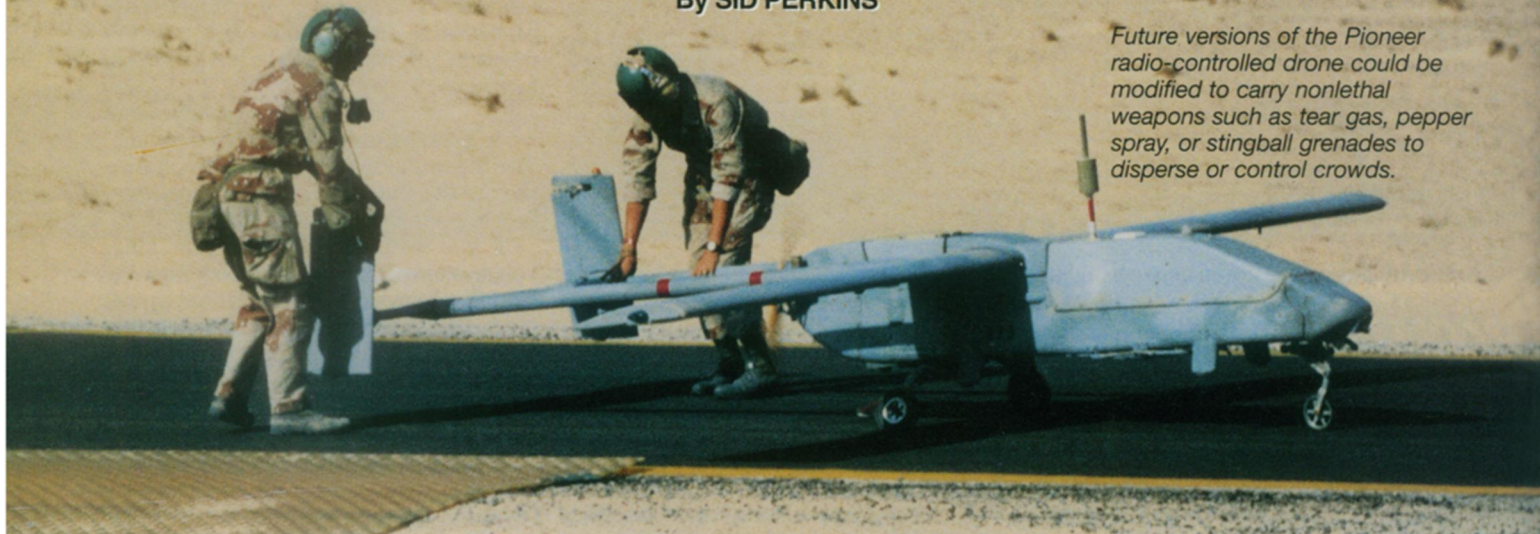


Not-So-Deadly Force

The search for a kinder, gentler knockout punch

By SID PERKINS



Future versions of the Pioneer radio-controlled drone could be modified to carry nonlethal weapons such as tear gas, pepper spray, or stingball grenades to disperse or control crowds.

Pioneer UAV

B Brilliant green lasers that dazzle the eye. High-tech projectiles that cling to clothing or skin and deliver immobilizing electric shocks. Mines that fling nets to ensnare bad guys *à la* Spiderman. These are just a few of the less-than-lethal weapons that may soon stock the arsenals of military and civilian law enforcement organizations across the United States.

The roles of the men and women who routinely face conflict are changing. Military units no longer simply kill the enemy and occupy his territory. They now form an integral part of peacekeeping operations in emotionally charged and hostile situations around the world. At the same time, federal, state, and local authorities face increasingly well armed opponents within the United States in an ever-widening range of confrontations, including domestic violence, hostage dramas, and armed standoffs.

As a result, military and law enforcement professionals need weapons that can zap, shock, stun, subdue, nauseate, temporarily blind, or otherwise incapacitate opponents without putting themselves or others at risk. With such weapons, those charged with keeping the peace may be better able to bridge the gap between verbal warnings and the use of deadly force.

U S. troops participating in peacekeeping and humanitarian assistance operations often encounter adversaries intent on exploiting their goodwill. In Somalia, for example, Marines were confronted by hostile warlords who used women and children as shields. In

Bosnia, soldiers armed primarily with lethal weapons faced a harrowing choice when they came up against violent crowds: Use deadly force or risk personal injury.

"Opponents were quickly able to determine the soldiers' rules of engagement"—when they could fire their weapons and when they couldn't—"and then exploit them," says Dennis B. Herbert, a retired Marine colonel who is now a program manager with the Institute for Non-Lethal Defense Technologies at Pennsylvania State University in State College.

Soon after the confrontations in Bosnia, U.S. troops there were issued gun-mounted launchers that fired "sponge grenades," hard rubber projectiles 40 millimeters in diameter that are meant to knock the wind out of a person without causing permanent injury. They also received dye markers that could be thrown into a mob to tag troublemakers with an orange color so they could be rounded up later, Herbert says.

A variety of sublethal weapons are available commercially and are widely used by civilian law enforcement. However, the Department of Defense is moving to develop a new generation of equipment. Its Joint Non-Lethal Weapons Directorate, located at the Quantico Marine Corps Base in Virginia, plans to spend around \$17 million this year and about \$25 million for each of the next 7 years to study 14 sublethal weapon technologies.

Many of these weapons could be ready for use in the next 2 to 5 years, says Capt. Sean Gibson, a spokesperson at Quantico. Although some of them will be simi-

lar to equipment already in stock, others could be futuristic beam weapons akin to a *Star Trek* phaser.

Among the more familiar items would be the bounding net munition, a less-than-lethal version of the so-called Bouncing Betty mine, which springs 3 to 5 feet into the air before exploding in a hail of shrapnel. The new mine, scheduled to be produced in 2001, will deploy a net that ensnares its victim and may discharge a cloud of pepper spray or tear gas.

The Navy wants to modify its remote-controlled Pioneer reconnaissance drones for use in crowd control or dispersal. Engineers plan to equip a device mounted on the drone with nonlethal pepper spray, tear gas, or stingball grenades, to be dropped on crowds. Pilots now use the device to eject metallic chaff and missile-decoying flares from fighter aircraft.

Researchers are also investigating acoustical weapons that would use low-frequency sound waves to nauseate and disorient an opponent, as well as a pain-inducing beam, many details of which remain classified.

Other weapons would work against an opponent's equipment, including an electromagnetic beam to fry a vehicle's electronics and a strong, fast-curing polymer foam to gum up machinery or weapons.

In addition to its role in the development of these sublethal weapons, the Quantico directorate serves as the Defense Department's clearinghouse for related unclassified information. It works closely with civilian law enforcement and with other government agencies, such as the Defense Advanced Research Projects Agency (DARPA) and the Department of



The flashlight-size laser dazzler distracts and disorients an adversary by projecting a green optical wall (inset) that the opponent can't see through.

Justice, which sponsor similar research.

In June 1996, DARPA funded the development of a 300-milliwatt, hand-held green laser baton, informally known as a laser dazzler. The first of these devices was delivered to the Department of Defense late last month.

Similar in size and weight to a heavy-duty flashlight, the laser dazzler is manufactured by LE Systems of Glastonbury, Conn., and can be used for both military purposes and civilian law enforcement. Its primary aim is to distract and disorient an adversary from a safe distance, says Richard J. Nelson, a program manager with the company.

The laser dazzler—which causes no permanent damage, even if held close to the eye, Nelson says—presents an impenetrable “optical wall” to an opponent and is bright enough to be effective even in the daytime. Random stroboscopic flickering of the laser adds to the adversary's disorientation.

“If you temporarily impair the vision of your opponent, then you've gained the advantage,” he says. “If instead, he closes his eyes or looks away for a fraction of a second, then you've still gained the advantage.”

The battery-powered laser dazzler operates for slightly more than an hour on a single charge. In most instances, Nelson explains, the device would be used for only a few minutes or even seconds. A situation not resolved within that time would most likely escalate and require other measures.

The laser dazzler has additional features that could make it useful in civilian law enforcement. It can illuminate objects hundreds of yards away, and, in conjunction with the proper chemicals, it can be used to highlight fingerprints at a crime scene, Nelson says.

Sublethal weapons can provide tools for dealing with low-level threats before they get out of hand. Most such weapons in wide use today were developed in the late 1960s and early 1970s in response to the anti-

Vietnam war demonstrations and other civil disturbances.

So-called kinetic munitions, such as bean bags, rubber bullets, and bundles of small wooden batons, all of which are fired from a gun to stun people or knock them down, date from that era. Another type of weapon includes the hand-held electric stun gun and the taser, which delivers an electric shock through two wire-tethered barbs fired from the device.

Jaycor, a high-tech company in San Diego, is developing a weapon that puts stun-gun technology into a wireless projectile. Recent company tests show that the Sticky Shocker—a 4-inch-long, 37-mm cylindrical device that can be fired from many existing police and military weapons—is accurate to at least 30 feet. Powered by six AAAA batteries, it can deliver an incapacitating shock through clothing or leather, says Edward J. Vasel, a Jaycor program manager.

When fired, the Sticky Shocker travels 30 feet in about one-third of a second, not enough time for the average person to react and get out of the way, Vasel says. The projectile strikes its target with the force of a baseball moving at 60 miles per hour—a force comparable to a blow from a police baton and only 70 percent of the impact delivered by a standard 37-mm rubber bullet. The shocker sticks to clothing or skin, drops into a vertical position, and then begins to deliver 12 to 15 muscle-contracting shocks per second. After 6 or 8 seconds, the device turns itself off.

The distance between the device's electrodes—a star-shaped one is located at the tip, and stiff wire ones project from the rear of the unit—helps ensure that the shock travels into the underlying muscle, not just across the skin.

Early prototypes of the Sticky Shocker used either a barbed tip to snag a target's clothing or an adhesive tip that would stick to skin and clothing, Vasel says. Further testing may add adhesive to the center of the barbed tip, thus making use of both means of attachment at once.

Jaycor is studying the feasibility of equipping projectiles with additional circuitry so that a second series of shocks can be delivered by remote control, if needed. Alternatively, the electronics could be modified to automatically deliver a second set of shocks, Vasel says.

Law enforcement agencies have been using sublethal weapons more and more often since the mid-1980s,

says Sgt. Ken Hubbs, a member of the San Diego Special Weapons and Tactics (SWAT) team. Hubbs compiles information submitted voluntarily by other SWAT teams across the nation regarding the use of such weapons.

“Ten years ago, using [sublethal weapons] was practically unheard of,” he says. “Five years ago, it was rare. Now, hundreds of agencies across the country are using them. They're the hot item in law enforcement.”

For officers, keeping distance between themselves and a potentially hostile opponent is a key strategy for minimizing personal risk. Most law enforcement personnel are trained to stay at least 21 feet from an adversary who's armed with something other than a gun, says Lt. Sid Heal of the Los Angeles Sheriff's Department. Twenty-one feet is the distance a person could cover from a standstill in about three-quarters of a second.

Besides helping officers minimize their risk, sublethal weapons reduce chances of bystander injury, Heal says.

The most obvious benefit, however, accrues to adversaries. Hubbs says that attempted “suicide-by-cop”—when a distraught person who is unable or unwilling to pull the trigger tries to provoke the police into delivering the fatal blow—vastly outnumbers all other types of incidents in which sublethal weapons are used. Violent or barricaded individuals account for most of the rest.

Both Heal and Hubbs emphasize that

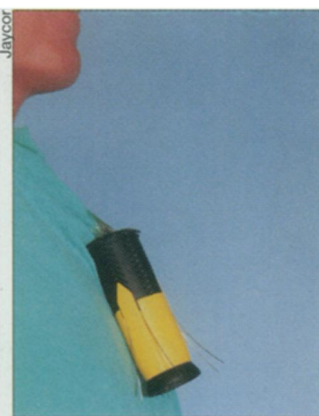
less-than-lethal weapons can be lethal if used inappropriately. Most weapons that fire projectiles have a stand-off distance within which they shouldn't be used, he says. Bean bag rounds fired from close range have caused two fatalities, one in New Mexico and one in Canada. In another instance, a woman with osteoporosis was killed when a rubber bullet broke three of her ribs and a bone splinter punctured her heart.

Even so, Heal says, for every person killed or severely injured, hundreds of others are spared

because sublethal weapons were used.

“Unfortunately, we don't have a ‘magic bullet,’” he says. “Lethal force has never been 100 percent effective, and sublethal weapons are even less so. But for those who question their use, we have an adage: ‘If using a standard bullet was the alternative, what would've happened?’” □

Sid Perkins is a former SCIENCE NEWS Science Writer Intern.



The Sticky Shocker puts stun-gun technology into a wireless projectile that delivers 12 to 15 muscle-contracting shocks per second.