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ENGINEERING **SHOCK MARTENS**

Landmines are soon to be given the boot. That's if a new invention from a Singaporean tycoon takes off. The Blast and Fragment Resistant Boot (BfR Boot) has been developed by one Andrew Vaz, who claims the novel footwear can reduce the damage caused by anti-personnel explosives.



 **Beyond 2000**
Handheld version

With over 100 million landmines still active in over 65 countries, soldiers and civilians alike are greatly at risk from these indiscriminate killers. Every 22 minutes, someone in the world is killed or maimed by one. The BfR Boot can go some way to making work in landmine-rife areas safer for soldiers.

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The boot boasts 13 shock-absorbing layers in its sole, that combine to create a barrier stronger than steel. As a bonus, the sole is additionally made up of corrugated stainless steel and aluminium, which give added protection. While the manufacturers and distributors don't claim the wearer will walk away unscathed if they encounter a landmine, they do believe it will reduce soft-tissue and skeletal damage.

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The testing poses a lot of problems in its own right. You can't exactly strap the boots on someone and ask them to jump on a mine to see what happens. In the past, the usual method was to fit the protective clothing over human or animal cadavers and limbs. However, besides the Pandora's Box of ethical problems both test subjects present, they're also fairly unscientific. The cadavers tend to be elderly people and commonly exhibit osteoporosis; hardly reflective of your average soldier. As for pigs and sheep, they're even less likely to generate an accurate picture of humanity.



Fake limbs: eerie

One idea for beating the testing dilemma is artificial humans. A team from Australia's Defence Science and Technology Organisation produced their first models of a replica human leg in the late 90s.

Since then the mock-ups have become more sophisticated. The latest legs are made from a synthetic bone packed with instruments and overlaid with ballistic gelatin muscles, tendons and vascular structures. Rusty-red, X-ray visible blood tinges the limb and a sickeningly realistic kneecap is also included. The top-of-the-range version is wrapped in oiled chamois leather; in other words, skin.

During any detonation trial the leg can provide 14 channels of sensor output measuring the effects of the blast shockwave and the induced bone stresses as they travel through the tissue. The gelatin and plastic structures mirror the trauma a real limb would suffer. In fact some of the legs were included in a recent evaluation of armoured vehicles for the Australian Defence Forces. After the vehicles had been subjected to various landmine blasts the legs were retrieved. In each scenario the damage resulting to the fake limbs correlated extremely closely to documented cases of landmine-related injuries in humans.

Getting it out there

Tests on the BfR Boot have so far confirmed all the manufacturer's claims, and it's now up to the distributors, who have secured the patent, to start getting them onto the market. Lee Fook Kiong, chairman of manufacturer BfR Holdings Limited, which is manufacturing and marketing the boot, says samples have been sold to a dozen countries, including Spain Turkey, Sri Lanka, Saudi Arabia and the US.



Of course, the protective footwear is not going to be much use to the millions of civilians who have to live with landmines on a daily basis, in countries like Cambodia and Afghanistan. With the boots retailing for around \$170, they'll hardly be a viable option for anyone outside the

they'll hardly be a viable option for anyone outside the military.

But the boots may be a boon for humanitarian organisations involved with landmine removal. Then countries like the United States, Israel and China just need to agree not to make and use mines in the first place.

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