

**POLICE**  
THE LAW ENFORCEMENT MAGAZINE

**SPECIAL  
REPORT**

**BALLISTIC  
PROTECTION**

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# Maintaining Concealable Body Armor

**Although soft armor is tough enough to stop bullets, it's not tough enough to survive mistreatment.**

**David Griffith**

■ It can be argued that the most valuable item you possess is your body armor. Sure your house, your car, and numerous other things that you have purchased over the years cost more to initially buy and they retain more monetary worth. But your body armor is even more valuable because it can literally save your life.

But it can only save your life if you wear it. And even if you wear it every day on duty but don't take care of it properly, it might not give you optimal protection. Experts say you need to treat your body armor like the valuable possession it is. You maintain your house, you maintain your car, and you also need to maintain your body armor.

## STORE IT PROPERLY

**O**ne of the worst things you can do to body armor is store it in a fashion that will damage it. Some officers have found out the hard way that smashing a vest down into the bottom of a locker or putting it in the trunk and setting heavy stuff on top of it is a good way to wreck it.

Ballistic panels are made of many layers of bullet-resistant fiber. If they get bent out of shape, they can't be ironed or straightened out. If you store a sweaty vest in the bottom of your locker all mashed up, it will dry into a wrinkled mess. And wrinkled armor panels are going to look horrible and may provide less than optimal protection. If you do this, you may have to replace your vest.

There is one preferred way to store concealable body armor. You lay it flat with no other objects on it that could make the panels bend or curl.

Some experts say you can hang armor, if you do it right. But this is a matter of some debate.

If you hang your body armor, you need to consider what gravity might do to it. Don't just hang it up by the straps. This



can stretch the straps and affect the fit. A number of manufacturers make hangers designed specifically for hanging body armor. If you plan to store your armor by hanging it, these products are a good investment. But before hanging your vest in any fashion, check the manufacturer's instructions.

### WASHING THE CARRIER

**A**nybody who has ever worn body armor under a uniform shirt knows that the carriers can get soaking wet with perspiration. This happens even when the wearer has an undershirt beneath the carrier. All of that sweat can make armor stink. So it needs to be cleaned.

There is an art to properly cleaning body armor. If you do it wrong, you will ruin it.

Your ballistic vest consists of the cloth carrier, front and back armor panels, and a soft trauma plate or insert.

You have to clean the armor panel and the carrier separately. So the first thing to do is take it apart. Pull out the armor panels and soft trauma plate and set them flat on a flat surface. They cannot be washed with the carrier.

You should have at least two carriers for your ballistic panels. This will allow you to wash one and wear the other. Keeping your carrier clean and dry will help your ballistic panels last the full five years that most armor is rated to last.

Your carrier is a cloth garment and like most cloth garments it probably has the manufacturer's care instructions on a tag inside. You should follow those instructions. Note: Some manufacturers have gone digital and their care instructions are on their websites.

Here's what those instructions are likely to say. Do not dry clean. You can probably machine wash the carrier but some manufacturers advocate hand washing. (Make sure the armor panels are not in it. Machine washing the armor panels or even dipping them in water can damage them.) Once you take the armor panels out, you can wash the carrier in the machine on the gentle cycle with a mild detergent or hand wash it. Do not use bleach, not even



PHOTO: POLICE FILE

non-chlorine bleach. Do not use starch or fabric softener. Be sure to remove (or some manufacturers say "secure") the carrier's straps before dropping it into the machine.

Once your carrier has taken its ride in the washing machine or it has been washed by hand, you can probably dry it in the dryer on low. If the tag inside your vest contradicts these instructions, follow the instructions. Some manufacturers recommend air drying the carrier inside on a hanger.

### CLEANING THE ARMOR

**C**leaning armor panels is hand work; keep them away from the washing machine and don't send them to the dry cleaner.

When you take the armor out of the carrier before washing the carrier, give them an inspection. Make sure there are no holes or cuts in the covering and no ballistic material is showing. Do not spray with Febreze or any other disinfectant or freshener. The chemicals in these products can compromise some ballistic materials.

Keep the panels flat while cleaning. Do not rinse them, submerge them, or soak them. Use a minimal amount of water. A damp sponge or cloth is recommended. Some manufacturers say you can use mild soap. Check the pro-

vided instructions.

Armor panels cannot be machine dried because it will damage the ballistic material. They also cannot be hung on a clothesline or dried in the sun because ultraviolet light exposure can degrade the ballistic material. Let them air dry on a flat surface. Do not iron armor panels. Do not use a blow dryer on the panels.

Before wearing the vest again, make sure that it is reassembled properly; that includes both armor panels and the trauma plate. Your panels will say which side should face the threat. Flipping them can lead to tragedy. The "strike face" of the panel is designed to slow the bullet and disperse the bullet's energy; the back of the panel is designed to minimize trauma. Experts say if you flip the panels, you may experience more trauma and it's possible that the armor may not stop rounds it is rated to stop.

Never wear your vest without its armor panels. The carrier without the armor offers no more protection than your favorite dress shirt.

### DON'T DAMAGE IT

**B**elieve it or not there are stories that some officers have decided to test their vests. In what may very well just be police tall tales, there are reports that rookies have been convinced to do this by mischievous (malicious) veteran officers.

You do not have to test your vest by shooting it or stabbing it or doing anything else to it. The manufacturers have submitted their designs to special testing labs that certify them according to NIJ standards.

Even though your vest is rated to withstand multiple hits from specified rounds, it is not made to be worn after it has been damaged. Once it's shot it is either evidence or something to be discarded.

If you take good care of your vest, it should protect you against certified threats for at least five years. If you don't take care of your vest, you may have to replace it much sooner, or worse, it may not protect you when your life literally depends on it. ■

# Adding Ballistic Armor to Patrol Vehicles

**Agencies across the nation are fitting their officers' rolling offices with bullet-resistant materials.**

*David Griffith*

→ If you mention vehicle armor used by law enforcement, most people will imagine a heavy rescue vehicle such as a Bearcat. But in recent years more and more American law enforcement agencies are adding armor capable of defeating both pistol and rifle rounds to their patrol vehicles.

For a standard patrol vehicle, the areas that are most likely to come under attack are the doors and side windows. So that's where most law enforcement agencies are focusing their armoring efforts.

There are two basic ways to add ballistic armor to the doors of a law enforcement vehicle that isn't specifically designed to be an armored car: You can install it into the door or apply it to the surface of the vehicle.

## **IN THE DOOR**

Ford was the first maker of law enforcement patrol vehicles to offer armor as an option. The company first showed its NIJ Level IIIA (handgun, shotgun) and Level III (rifle, but not armor piercing) vehicle armor at the International Association of Chiefs of Police show in 2007. The armor is offered as an option, and is now available in Level IV (armor piercing).

Since 2015, Ford's in-the-door vehicle armor has been made by DEW Engineering (www.dewengineering.com), an Ottawa, Canada-based company



*DEW Engineering makes Ford's in-the-door armor for law enforcement patrol vehicles.*

PHOTO: DEW ENGINEERING

that built its business on producing military armor for the U.S. and Canadian militaries.

Jackie Pothier, a DEW engineer and director of the company's business development, says that in addition to its work with Ford in the OEM market, the company is now branching out into making armor for vehicles that are already on the road. "It's not unusual for agencies to have wanted armored panels when they ordered the vehicle but they couldn't afford them at the time. Now they have the budget and want to add them," Pothier says, adding the company is now selling directly to agencies.

DEW's aftermarket products are available for a variety of popular law en-

forcement vehicles, including Chevrolet and Dodge models. For aftermarket sales, DEW ships the panels directly to the agency or to the agency's upfitter for installation.

One concern about installing armor inside the doors of patrol vehicles is how much weight the armor adds to the vehicle and how the additional weight affects performance. Pothier says weight varies based on the protection level and composition of the armor, but DEW has a policy of never adding more than 50 pounds per door. DEW's most popular law enforcement armor panel is its Level III door panel, which weighs 42 pounds.

Pothier says that when DEW first started offering products to the law en-

## Adding Ballistic Armor to Patrol Vehicles

forcement market, its Level IIIA panels were in the greatest demand. In just four years that has changed. “A lot more agencies are asking for rifle protection,” she says. “Whether an officer works in the inner city or out in farm country, the rifles are out there.”

### ON THE DOOR

Pocomoke City, MD-based Hardwire LLC ([www.hardwirellc.com](http://www.hardwirellc.com)) takes a very different approach to armoring law enforcement vehicles than its competitors. It applies the armor to the outside of the vehicle.



NYPD patrol vehicles are fitted with ballistic door panels and windows from Hardwire.

Hardwire CEO George Tunis says the idea for adding armor to the exterior of patrol vehicles was developed from the company's work for the military. That's why the company refers to its police vehicle armor system as a “B-Kit.” In military vehicle armoring nomenclature, the vehicle itself is the “A-Kit,” and the armor added to the exterior to protect the occupants from small arms fire is the “B-Kit.”

Hardwire's B-Kit armor covers the patrol vehicle's doors, and it is available for 14 different makes of popular law enforcement vehicles, including all of the pursuit-rated patrol vehicles pro-

duced by Chevy, Dodge, and Ford.

Tunis says that because Hardwire's armor is applied to the exterior of the vehicle it is easy to install. “It takes about 10 to 15 minutes for a crew of four to armor the vehicle,” he explains. Also, agencies can add to the armor in order to increase the protection. “Our kits all work like Lego,” Tunis says. “You can go from IIIA to III and add on just like Lego.”

Tunis adds that the armor comes off as easily as it goes on. If a car is wrecked or it is being retired because of mileage, the armor can be transferred to the same make and model of vehicle.

He says, “Reusing it has been a huge cost-savings for all the departments that use it.”

Currently, Hardwire's B-Kit armor is in use by the Philadelphia Police Department and the NYPD. Tunis says both the officers and the public can tell that the vehicle is armored. “It makes the car look a little more muscular, not militarized, but muscular,” he says, adding that officers take comfort in the “blister” on the side of their cars. “Officers rest their hands on it to confirm their vehicles are armored,” he explains.

Bad guys also apparently notice the armor on the outside of the vehicle. “It's

definitely a deterrent,” Tunis says, adding that no police vehicle protected by Hardwire's B-Kit armor has been shot at.

Hardwire's B-Kit armor is made of Dyneema's ultra-high-molecular-weight polyethylene ballistic material. It also has a molded cover that's made of the same material as the plastic trim used on contemporary vehicles. The cover can be color-matched to the vehicle's paint and decorated with the agency's markings.

### WINDOWS

Glass is one of the greatest vulnerabilities on any law enforcement patrol vehicle. An attacker can fire into the windshield or more likely into the side windows. Armoring an SUV windshield is expensive and adds a lot of weight. But armoring the side windows is much more practical.

Patrol vehicle window armor is usually made of polycarbonate or layered glass. DEW's Pothier says customers choose the material based on the value they place on different factors such as scratch resistance.

Vehicle armor manufacturers have produced an ingenious solution to protect the driver or passenger while maintaining functionality of the window and minimizing weight and expense: They only shield the part of the window where the driver or passenger can be hit by gunfire. “It covers about half of the window,” says Hardwire's Tunis.

With both DEW's and Hardwire's window armor, the existing vehicle window stays on the vehicle, and the armor is not attached to the window but the door. This way officers can roll down their windows and talk to people while the armor stays in place. Pothier says there's no way with current technology to replace the window with the armor material and maintain functionality. “The armor would be too thick for the window slot,” she says.

Patrol vehicle window armor is extremely tough, according to Tunis. Answering a question about multiple shot capabilities, he says, “You can shoot it all day and not penetrate it. At some point it just fills up with lead.”

## ARMORING NYPD VEHICLES

On Dec. 20, 2014, New York City police officers Rafael Ramos and Wenjian Liu were sitting in their patrol car at an intersection in the Bedford-Stuyvesant neighborhood of Brooklyn. The two officers were participating in an anti-terrorism exercise when a man opened fire on them through the doors and side windows. Officer Ramos and Officer Liu were killed. Both were posthumously promoted to the rank of detective, per NYPD tradition.

The murders of Detective Ramos and Detective Liu and of Officer (Detective) Brian Moore less than six months later spurred NYPD brass to search for a way to make officers safer inside their vehicles. It wasn't the first time that the NYPD had considered adding armor to its patrol cars, but Deputy Commissioner Robert Martinez who commands the NYPD's vehicle fleet operations says the 2014 and 2015 cop killings spurred the department to action. "When you have three officers murdered in their vehicles in a short period of time, something has to be done," he says.

What Martinez and then NYPD Commissioner Bill Bratton decided to do was armor all patrol vehicles. The NYPD now deploys some 4,000 armored patrol vehicles, all fitted with ballistic door panels and windows from Hardwire.

In addition, after the murder of Detective Miosotis Familia in the summer of 2017, the NYPD also chose to armor its command vehicles. Then Officer Familia was working in a marked command vehicle when a gunman fired one shot through the window, hitting her in the head.

Martinez says he knew after the Familia murder that officers in command posts also needed ballistic protection. He met with the mayor directly and came away with the funding to armor the command vehicles. But that was much easier to say than do.

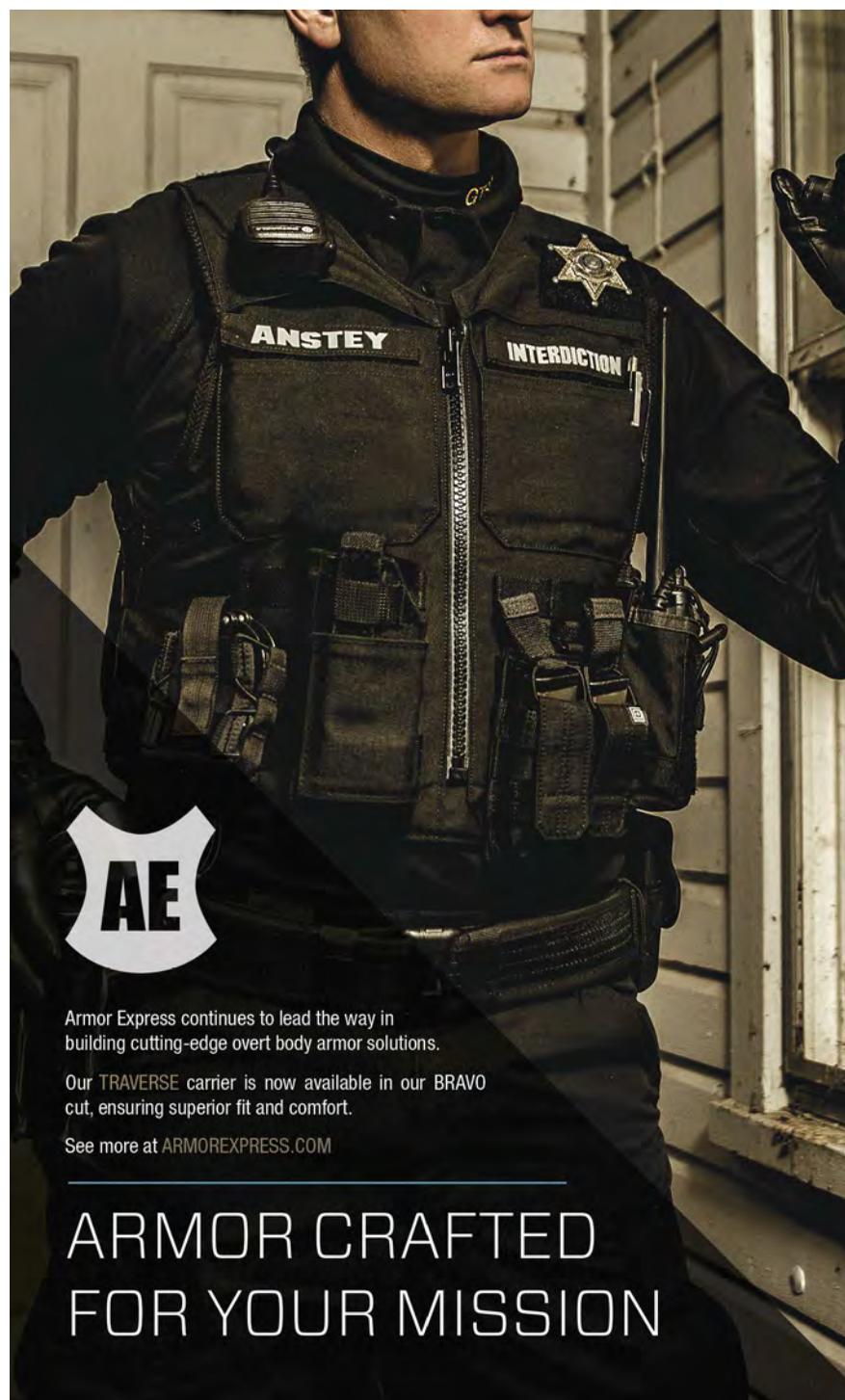
The NYPD has about 70 marked command vehicles, ranging in sizes up to almost 40 feet. And unlike patrol cars, they had to be armored all around because the officers using them move

around in them while working. "They have been armored 360 degrees around from the floorboard to the height of a police officer," Martinez says.

The cost of armoring the NYPD's patrol vehicles and command vehicles varies according to type of vehicle and size of vehicle. But Martinez estimates

the cost for a standard patrol SUV is between \$3,500 and \$4,000.

That investment could very well save lives if a gunman attacks another NYPD officer inside a patrol vehicle. Fortunately, that has not occurred since the agency made the decision to fit its street vehicles with ballistic protection. ■



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# ARMOR CRAFTED FOR YOUR MISSION

# 10 Things You Need to Know About Ballistic Helmets

Head protection is becoming more prevalent in police operations, and many officers have questions about how to gain the most benefit from this gear.

**Jonathan MacNeil and Steve Murphy**

**A**S PATROL OFFICERS EXECUTE MORE SEARCH WARRANTS FOR DANGEROUS OFFENDERS OR RESPOND TO AN INCREASING NUMBER OF ACTIVE SHOOTER ATTACKS, they need specialized equipment including first-rate head protection. That's why more and more agencies are providing patrol officers with helmets that offer ballistic protection.

As a patrol officer being issued a helmet, you likely have questions about this gear. Here are some answers from helmet experts to some common questions you are likely to have about your head protection.

## 1. What are the current standards for head protection?

The current body armor standard and testing program of the National Institute of Justice (NIJ 0101.06) does not stipulate specific requirements for ballistic helmets as it does for ballistic vests, but protocols established by the Department of Justice through its federal agencies are driving developments and adoption. Similarly, military/NATO requirements like the STANAG 2920 and international specifications such as VPAM (HVN-2009)—considered to be the gold standard in Germany, Austria, and Switzerland—have been instrumental in providing guidelines for the global law enforcement community.

## 2. What are the latest technologies advancing ballistic helmet performance?

New materials based on ultra-high molecular weight polyethylene (UHMWPE) tape technology are leading the way. Tape technology involves a different creation process compared to traditional fiber production and presents an innovative structural element that boosts ballistic-resistant properties for use in helmets and other hard armor applications. There is also ongoing research in resin technology that shows significant performance enhancements in ballistic material fibers.

## 3. How are innovations helping to make officers' jobs safer and easier?

New advancements are giving officers more options and features than ever before. These include: increased edge and multi-impact capabilities that boost the helmet's protective



area; lighter ballistic materials that provide a more ergonomic and comfortable solution; dial/extension systems that offer uni-sizing, greater adjustability, and better fit; and more compact designs that make it easier to store and access equipment from the officer's patrol car.

## 4. What should agencies be looking for when considering ballistic helmet protection?

A helmet that is designed to stop NIJ Level IIIA rounds and is multi-hit capable is a must-have. Agencies should also consider a modern helmet solution that provides a one-size-fits-all option, so that any officer can utilize the equipment. Further, the helmet needs to be easily accessible from a patrol vehicle. Look for key features such as blunt force protection, high-fragmentation protection, a riot/impact shield, advanced padding system for shock attenuation, NVG mounts, rails with speed-system connection for adding critical tools such as visors and cameras, and a quick release harness detachment system. Traditional helmets protected officers against liquid threats and other impacts but now there are advancements that safeguard against missiles, including thrown bottles and rocks and, depending on ballistic rating, bullets.

Agencies must consider what their budgets can afford them. If they are able to purchase more advanced capabilities, they should do so. Your run-of-the-mill helmet will not offer the level of flexibility to add features as needed.

## 5. How can helmets be an affordable line item in my agency's budget?

The modular and multi-use capabilities provided by today's ballistic helmet innovations make them a more budget-friendly option for law enforcement departments. This is reinforced by one-size-fits-all designs that let agencies purchase fewer units than they did in the past.

## 6. How important is officer training?



PHOTOS: ARMOR EXPRESS

Training and education are paramount. Officers should especially understand how their ballistic helmet and ballistic vest work together to keep them safe. Knowing how to don their helmets correctly and size for proper fit becomes even more crucial in an emergency when time is of the essence. This is especially true when officers need to wear other equipment in tandem, for example, a helmet with a gas mask. Training should also take into account the environment in which the officer functions, as factors such as climate and weather could have an impact.

It is up to the agency's training officer and/or manufacturer representative to conduct the necessary educational sessions on how to best use and manage the equipment. Typically, training is done on an annual basis for mobile field forces and more frequently for specialized units. The point is that you should train in your helmet at least once a year. Many of us in the industry



Agencies should look for a helmet that is designed to stop NIJ Level IIIA rounds and is multi-hit capable.

even recommend integrating ballistic helmet protection into a qualification course as a component of assault training, active shooter training, or mobile field force exercises.

**7. When is it appropriate for a patrol officer to use a helmet?**

Your agency's policy should be followed. But we recommend that officers wear their helmets any time a threat is heightened, for example, when serving warrants. If the officer feels they need to be protected and policy permits it, they should put on their helmet. Let your intuition be your guide. The most important factor is that the ballistic helmet must be accessible in the first place, with the patrol officer in their patrol vehicle.

**8. How should officers take care of their helmets?**

Always refer to the equipment manual for correct use and care, but a few guidelines include:

- \* Keep helmet away from any caustic materials
- \* Ensure retention straps are in good condition
- \* Use a protective cover for face shield to avoid scratches
- \* Use a protective case for storing helmet

**9. What next-gen helmet standards are anticipated?**

New specifications are being developed by the military. These focus particularly on protection from rifle threats. In addition, various research teams within the Department of Defense are studying traumatic brain injury, with the goal of quantifying the effects to determine the best level of protection and which threats helmets should be rated to protect against.

In addition, the hope is that NIJ-specific mandates will be available in the near future.

**10. What are head protection makers focused on for the future?**

Manufacturers essentially have two goals as they look toward the future of head protection:

1. They are working to advance more lightweight, ergonomic equipment through the introduction of high-tech materials and application of new configurations. We are also seeing enhancements around reducing weight while building in more robust ballistic protection and accommodating accessory tools such as communication devices, body cameras, and more.

2. Greater attention is being paid to traumatic brain injury and how to prevent or decrease it. The emphasis is on better management of backface deformation and energy transfer.

The information and recommendations provided in this article are intended for general education purposes only. Officers should be guided by their agencies' policies and practices.

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*Steve Murphy is Armor Express' tactical product line director and has served in various leadership roles in law enforcement, corrections, and fire/EMS, including as a SWAT team member and tactics/firearms instructor. He is an adjunct board member of the Michigan Tactical Officers Association.*

# Defensive Measures on Campus



**Manufacturers are making a variety of bullet-resistant packs, blankets, and window treatments for use in schools.**

*Doug Wyllie*

**T**HE TRAGEDY of active shooters targeting schools—from Sandy Hook Elementary in Connecticut to Marjory Stoneman Douglas High School in Florida to Oikos University in California—appears to be increasing in severity.

Arguments have been made to arm teachers and provide them with law enforcement firearms training. Arguments have been made to increase police presence at schools with mandatory SROs and regular patrols. Arguments have been made to incorporate into the school budget funds for private armed security to roam the halls.

These arguments are really all about installing what amount to measures to go on the offensive against an armed threat. However, an argument could be made that schools at every level—elementary, middle, high, college, trade school—should be more proactively taking defensive measures. Specifically, schools and students can purchase and utilize a host of ballistic protective products that can help keep students safe in the event of an armed attack.

## Backpacks and Inserts

A variety of companies are now producing backpacks and/or backpack inserts that offer ballistic protection. In fact, there are



*Leatherback Gear sells backpacks that separate to provide NIJ Level IIIA ballistic protection on a person's front and back.*

companies that produce nothing but ballistic backpacks.

Leatherback Gear ([www.leatherbackgear.com](http://www.leatherbackgear.com)) produces a line of backpacks in a variety of styles from covert to overtly tactical that offer protection from gunfire.

The two models—the Civilian One and the Tactical One—separate so that the wearer can have NIJ Level IIIA ballistic protection on both front and back sides. The packs weigh less than four pounds (not including books, school supplies, laptop computers, and the like) and measure a pretty standard backpack size. The Leatherback Gear packs also have a drag handle on the top that can withstand a 300-pound pull.

Another popular set of options comes from Tuffy Packs (<https://tuffypacks.com>), which makes inserts that can go into consumer packs as well as purpose-built backpacks that include Level IIIA protection. The inserts from Tuffy Packs come

in a variety of shapes and sizes—either rectangular or rounded tops—so a consumer can choose the best option for their own existing backpack.

The backpacks from Tuffy Packs look like any other pack you've seen on the streets but they have 24 layers of Twaron anti-ballistic material sewn into the center divider of the pack, offering protection to the wearer.

Tuffy Packs also makes a briefcase/laptop bag.

ShotStop Ballistics ([www.shotstop.net](http://www.shotstop.net)) produces the BallisticBoard insert in both soft and rigid form. Consumers can choose to get level IIIA or level III protection. Made with Duri-tium technology, the inserts are thin and light.

The BallisticBoard insert (soft and rigid) and clipboard are designed for placing in a backpack, computer bag, luggage, or purse to turn it into instant ballistic protection.

Interestingly, ShotStop Ballistics also makes a ballistic clipboard offering IIIA protection. Teachers or students can make everyday use of the clipboard for school activities, and in the event of an attack can rely on it for some level of protection against gunfire.

Another company that makes ballistic clipboards is Hardwire (<https://hardwirellc.com>). The clipboards from Hardwire come in a variety of colors and patterns to suit just about anybody's fashion sense, and weigh about the same as a typical modern laptop computer. They come with a 10-year warranty and are manufactured in the United States.

Also from Hardwire are backpack inserts in both hard and soft form offering either Level III or IIIA protection, respectively. These inserts come in a variety of sizes so the consumer can select the model that is best suited to their backpack of choice.

BulletSafe ([www.bulletsafe.com](http://www.bulletsafe.com)) argues in favor of backpack inserts instead of ballistic backpacks. The company makes note that their inserts are guaranteed to last for five years, which long outpaces the usable life of a child's backpack, so as each school year begins with a new pack, the insert goes along for the ride in the pack fitting this year's fashion. The company produces durable and washable soft inserts that weigh just one-and-a-half pounds and can be placed into any ordinary backpack for Level IIIA protection.

## Shields and Barriers

Another form of ballistic protection for use in the classroom is shields and barriers to protect faculty, staff, and students from an attack.

For example, U.S. Armor ([www.usarmor.com](http://www.usarmor.com)) offers a type of ballistic blanket that can be affixed to a standard-size rolling blackboard or white board. It provides standard IIIA protection—measuring four feet by six feet—with grommets all along the top of the six-foot side. Students and teachers take the blan-

ket down and hide beneath it. Depending on the number of students in a given classroom, a dozen or so blankets per classroom can make all the difference in saving lives.

U.S. Armor also produces a level IIIA barrier that can be mounted at the top of the classroom door. The barrier looks like a blanket roll, but can be very quickly dropped. The Door Shield-QR is a self-contained ballistic shield (Level II or IIIA) that mounts above any open or closed door frame. One pull on the release and gravity does the rest, allowing the door to open to the classroom—which by federal law must open out into the classroom—and contains all sorts of fire protection inside. The Door Shield-QR Measures 20x30 inches but custom sizes are also available.

Most every school has procedures now to ensure that entry way doors remain locked and that they be monitored via security camera during the hours when classes are in session. However, there are dozens if not hundreds of alternative access points for a driven attacker: namely, first-floor windows.

Recognizing this, companies have developed a protective film that can be applied to the glass to offer protection against gunfire that otherwise would shatter the glass.

For example, 3M ([www.3m.com](http://www.3m.com)) has provided thousands of schools across the country with its Ultra Prestige Film

that can be easily installed on existing classroom windows. An added benefit is that this protective film also can protect classrooms from flying objects that could come from outside in areas where tornados can suddenly occur. This film also provides UV protection from the sun.

Another company providing ballistic film that can be applied to classroom windows—as well as the windows in classroom doors—is CJ Buffer ([www.cjbuffer.com](http://www.cjbuffer.com)), which has been producing ballistic film for a variety of customers since 1996.

In addition to also producing and installing bullet-resistant film on windows, Total Security Solutions (<https://tssbulletproof.com>) manufactures bullet-resistant glass in acrylic, polycarbonate, and glass-clad polycarbonate, and produces and installs bullet-resistant barriers behind which people can hide from an attack.

Total Security Solutions' primary customers are banks, convenience stores, and other commercial enterprises at an elevated risk of coming under armed attack. But the company has also begun to receive interest from places like private universities with ample budget to offer students and staff this extra level of protection.

It's terribly unfortunate that there is such a need to protect students from sudden shooting attacks in schools. But the need for ballistic protection in the classroom is undeniable, and necessity is the mother of invention. ■

*Doug Wyllie is contributing web editor for POLICE.*



*U.S. Armor offers ballistic blankets that can be affixed to the top of a classroom door to protect students and teachers.*

PHOTO: U.S. ARMOR

# What You Should Know About Hard Armor

New materials and designs have improved rifle plates' performance and comfort.

MELANIE BASICH

You wear your soft body armor when you're on duty. But what if you have to respond to a school shooting or other incident that might involve rounds your armor isn't rated to stop? The trauma plates that fit inside front and back pockets in armor carriers offer protection against rifle rounds, and some protect against armor-piercing rounds. But should you have them? And if so, how do you know which kind to choose?

## MATERIALS

Plates that use ceramic tile to slow a bullet have been around for decades. Different types of backing help to both increase absorption and protect the ceramic itself from accidental breakage.

But because the ceramic is designed to break when a bullet hits it, the hard yet brittle plate can only take a limited number of bullets. And the ceramic in the plate can crack if it's dropped or hit in any way, such as when thrown into a bag or cruiser trunk. Such cracks diminish the plate's ability to protect an officer from a bullet, and the cracks aren't always visible.

While they've been around since the late 1980s, the technology to make polyethylene plates thin enough for practical use is more recent. High-pressure treatment increases performance and decreases weight. Unlike ceramic, ultra-high-molecular-weight polyethylene (UHMWPE) plates take advantage of the spin of a bullet to slow it down. The bullet's friction creates heat, which partially melts the polyethylene until it stops the bullet. Then once the bullet slows and eventually stops, the polyethylene cools and rehardens.

Because of the way in which polyethylene plates work, they can stop multiple bullets. And because the material is more resilient than a hard material like ceramic, dropping a polyethylene plate will not cause damage. They are also relatively lightweight. Some manufacturers use a blend of ceramic and pressed UHMWPE in hard rifle plates to help reduce the weight significantly. Plates made only of polyethylene tend to be thicker but lighter.

Steel is a comparatively inexpensive material for trauma

plates and it is able to stop multiple rounds. But steel hard armor is generally impractical because it is so heavy. The weight makes wearing steel plates uncomfortable and cumbersome. Any steel armor that is worn should contain an antispall coating to trap any shrapnel created when a bullet hits the steel and fragments. Titanium is another, lighter metal that is used in hard armor plates.

## SHAPES AND SIZES

Now, thanks to the military's insistence that companies create five sizes of SAPIs (small arms protective inserts) to fit different soldiers' torsos, more size options have become available to law enforcement in the United States.

Even smaller side plates are now available to protect the area under the arms that becomes exposed when aiming a weapon. This is in large part due to advances in shaping technology.

In addition to absolutely flat plates, officers now also have the option of purchasing a single curve or a multi- or sometimes called triple-curve plate. These are designed to wrap around the body for a better fit, which improves comfort and performance.



PHOTOS: U.S. ARMOR



## ARMOR RATINGS

To verify how well it will protect wearers from specified threats, about five independent labs test ballistic armor for law enforcement use, according to standards set by the Department of Justice's research and development arm, the National Institute of Justice (NIJ). Periodically, the NIJ revises its standards for the testing and certification of ballistic protection gear, as it has done recently.

If the NIJ's proposed 0101.07 standard (or 07 for short) passes, the terminology used to discuss the protective level of armor worn by law enforcement will be much simpler and easier to understand. There will now be three levels of hard armor called Rifle 1 (RF1), Rifle 2 (RF2), and Rifle 3 (RF3).

The 07 standard specifies improved methodology for determining how much force is transferred into the body of the wearer during a bullet strike, a concept known as backface de-

Trauma plates are now available in a variety of materials, shapes, and sizes to be used in conjunction with soft armor to increase ballistic protection.

formation. "Backface" is measured by mounting the armor on specially treated clay and shooting it to see how deep an impression the impact makes in the clay.

Interestingly, with the new standard, the NIJ is increasing the amount of backface deformation it will allow before failing hard armor. Backface deformation is a way of measuring how much trauma the wearer of the armor will experience, so the increase could have medical effect, even though it is only a small difference.

So why would the NIJ increase the backface tolerance it allows on NIJ certified hard armor? Experts believe the answer is that the agency hopes the change in the standard will lead to lighter armor and more officers wearing hard plates when facing rifle threats.

Perhaps the biggest change in the new standard is the establishment of three levels of hard armor. Under the current standard, the NIJ only recognized two levels of hard armor, Level III certified to defeat 7.62x51mm NATO M80 ball ammo and Level IV certified to defeat .30-06 Springfield M2 armor-piercing bullets. A lot of hard armor manufacturers also produced an intermediate plate they called III-plus that was independently tested against SS109/M855 5.56mm steel core ammo know colloquially as "Green Tips."

The proposed 07 standard would eliminate any need for

manufacturers to create intermediate categories of plates because the standard does it for them. Under the proposed standard, hard armor plates will be categorized as:

RF1: Tested against 7.62 x 51mm M80 Ball NATO FMJ, 7.62 x 39mm surrogate test round, and 5.56mm M193 BT. This is equivalent to current NIJ Level III.

RF2: Tested against all of RF1 test rounds plus 5.56mm M855 BT (Green Tip)

RF3: Tested against .30-06 M2 armor-piercing FMJ. This is equivalent to current NIJ Level IV.

As with soft armor, experts believe the new NIJ terminology for hard armor will be good for law enforcement customers, as it will make the protective capabilities of the armor easier to understand.

Unfortunately, there could also be a downside to the new standard for hard armor customers. A new testing procedure for hard armor requires manufacturers to submit more product. This could raise the price of hard armor.

Deciding what plates to purchase and use is not easy, but it helps to look at the available options. It comes down to the level of threat you need protection from and the material that will best satisfy your operational and cost considerations. Try focusing on the trade-offs between protection level and comfort, mobility, and wearability to make your decision. ■



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# The Ballistic Armor Materials of the Future Sound Like Science Fiction

David Griffith



PHOTO: GETTY IMAGES

The dream for the future of body armor is a garment as comfortable as a polo shirt that can stop rifle fire. Making that dream a reality will involve research into two types of exotic materials: spider silk and graphene.

Today, all ballistic protection is inorganic. It's made of steel, ceramic, ultra high molecular weight polyethylene, and a variety of aramid fibers. In the future it may be made of biological material.

Using spider silk, which by mass is five times stronger than steel and much more flexible than any ballistic fiber, has long been the obsession of some armor researchers. But it's never really made it past the realm of lab work and speculation. Maybe in the next 10 years that could change.

One major obstacle is that scientists have decided the silk of the black widow is their best option for making armor.

Raising a bunch of black widows to harvest that silk is a big

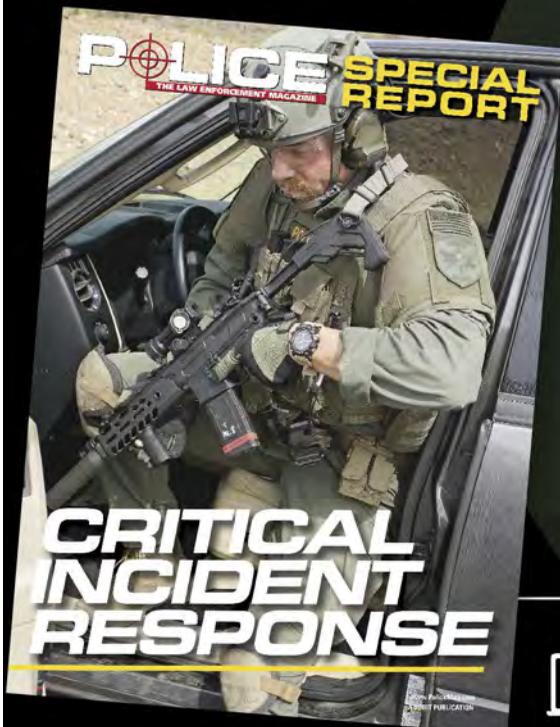
problem because each spider has to be housed separately or there will be spider wars. One proposed solution has been to genetically modify tomato plants to produce black widow silk.

Which is why maybe sheets of carbon atoms called "graphene" are a better option. This material is 100 times stronger than steel, and in 2017 researchers at the City University of New York discovered that two one-atom-thick sheets of graphene can stop really powerful bullets. The stuff hardens into something researchers call "diamine" when it gets hit by a projectile.

Part of the statement from CUNY's Advanced Science Research Center reads: "Imagine a material as flexible and lightweight as foil that becomes stiff and hard enough to stop a bullet on impact."

Research on spider silk, graphene, and other materials for producing the next evolution of armor is ongoing. ■

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# NIJ Expected to Create New Terminology for Soft Armor Performance

David Griffith

Periodically, the National Institute of Justice (NIJ) revises its standards for the testing and certification of ballistic protection gear. The current standard is 0101.06. That 06 has nothing to do with the date of adoption; the standard was adopted in 2008 as a replacement for the 05 standard. Last year the NIJ released a draft of its proposed 0101.07 standard for public and industry comment.

The new standard was expected to take effect in the fourth quarter of 2018, but the NIJ received an overwhelming number of comments and that delayed the process. Now the target is end of 2019.

When the new standard is published, it will change the way officers and armor makers talk about the performance of armor.

One of the most difficult things to explain about the certification of armor is the NIJ protection level rankings, which

are currently expressed in Roman numerals and the letter “A.” Soft body armor is rated IIA (least protective) to II to IIIA (most protective). This system does not clearly delineate that soft armor is only certified to protect the wearer from handgun rounds.

If the proposed 07 standard passes, the terminology used to discuss the protective level of soft armor worn by law enforcement will be much simpler and easier to understand. There will now be two levels: Handgun 1 (HG1) and Handgun 2 (HG2).

HG1 is the equivalent of the current Level II protection and HG2 is the equivalent of Level IIIA with a slight change in the threats used to test the armor. Level IIIA vests are currently tested with the .44 Magnum and the .357 SIG; HG2 armor will be tested with the .44 Magnum and a 9mm FMJ with a velocity of 1,470 feet per second. There will be no equivalent to Level IIA armor. ■

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