Defense Technology Monitor No. 59

December 17, 2020 **Richard M. Harrison**, **Sydney Duckor**

Related Categories: Military Innovation; Science and Technology; China

A STEP FORWARD FOR SENSOR TECHNOLOGY

A U.S. Army-funded research team has designed a sensor 100,000 times more sensitive than similar commercially available products, and with extensive military applications. According to Dr. Joe Qiu, program manager for solid-state electronics and electromagnetics in the Army Research Office, "the microwave bolometer developed under this project is so sensitive that it is capable of detecting a single microwave photon, which is the smallest amount of energy in nature." The impact of the breakthrough cannot be overstated; as Qiu puts it, "this technology will potentially enable new capabilities for applications such as quantum sensing and radar, and ensure the U.S. Army maintains spectral dominance in the foreseeable future." (*Sci Tech Daily*, October 5, 2020)

CHINA'S MOBILE-LAUNCHED SUICIDE DRONE SWARMS

China has emerged as a leader in drone technology and drone swarms in recent years. Back in June of 2017, Chinese researchers carried out a record-breaking demonstration of 120 small fixed-wing drones operating in tandem. Now, Beijing's China Academy of Electronics and Information Technology (CAEIT) has come up with a new advance in the field: a multiplatform 48 drone launcher system that can be deployed at a fixed ground position, or on a light tactical vehicle, ship, or even (with modifications) a helicopter. CAEIT recently conducted a test with loitering munitions, demonstrating them flying in swarms.

The potential battlefield applications of the new system are significant. If 48 drones can be launched in quick succession, it could significantly complicate U.S. and allied air defenses in future conflicts — taxing directed energy defenses, electronic warfare, and small interceptors. The Chinese drones could also be outfitted with various payloads, ranging from reconnaissance to electronic warfare to explosives. (*The Drive*, October 14, 2020)

MODELING NUCLEAR FUSION

Developing a controllable nuclear fusion reaction has proven to be a challenging feat, but one that remains highly desirable. Fusion's main advantages over nuclear fission, which is a relatively easier reaction to control, are increased fuel, limited radioactivity, and a reduced amount of nuclear waste. Researchers at the Max-Planck-Institut fur Mlasmaphysis (IPP) have recently taken a step toward making fusion reactions a reality by developing a simulation that allows scientists to study "edge localized motes." These hot plasma edge instabilities have not previously been studied in great detail due to their highly unpredictable nature, and this development could go a long way to reducing the complexity inherent in fusion nuclear reactor operation. (*Popular Mechanics*, October 26, 2020)

PENTAGON BORROWS FROM BEETLES

The Defense Department has not shied away from using nature to inspire its engineers. Over the past few years, we have seen body armor mimic both fish scales and pearls (see *Defense Technology Monitor* no. 47 and *Defense Technology Monitor* no. 46, respectively) and the decision-making of dragonflies influence missile defense algorithms (see *Defense Technology Monitor* no. 44). So it is no surprise that the U.S. Air Force is now attempting to apply the characteristics of a beetle's exoskeleton in order to strengthen aircraft components. According to researchers at the University of California, Irvine and Purdue University, the Diabolic Ironclad beetle can withstand a force of 39,000 times its weight prior to seeing any fracture – a resilience that planners hope to be able to replicate for defense applications. According to university researchers, the finding is promising because in the aerospace industry, "an active engineering challenge is joining together different materials without limiting their ability to support loads. The diabolical ironclad beetle has strategies to circumvent these limitations." (*The New Daily*, October 31, 2020)