



Defense Technology Monitor No. 50

March 10, 2020 **Richard M. Harrison, Ethan Pann**

Related Categories: Intelligence and Counterintelligence; Military Innovation; Science and Technology; China; Israel

THE FUTURE OF ORGAN TRANSPLANTS?

The capabilities of 3D printing are seemingly endless, as recent research is demonstrating. Using a novel technique called photolithography, researchers at Rice University are beginning to perfect the use of a 3D printer to make usable human organs, and have already had success creating part of an artificial lung. While other scientists have had some breakthroughs in building layers of tissue through 3D printing in the past, none were able to master the ability to create a vasculature able to bring oxygen and nutrients to the tissue for creating truly complex organs - until now. The Rice researchers also plan to experiment with incorporating designs from other species — specifically identifying bat lungs, which are more efficient than human lungs, as models — but there is no guarantee that such a fusion will work. The U.S. military has committed an unspecified amount of funding to support this groundbreaking research, which - if perfected - could eliminate the need for organ transplants for soldiers wounded in battle, and even eventually for the general public. (*Texas Monthly*, January 3, 2020)

CHINA FOCUSES ENERGY ON AIRBORNE LASER...

Postings on "weain.mil.cn," the online procurement platform of the People's Liberation Army (PLA), suggest that the Chinese military is keen on acquiring technology which would allow it to mount offensive lasers on planes. The idea, which has also been reported on by Chinese state-run media outlets, is an attractive one, given the advantages imparted by lasers in battle. China's prospective plane-mounted lasers would ostensibly function as offensive weapons, but impediments to their deployment remain. Specifically, like its advanced terrestrial laser systems, mounting such equipment on planes could prove difficult because they will require a significant (and heavy) power supply. (*South China Morning Post*, January 7, 2020)

[EDITORS' NOTE: The United States has itself focused on developing similar systems. However, the Pentagon's premier project in this domain, known as the Airborne Laser (ABL), was cancelled in 2014 because of cost overruns, and the Defense Department has slowly started to revive research on airborne laser anew only in the past couple of years.]

...WHILE ISRAEL READIES LASER DEFENSE

Israel, which faces threats from state actors such as Iran as well as terrorist groups like Hamas and Hezbollah, hopes to soon incorporate a new electric-powered laser weapon into its already-comprehensive Iron Dome aerial defense system. The system, which was formally unveiled by the country's Defense Ministry in early January, is the culmination of a decade of quiet work on laser technologies capable of intercepting enemy rockets, anti-tank missiles, and drones. It is designed to focus several high-energy laser beams into a singular one that can penetrate obstacles, including heavy cloud cover and dust storms. According to Brig.-Gen. Yaniv Rotem, head of the Defense Ministry's Directorate of Research and Development, the system represents a logical evolution of the country's defense focus. "[D]uring a war, missile interceptors will at one point run out, but with this system, as long as you have electricity, you have a never-ending supply," and the cost is a few dollars a shot relative to kinetic interceptors that are worth thousands of dollars each. (*Jerusalem Post*, January 9, 2020)

THE NEXT EVOLUTION IN EYESIGHT

Contact lenses are getting a major upgrade. Augmented reality (AR) company Mojo is in the process of developing AR contact lenses that will initially be capable of correcting poor eyesight, but which in coming years will overlay data directly onto the eye. The tiny display will be incorporated into the lens and situated directly in front of a subject's pupil. The technology is able to project 70,000 pixels in an area that is a fraction of a millimeter across directly onto about 5 percent of the wearer's retina. Vision enhancement features will include the ability to magnify objects, superimpose information onto objects, and communicate with cell phones and other networked devices. However, the innovation is raising privacy and safety concerns, as well as practical ones (such as the difficulty of developing microcomponents that would allow the device to function properly for long periods of time). Mojo is currently working with the FDA to position the technology as an aid to the visually impaired. Eventually, however, the service industry, emergency response services, and the U.S. Department of Defense will eventually become customers as well. (*Fast Company*, January 16, 2020)

MAKING BETTER BODY ARMOR

Modern body armor provides its wearer with added protection against projectiles, but is still vulnerable to impact from higher velocity rounds. That, however, may soon change. Researchers at Texas A&M University may have found a way to better protect warfighters through the use of boron carbide (colloquially known as "black diamond"). Boron carbide is the second-hardest known man-made element, and is scalable to produce in large quantities while remaining lighter than similar materials. Nevertheless, the substance has historically had one critical flaw: localized and high-velocity impacts, such as those from bullets traveling over 900 meters per second, cause black diamond to undergo a "phase transformation," reordering its chemical composition and shattering it like glass. But scientists at A&M's Department of Materials Science and Engineering found that adding small amounts of silicon to boron carbide reduces the effects of phase transformation by approximately 30 percent, while improving its protective properties. Researchers will likely explore whether other elements, like lithium, have similar or better effects. (*Science Daily*, January 22, 2020)