caseless telescopy less lethal system. Traditionally projectiles are surrounded by a casing that holds the bullet; however, the PogoJet does not make use of this technique favoring a projectile surrounded by the propellant. This kind of projectile is called telescoping ammunition. The PogoJet is a pistol sized device that implements a piston driven rocket assisted projectile and a lightweight magazine fed launcher in a device meant to allow for accurate targeting and quick transition from nonlethal to lethal use if the situation escalates. The projectile used by the PogoJet consists of a body, a front, a piston and base portion. The base has a piston hole and vent holes located radially around the piston hole. The piston shaft can extend out through the piston hole, while the head of the piston remains inside the main body of the projectile. When the trigger is pulled, the propellant is ignited either mechanically or electronically and the piston is propelled through the bore and pushes against the back wall of the launcher to provide an initial thrust. Once the projectile exits the chamber, gases exit through radially positioned vent holes to provide additional thrust for longer range firing.

**Limitations of Current Non-lethal Weapons**

Current non-lethal devices are limited by inaccuracy, short ranges, slow use, logistical constraints surrounding the propellant, or usage that places the officer in harm’s way. Also, most non-lethal weapons only can operate in a specific range. For example, rubber bullets are a better choice for longer range shots while bean bag rounds and sponge grenades are best at short ranges. Furthermore, these devices often have adverse effects beyond what is intended. These include permanent blunt trauma, eye or auditory effects, toxicological effects, and psychological effects. The PogoJet design aims to solve these problems by providing an easy-to-use accurate device that can perform at all ranges.

**Time of Flight Rangefinding Devices**

Laser rangefinder time of flight devices are generally used by the military in targeting systems or in industry for surveying distances. The basic technology involves the kinematics of a 5 to 50 ns laser pulse. The time it takes for this pulse emission to reach the target and the pulse echo to travel back is measured, and this is multiplied by the velocity of the pulse, c. The value of c is the speed of light or 30 cm/ns. This value is halved, as the time that was recorded was for the trip to the target and back, and thus the distance to the target is known.

Noise-generated timing error refers to errors in the measurements caused by noise of the electronics or other radiation that is picked up by the receivers. Walk error is caused by variations in pulse amplitude and shape. Non-linearity is often present in the time interval measurement scale; however, averaging easily counteracts this type of error.

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