



**SUPPRESSED WEAPON  
SYSTEMS**

## RECOIL TEST

When a rifle is fired, a bullet and hot propellant gasses travel down the barrel, gaining momentum. Newton's third law states that the rifle itself must gain momentum as well, and its momentum must be equal and opposite to the momentum of both the bullet and propellant gas. Unfortunately, the rifle's momentum is then transferred to the shooter as felt recoil.

The Suppressed Weapon Systems MISB redirects a large portion of propellant gasses rearward. This reverses the momentum of the gas, thereby reducing the rearward momentum of the rifle. The result is a drastic reduction in felt recoil with none of the drawbacks of a conventional muzzle brake.

To test the recoil reduction capabilities of the MISB, test rifles are held in a simple recoil sled. The sled is suspended from the ceiling so that it can swing like a pendulum. This allows the recoil energy of each rifle to be measured with an extremely simple procedure.

At the instant that a test rifle is fired, recoil drives the sled rearward. For that instant, all of its recoil energy is kinetic. Kinetic energy can be calculated by the formula:

$$KE = \frac{1}{2} m v^2$$

Where  $m$  equals the total mass of the rifle and sled, and  $v$  equals their velocity. Measuring the instantaneous velocity of the sled at the moment of firing would be challenging without special instruments, but the alternative is simple. As the sled swings, it rises against gravity. This slows it down and converts its kinetic energy into potential energy. By measuring the maximum height to which the pendulum rises, its final potential energy can be easily calculated. If friction is disregarded (it is almost negligible in this case) the maximum potential energy of the sled at the top of its swing is equal to the initial recoil energy at the bottom. The formula needed now is even simpler.

$$PE = w h$$

For this equation, the weight of the rifle and sled ( $w$ ) is multiplied by the height that the sled rises as it swings ( $h$ ). If the weight of the sled is measured in pounds and the height is measured in feet, the units of energy will be given in ft·lbs.