NATIONAL LAW ENFORCEMENT AND CORRECTIONS TECHNOLOGY CENTER
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'Physics' in Corrections

The basic necessities of daily hygiene—a razor and a toothbrush—too often become the basic necessities of armed assault in the hands of correctional inmates. Through the efforts of a research team from the Johns Hopkins University Applied Physics Laboratory (APL), these items soon may become just toiletries again.

As part of a National Institute of Justice (NIJ)-sponsored project called "Improving Correctional Officer Safety: Reducing Inmate Weapons," an APL team has devised and developed prototype toothbrushes and razors that cannot be modified into weapons. The overall goal of the project is to improve safety in the correctional environment by reducing the number of improvised weapons "manufactured" within facilities.

"Inmates improvise weapons out of a number of common objects, including, but not limited to, toothbrushes and razors," says Paul Biermann, a member of the senior professional staff. "Metal strips from bunks, fences, or food service carts become dangerous. Inmates use concrete floors to sharpen objects, and may use contraband matches to partially melt down plastic items so that razor blades can be attached to form slashing weapons."

APL's prototype toothbrush and razor, however, can neither be sharpened nor melted, Biermann says. Inmate attempts to modify these items are thwarted by use of a unique two-layer design. The toiletries have a stiff resin core encased in a softer urethane shell, and the attachment points are made of a hard [poly]urethane.

The project included a survey of 72 Federal, State, and local correctional facilities, including jails, medium- and maximum-security prisons, and penitentiaries. The survey found that 90 percent of violent incidents involve inmates only, and only 10 percent involve inmate attacks on correctional officers. In addition, APL convened an 11-member working group composed of representatives from State and local facilities, the Bureau of Prisons, and representatives from NIJ's National Law Enforcement and Corrections Technology Center system to help analyze historical and survey information and identify potential solutions to the problem. The APL team also toured several correctional facilities. Currently, the team is searching for a commercialization partner to bring those products to market.

More Than Toothbrushes and Razors

Developing a toothbrush and razor that could not be modified to cause physical harm presented a challenge to APL, which is more accustomed to working on items such as submarine components or biomedical devices, Biermann says. But, it is not the only project of benefit to corrections and law enforcement in which APL is involved. APL also is working on a realistic, affordable model of a human torso that can accurately measure the effects of a serious blow to the heart, lungs, and other vital body parts. It is designed to measure the blunt force trauma inflicted behind soft body armor when it stops a gunshot or a nonlethal weapon strike.

Current approved body armor testing standards call for placing a vest on a test fixture filled with clay conditioned to specific tolerances. If a bullet makes an

APL

A major asset to the Nation since it was organized to help the war effort in 1942, 4 months after the attack on Pearl Harbor, the Applied Physics Laboratory (APL) is a not-for-profit center for engineering and research and development.

Located on a 360-acre campus midway between Baltimore, Maryland, and Washington, D.C., it is the largest division of one of the world's premier research universities, Johns Hopkins. APL is currently involved in more than 400 programs to protect our homeland and advance the Nation's vision in space science.

For more information, visit APL's website at www.jhuapl.edu.

indention in the clay deeper than 44 millimeters, or approximately 1.75 inches, the vest fails testing even though the round did not penetrate the vest. However, this type of test does not provide information on just how the impact affects internal organs or other body parts.

The prototype torso is made of reasonably inexpensive materials that are readily available commercially. APL staff members have created a computerized counterpart that will present a 3-D simulation chart of pressure waves and how they affect areas such as the heart, lungs, cartilage, and spine. The team also is working on refinements and improvements to the torso prototype. The project, which began as an independent research and development effort, is now receiving funding from the Office of Naval Research.

For more information on the prototype toiletries for corrections or prototype torso projects, contact Paul Biermann at the Johns Hopkins University Applied Physics Laboratory, paul.biermann@jhuapl.edu.

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