

## The Invention Militia

Amateur engineers are asking what they can do for the Pentagon.

By [Spencer Ackerman](#)

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On a recent, chilly day in upstate New York, I found myself riding shotgun in a black Chevy Trailblazer with a small arsenal of assault weapons in the trunk. The driver, Dave Warren, a 39-year-old Vietnamese-born ex-Marine and veteran of Desert Storm, was a man on a mission. An inventor and an engineer for a Connecticut security company, Warren had devised a lightweight vehicle armor he thinks will better protect Humvees from Iraqi insurgents armed with Kalashnikovs and homemade bombs than the steel currently used to belatedly up-armor the vehicles. He's currently lobbying to have it reviewed by the Pentagon.

After we parked at a Saugerties firing range, Warren unpacked his M-14, 12-gauge shotgun, and AK-47--the insurgent assault rifle of choice--then hauled out the experimental armor, which he calls Magmacore. It was a two-inch thick panel about a foot in length and width. Despite weighing 18 pounds or so, it didn't look too sturdy. Its white coating was slathered on, giving it the appearance of runny plaster; while not gummy, the panel flexed ever so slightly when squeezed. Imagine a giant, sugar-glazed Rice Krispies Treat. Not exactly what you imagine you'd want standing between your flank and an armed terrorist.

Warren walked out 15 yards onto the still-snow-covered range and mounted his panel onto a stand a few feet high, then slid a thin sheet of aluminum behind it. "We're going to take this thing to failure," he said. I imagined it wouldn't be long before the aluminum was gnarled and fragmented beyond recognition.

It didn't happen. Over the next hour, Warren unloaded magazine after magazine from his AK-47. First, he fired directly from 15 yards, drilling the panel with 20 rounds, then another 20, all in practically the same spot. Then he emptied another clip a little to the left. Next, he fired off another 20 bullets while walking within 5 yards of the panel. He put down his AK-47, grabbed his M-14, and fired off another 10 rounds. Finally, he lofted the shotgun and discharged a last volley of punishment into the panel.

All told, the Magmacore withstood 135 rounds of bullets varying in shape, size, and velocity, all right on top of each other. (The steel currently protecting Humvees in Iraq will take about a dozen rounds in the same spot before giving way.) Though every shot had pierced the panel's exterior, not a single bullet had come out the other side. The only visible evidence that the panel took significant fire was a constellation of pinprick holes and some minor tearing in its outer layer. Warren joked, "I'm kind of disappointed."

As I puzzled how the aluminum sheet behind the panel could emerge as smooth as the day it was forged, Warren explained how Magmacore worked. He said he had avoided the conventional approach to strengthening armor--increasing the density of a material--and instead reexamined what he called "the physics of what's happening." By design, a bullet easily penetrates his armor's outer layer only to smack into a denser core where intense friction converts the bullet's momentum into heat so extreme that its full metal jacket melts off, reducing the round to molten lead inside the armor panel. "We're using the energy of the round against itself," Warren explained, before pointing out two other benefits of his design. First, there's no danger of a bullet ricocheting off the armor and back onto the battlefield, or of it fragmenting the panel into potentially lethal shrapnel, an ever present danger with steel and other armor materials. Second, his armor is light enough to allow wheeled vehicles like Humvees to remain highly mobile (which is what the "Hum" in Humvee means): He calculates that his 18-pound sample of Magmacore would provide protection comparable to that of 45 pounds of steel, relieving much of the burden on the Humvee's engine, transmission, and suspension.

While Warren can subject his armor panel to small-arms fire at a range like this one--consider that a happy consequence of the expiration of the assault weapons ban--only an Army facility such as the Aberdeen Proving Ground in Maryland can evaluate its capacity to withstand a full range of threats, including simulated blasts from explosive devices like those used by insurgents in Iraq. To that end, in March, Warren paid a visit to Capitol Hill and met with staffers for Rep. Duncan Hunter (R-Calif.), chair of the House Armed Services Committee, as well as aides to his home-state senators Hillary Clinton (D-N.Y.) and Chuck Schumer (D-N.Y.), who helped him get Magmacore on the road to testing at Aberdeen, which is on track to happen by the time this article is printed.

Warren isn't the only private-sector inventor to knock unsolicited on the Pentagon's door since the fall of Baghdad. The well-known vulnerability of U.S. troops to insurgent attacks has spurred a boom in rethinking armor design, and hundreds of submissions for research, testing, and development have poured into the Defense Department. According to Col. John Rooney, who heads armor testing at Aberdeen, since October 2003, the Army has evaluated over 300 new armor designs. Tom Madison, director of research and development for First Choice Armor in Massachusetts, for example, shares Warren's skepticism of steel. "We're working on a composite to achieve the same protection levels, but with less weight [than] steel," says Madison, whose design is also slated to be tested soon at Aberdeen.

Madison's company, like many of those who've submitted designs to Aberdeen, has already worked on several products for the military. Warren, by contrast, is a total

novice: His foray into armor design came entirely from his disgust at how vulnerable U.S. troops in Iraq are, which he gleaned from watching the news and reading the papers. And if his design survives the abuse at Aberdeen, it wouldn't be the first time that an outside entrepreneur has crafted a critical invention to fit the needs of a particular war. During WWII, a bourbon-swilling Nebraska native named Andrew Jackson Higgins adapted his design for a swift workboat made to navigate shallow Louisiana swamps into the landing crafts made possible the victories at D-Day and Iwo Jima. "A lot of [military technological advances] early on came from civilians and civilian industry," notes Andrew Krepinevich, executive director of the Center on Strategic and Budgetary Assessments, a leading defense-futurist think tank. But such innovations by outsiders have become rarer in recent years because, as Krepinevich explains, "now the military and industry are embedded with each other in ways that would have been unheard of" in past wars.

But with Iraq still an open-ended U.S. commitment, the need for better ballistic and blast protection isn't going away. Perhaps blanket news coverage of the conflict, which both arouses the concerns of crafty armchair patriots and allows them to pinpoint some of the crucial needs of the ground forces in Iraq, will spur more would-be Higginses to the challenge.

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