



Defense Technology Monitor No. 77

June 8, 2022 Richard M. Harrison, Alexis Schlotterback

Related Categories: Cybersecurity and Cyberwarfare; Military Innovation; Science and Technology

TOWARD BOUNCE-BACK BODY ARMOR

The most effective body armor should not only protect the wearer, but also be reusable and bounce back into shape after withstanding an attack. Improving upon current models, researchers from Johns Hopkins University have engineered a lightweight body armor material that uses a complex liquid crystal structure that enhances armor strength and reusability. The material is designed from the ground up, starting at the atomic level, and the resulting "elastic buckling instabilities" distribute energy from an impact and store it like a spring, then regain its shape without permanent deformation. During extensive testing, the new material withstood impacts from objects traveling at 22 miles per hour and weighing up to 15 pounds. (*Popular Mechanics*, April 5, 2022)

SUPPLEMENTING OR SUPPLANTING GPS?

As demonstrated by the war in Ukraine, the jamming of location, navigation and timing satellites, such as the U.S. GPS system, is a devastatingly effective warfare tactic. U.S. military officials are increasingly acknowledging this fact. "We know that the way of warfare has changed, and we're going to be having difficulties with jamming, and having difficulties getting our position navigation and timing signals to our warfighters," says Maj. Gen. Heather Pringle, the director of the Air Force Research Laboratory (AFRL). In response, AFRL is testing technology that can serve as a supplement to GPS systems on its Navigation Technology Satellite-3 (NTS-3). NTS-3 can be placed in higher orbits, which are less susceptible to compromise, and outfitted with better antennas. It can also contain software that can be reprogrammable from orbit, and utilize a more robust timing architecture. If successful, some of these technologies can be expected to be incorporated in successor satellite systems as a means of creating resiliency in or a substitute for GPS. (*Breaking Defense*, April 8, 2022)

MILITARY IN THE METAVERSE

If Facebook creator Mark Zuckerberg has his way, reality as we know it may be a thing of the past as people shift to life in the Metaverse. A fully integrated virtual world offers benefits not only for civilians, however. Military personnel would be advantaged as well, and Pentagon leaders are in the process of discerning just how useful a tool the "metaverse" could be. Synthetic environments are already being used to train soldiers, but a military metaverse of the future would represent something far more robust: a collective environment that allows data to flow seamlessly across platforms, incorporating training, education, and collaboration for warfighters and flag officers.

One potential functionality that could be provided by a military metaverse is to assist mission planners by providing the ability to visualize operations with increased amounts of data and see "second and third order effects," thereby gaining a better understanding of possible outcomes. It could also give warfighters the ability to experience weapon systems in higher fidelity, and enable soldiers to maintain a persistent virtual physical profile matching their real-world attributes (which would better prepare them to meet training requirements for real life missions). However, Jenny McArdle, head of research at Improbable U.S. Defense & National Security, cautions, "for synthetic training to get to the point where we have these seamlessly interoperable virtual worlds, we're going to have to move towards building these environments in a way that are far more modular and composable." (*Breaking Defense*, April 12, 2022)

IRON BEAM ADVANCES

Despite the massive successes of Israel's Iron Dome air defense system in guarding against militant rockets, the prohibitive costs associated with firing expensive interceptors against cheaply made short-range projectiles has left policy planners in Jerusalem scrambling for a solution. Directed energy defenses are increasingly seen as providing at least part of the answer. A mobile directed energy system, dubbed "Iron Beam," has been under development for some time by Israeli defense contractors, and successfully carried out a field test in April. Iron Beam is intended to serve as a supplement to – rather than a replacement for – Iron Dome, and its capability is hampered by issues such as reduced function in low visibility and poor weather conditions. Nevertheless, Israeli planners are optimistic that the new system, which is expected to attain operational capability this calendar year, will help improve their current, cost-prohibitive, intercept equation. (*The Times of Israel*, April 14, 2022)

TRANSPORTABLE NUCLEAR POWER

The Pentagon's push for a transportable nuclear reactor dates back to the 1960s and 1970s. While those early attempts were unsuccessful, the benefits of such a capability – which holds out the promise of eliminating vulnerable supply lines and powering forward operating bases – are obvious. This understanding has fueled a continued DoD research effort, known as "Project Pele." The program calls for the construction of a nuclear reactor capable of being transported in a few 20-foot shipping containers, carried by a C-17 cargo plane, and quickly installed to provide up to five megawatts of power to a military base. Skeptics, however, worry that the resulting mini-reactors could be a dangerous, and inviting, target for adversaries in-theater. Nevertheless, work on the capability is progressing, and testing and demonstration of the new reactors are expected to be conducted by Idaho National Laboratory in 2024 and 2025. (*Military Times*, April 15, 2022)