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Related Categories: Democracy and Governance; Military Innovation; Science and Technology

A NEW DETONATION ANALYSIS TOOL
Battlefield bomb explosions generate a wealth of pertinent data for military forces - from the bomb's trajectory to the damage inflicted upon surrounding infrastructure and warfighters. Identifying, cataloguing, and assessing explosions, however, is a time intensive and challenging task, both on the battlefield and in weapon testing environments. This process may now become a bit simpler, though, thanks to the development by the U.S. Army Combat Capabilities Development Command (DEVCOM) of a new functional tool. Known as the Fragmentation Rapid Analysis Generator using Computed Tomography (FRAG-CT), and designed to employ cameras and sensors to collect data, the system can more efficiently gather and analyze bomb explosion data, and create useful files that can guide military research. The collection and analysis process using the FRAG-CT software is reportedly 200 times faster than the traditional and more labor-intensive hand-count method. Importantly, FRAG-CT collection and analysis will also allow the Army to develop advanced body armor to protect American soldiers on the battlefield from new types of explosives, and allow the service branch to develop enhanced munitions. (*Popular Science*, March 3, 2021)

TINY DRONES WITH A BIG UPSIDE
While modern drones have many practical applications, they are typically too large to be used in tight spaces and are unable to withstand in-flight collisions. Researchers at MIT have now developed a new class of insect-sized drones to overcome these deficiencies. Whereas past mini-drones were often powered by fragile piezoelectric actuators, the new insect-sized drones are powered by more resilient soft actuators that are composed of carbon nanotube-coated rubber cylinders. The carbon nanotubes generate an electrostatic force that contracts and lengthens the rubber cylinders when voltage is applied. This process, which mimics a muscle, leads the drone's wings to move rapidly. The actuators of these drones are capable of flapping around 500 times per second, providing the drones with an insect-like ability to recover from in-flight collisions. In addition to expanding scientific knowledge of insect flight patterns, these drones could potentially be used to inspect machinery, artificially pollinate crops, assist in search and rescue operations, and carry out a range of military and intelligence gathering applications. (*Science Daily*, March 3, 2021)

AIR FORCE SEEKS AI EW CAPABILITY
The U.S. Air Force is now exploring the development of cognitive electronic warfare (EW) capabilities that can be integrated into the F-15 fighter aircraft and fielded within two years. Cognitive electronic warfare involves leveraging AI and machine learning to expedite and automate a range of EW capabilities, particularly the development of countermeasures. A particularly important characteristic is the ability to recognize novel electromagnetic signals (for example, a new type of enemy radar). Following the detection of such signals, the cognitive electronic warfare systems would conduct an initial analysis and then transmit that information to ground-based personnel, who could conduct an additional analysis and start developing countermeasures. Ideally, such a system would eventually be able to automatically do so in real-time. Once the Air Force fields F-15 cognitive electronic warfare defense systems, it could potentially apply such systems to other aircraft and non-aircraft platforms, as well as employing them for offensive EW activities. (*The Drive*, March 16, 2021)

DRONE SWARM STOPPER
As showcased in recent conflicts around the globe, drones are already a staple on the modern battlefield - and a potential threat to deployed U.S. forces. The next evolution of the technology, experts believe, will involve the use of drone swarms for attack by both near-peer adversaries and non-state actors. Countering swarms is consequently a major priority for the Pentagon, and the MORFIUS drone developed by defense contractor Lockheed Martin may be a step toward creating a layered defense. The MORFIUS is a reusable drone, weighing less than 30 pounds, that can fit inside a six-inch diameter launch tube. It is capable of being attached to aircraft, as well as to ground vehicles and stations. These drones are intended to fly close to an enemy drone or drone swarm, then zap and disable them with a High-Powered Microwave (HPM) weapon, which can deliver a gigawatt of microwave power. (*Breaking Defense*, March 19, 2021)

A MAJOR BREAKTHROUGH IN QUANTUM COMPUTING
Quantum computing has the potential to revolutionize society. The technology promises to drastically improve cyber security (see *Defense Technology Monitor* no. 56), enable advanced AI systems (see *Defense Technology Monitor* no. 63), allow for the development of new therapeutic drugs, and process data at exceptional speeds, among many other applications. Currently, however, quantum computers are not practical on a commercial scale because handing qubits requires operations to be carried out at temperatures near absolute zero. To overcome this dilemma, scientists at the Australian National University (ANU) are developing a quantum computer that can operate at room temperature and is around the size of a lunchbox — a potentially game changing advance. The quantum microprocessors developed by ANU and its spin-off company, Quantum Brilliance, are made from synthetic diamonds. The resulting quantum computer will be installed and activated later this year at Australia's Pawsey Supercomputing Centre. ANU, Quantum Brilliance, and Pawsey hope to use the technology to develop quantum applications in a range of different areas, including defense, aerospace, machine learning, and logistics. (Australian National University, March 24, 2021)

[EDITORS' NOTE: To learn more about quantum technology, see Richard M. Harrison's article on "The Promise and Peril of Quantum Technology" in the December 2020 edition of the AFPC *Defense Dossier*.]
