



DEFENSE TECHNOLOGY MONITOR

The American Foreign Policy Council's Review of
Developments in Defense Technology

Defense Technology Monitor No. 54

July 1, 2020 **Richard M. Harrison, Lauren Szwarc**

Related Categories: Military Innovation; Missile Defense; Science and Technology; SPACE

NEW 3D PRINTING TECHNIQUE CHANGES THE GAME

The U.S. military is pinning its hopes on 3D printing in order to reduce its existing dependency on a diminishing supply of parts, as well as to increase the speed at which replacement parts become available while lowering overall costs. However, questions have persisted about the quality of 3D printed products. Now, researchers at Advanced Photon Source (APS), a U.S. Department of Energy facility, have discovered a way to make 3D printing a more durable manufacturing tool. Using a high-powered x-ray system capable of capturing images at the nanosecond-level during the 3D printing process, researchers were able to discern that thermal conditions are the cause of microscopic pores in the finished products of 3D printed parts. These pores, not prevalent in a traditional manufacturing process, result in a more brittle finished product. APS researchers have discovered that by modifying the power and speed of the laser on existing 3D printing equipment, thereby controlling the temperature gradient, the microscopic pores can be eliminated, leading to increased structural integrity. If proven to be an effective technique, this process could make a significant impact on military and civilian manufacturing. (Phys.org, May 8, 2020)

PLASMA SERVES AS NEW MISSILE DECOY

For decades, military aircraft have relied on decoy flares to temporarily mask hot jet exhaust and fool heat-seeking missiles. Today, the U.S. Navy is developing a laser technology capable of countering both infrared sensors and the human eye for long durations of time. The Navy is utilizing an "ultra-short, self-focusing laser pulse" to make laser-induced plasma filaments (LIPF), which create a 2D or 3D image at a range of hundreds of meters in both the visible and infrared spectrum. The image can be held stationary or moved around and take on various shapes and sizes. Navy officials are not willing to discuss the project, but according to the patent, "There can be multiple laser systems mounted on the back of the air vehicle with each laser system generating a 'ghost image' such that there would appear to be multiple air vehicles present... The potential applications of this LIP flare/decoy can be expanded... to cover and protect a whole battle-group of ships, a military base or an entire city." (Forbes, May 11, 2020)

POWER-BEAMING TEST ON BOARD SPACE PLANE

The clandestine U.S. Air Force X-37B space plane, which launched this May, was equipped with a device set to conduct a revolutionary power-beaming experiment. The device, called the Photovoltaic Radiofrequency Antenna Module Flight Experiment (PRAM-FX), is designed to test the idea of using a solar array to collect sunlight and transmit it back to power stations on Earth via microwave beams — potentially leading to a future of clean energy. However, the test that will be carried out on board will only collect solar power and measure a potential output, without transmitting any energy back to Earth.

If the technology matures, however, the results will be nothing short of transformative. The DoD intends to utilize the beams to provide power to conflict zones abroad and greatly ease the logistics of providing fuel to the front lines, as well as to deliver constant power to military drones (see *Defense Technology Monitor* no. 34) that conduct persistent surveillance or carry munitions, thereby making landing unnecessary. (Live Science, May 15, 2020)

USAF LAUNCHES AI TO CONTROL DRONES

Skyborg, an artificial intelligence suite of systems used to control drones, is becoming a reality. The U.S. Air Force has submitted a request for proposal for contractors to develop software that initially uses AI to control loyal wingmen drones that accompany manned aircraft (see *Defense Technology Monitor* no. 25) or eventually pilot fully-autonomous unmanned combat air vehicles (UCAVs). Initially, the software may be limited to missions similar to those undertaken by a human pilot, but eventually the AI will be capable of processing information faster and outperforming human metrics under complex battle conditions. The Air Force is planning to have a working prototype drone testing the system in 2021, with a more complete configuration of the suite flying by 2023. (The Drive, May 19, 2020)

NAVY DEMONSTRATES NEW LASER AT SEA

The U.S. Navy continues its march toward adopting directed energy weapons to bolster or supplant traditional missile-based platforms. The service recently mounted its most powerful laser to date aboard the USS Portland. The MK2 MOD 0 Technology Maturation Laser Weapon System Demonstrator (LWSD) can blast drones, rockets, and artillery out of the sky with its 150-kilowatt laser — a fivefold improvement over the 30-kilowatt Laser Weapon System (LaWS), which has been operational since 2014. But, while promising, it has limitations in common with all laser systems, such as degraded beam quality in harsh weather conditions. Accordingly, the demonstrated system will need to be substantially hardened in order to survive the unforgiving conditions at sea.

LWSD will not be able to destroy inbound anti-ship missiles, and its range is currently unknown. However, the initiative does compare favorably to the Navy's current system missile-based SeaRAM close-in weapon, which is limited to less than a dozen missiles that each cost thousands of dollars. (*Popular Mechanics*, May 27, 2020)