



Ballistic Protection



Mini-Documentary: [*Bullet-Resistant Brazil*](#)

Ensuring the protection of life and helping to safeguard our environment in these turbulent times are what drives DuPont's constant vigilance to innovate technologies to protect those who protect us.

DuPont scientists work tirelessly to develop new and refine existing products and technologies while collaborating with local partners to ensure that cost-effective safety reaches the most dangerous regions of the world. It was through such a collaboration with Companhia Brasileira de Cartuchos for the manufacture, testing and marketing of locally made ballistic products utilizing DuPont's sophisticated technologies that an affordable vest made with Kevlar® saved the life of Officer Da Silva in Sao Paulo, as recounted in "Bullet-Resistant Brazil."

Looking at the Past to Innovate for the Future

From manufacturing gunpowder in 1802 to providing affordable, sophisticated ballistic protection for local law enforcement today, DuPont has maintained a trajectory of innovative technology for safety and protection from emerging threats around the globe. By drawing on DuPont's deep history and investigating the patterns of threats and protection...from successes to tragedies...the world over, DuPont and its partners better understand what the future may hold and how to use science to meet future threats.

At DuPont's Armor Technology Center in Wilmington, DE, scientists and engineers employ the latest advances in protection technologies to design, produce and test prototypes of helmets and composites for vehicle armor. Sophisticated computer



Sophisticated computer modeling programs help DuPont scientists predict the performance of materials and designs at the [*DuPont Armor Technology Center*](#).



modeling programs help DuPont scientists predict the performance of materials and designs, which speeds innovation and leads to greater protection and cost-effective solutions. For example, recent innovations in thermoplastics resins have given Kevlar®, in use for over 40 years, even more protective properties and flexibility.

Layers of Performance in the Weave

The bullet-resistant vests designed for Brazilian law enforcement work by catching a bullet and dissipating the kinetic energy in a multilayer web of woven fabrics made with DuPont™ Kevlar® brand high tenacity fiber. A range of different Kevlar® fabrics are tailored to specific threats with each layer in the weave performing a different task to create the highest stopping power. Whether it's engaging a fast-moving projectile or helping to stop the blunted bullet, body armor made with Kevlar® fiber helps offer law enforcement officers superior protection in multiple ways.

The Kevlar® woven fabrics used in these vests provide the optimum combination of comfort, flexibility, durability and cost. The combination of layers for any design is selected after extensive ballistic testing to balance both the **ballistic limit** and the **back face signature** using different threat levels and projectiles.

The **ballistic limit** or **limit velocity** is the velocity required for a particular projectile to penetrate a particular piece of material 50 percent of the time.

The depression depth that results from a non-penetrating projectile impact in the body behind the armor is the **backface signature**. The **backface signature** (also known as the **backface deformation** or **trauma signature**) provides an indication of how much energy from the projectile is transmitted into the wearer.

DuPont strives continuously to strengthen and extend its portfolio of high-performance protection materials to complement the broad range of Kevlar® technologies developed through years of research. As an example, Tensylon™, ultra-high molecular weight polyethylene (UHMWPE) tape technology, offers additional routes to the development of strong and lightweight armor for both military and police applications.

Protecting the Military and Armed Services

From riots, civil unrest and IEDs, today's infantry is subject to an ever-increasing range of threats demanding multi-threat protection. To combat these threats, DuPont is constantly monitoring the state of the future and developing innovative products and technologies accordingly. To stay ahead of the fast-changing world of combat, DuPont works closely with governments, companies, academics and fellow scientists to develop cutting-edge technologies and materials that provide the utmost safety for the military. Equally important to protection is ensuring that the technologies and products developed do not impede the ability to protect and serve. For example, while the ballistic military helmets made with Kevlar® provide high performance protection, the lightweight properties of the material also helps to improve mobility and reduce fatigue in combat.

Not only are the men of combat wearing helmets of Kevlar®, body armor of Kevlar® and DuPont™ Nomex®, and armor vehicles with Kevlar®, but now the newly-added U.S. military's women in infantry divisions throughout the world are also wearing protection gear made specifically for the build and structure of a female body.

While no one can predict the future, the scientists at DuPont are committed to staying on the forefront of protection innovations to ensure the safety of those who protect our world.



Kevlar multi-threat protection jacket