



Defense Technology Monitor No. 44

September 4, 2019 **Richard M. Harrison, Jacob Thompson**

Related Categories: Missile Defense; Science and Technology; Russia

RUSSIAN HYPERSONIC WEAPONS FACE MATERIAL SHORTAGE

Not all that long ago, Russian advances in hypersonic weapons development were occurring at an alarming rate. But no longer. Reportedly, the highly maneuverable *Avanguard* system, which will allegedly fly at speeds of Mach 20 once fielded, is experiencing a material shortage that may lead to production delays. Specifically, the carbon fiber used on the glide vehicle is having difficulty enduring the exceptionally high temperatures during hypersonic flight. According to Russian media reports, the Kremlin's plan to date has been to field a dozen *Avanguard* missiles by 2027. It is unclear how that timeline will be impacted if a supply of more durable carbon fiber is not available. (*Engadget*, July 1, 2019)

ARMY EMBRACES VR TRAINING

Synthetic training environments are the wave of the future for the U.S. military, and thanks to new glasses being manufactured by Microsoft the Army may soon see a new path to access the virtual training ground. The smart glasses, known as the Integrated Visual Augmentation System (IVAS), have impressed Army leadership and made access to virtual training more robust. Having a virtual training ground allows soldiers to practice combat scenarios repeatedly without the cost or logistical challenges of traveling to dedicated military training facilities, and provides commanders with valuable insight into operations. Acting Secretary of the Army Ryan McCarthy has lauded the half-billion dollar project: "I literally came in a room... and they looked like Taliban targets and ISIS guys... It looked like a very good video game." In addition to training purposes, the IVAS system is also being considered as an augmented reality tool for field operations, and for pairing with the Army's Next Generation Squad Weapon (a new field weapon which will replace existing automatic rifles and carbines) to add targeting within the display. (*iHLS*, July 7, 2019)

BODY ARMOR ON DEMAND

The latest military application of 3D printing could be lifesaving for soldiers in the field. Researchers at the Army Research Laboratory are designing 3D printers capable of producing the high-density ceramic plates required to blunt the force of incoming projectiles. Nature has once again provided inspiration as engineers are using the layered growth pattern of the single shell mollusk to create durable layered armor. If the program succeeds, 3D printed armor would be lighter and more effective, tailored to the individual, and easier to replace when damaged. When deployed in combat zones, it would solve a significant problem for the Pentagon, ending the need to buy armor of every size and reducing corresponding shortages and surpluses. (*Popular Mechanics*, July 18, 2019)

AI HELPS TO ID SMALL UAVS

Small commercial and military drones capable of carrying explosives or conducting reconnaissance are a growing threat to U.S. forces. While a wide range of drone countermeasures are currently available (See *Defense Technology Monitor* No. 39, 42 and 43), unless enemy drones can be detected and tracked, eliminating them is near impossible. However, researchers from the Daegu Gyeongbuk Institute of Science and Technology and California State University at Fresno may have created a solution for tracking small drones as far as three kilometers away. The team combined an Active Electronically Scanned Array (AESA) and a Generative Adversarial Network (GAN) to identify potential flying threats appearing as small blips on radar. The innovative GAN software was able to utilize a combination of results from two neural networks and extrapolate a small training dataset into a machine-learning algorithm that drastically increases radar imagery identification. (*Defense One*, July 23, 2019)

DRAGONFLIES INSPIRE MISSILE DEFENSE

The advent of hypersonic weapons has raised serious concerns for defense planners because there are no real defenses in place to track (much less counter) these new, highly maneuverable missiles. However, nature may offer a solution... inside the brain of a dragonfly. The predatory insects possess incredible reaction times and have the ability to track and react to any movement that their prey makes in 50 milliseconds — a sixth of the time it takes humans to blink. Researchers at Sandia National Laboratories are now using Artificial Intelligence to apply dragonfly hunting skills to missile defense. If successful, the complex computations for calculating missile intercept trajectories could be greatly simplified, yielding smaller onboard processors for lighter more navigable interceptor missiles. Algorithms modeling dragonfly flight have already been successfully simulated. The challenge now is to determine if the algorithms will be applicable for weapons traveling at speeds over Mach 5. (*Science Daily*, July 24, 2019)