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Related Categories: Cybersecurity and Cyberwarfare; Military Innovation; Missile Defense; Science and Technology

THE PENTAGON'S NEW PROJECT: LONGER-LASTING DRONES

With the military increasingly relying on the support of drones for added communication, intelligence, surveillance, and reconnaissance (ISR), the Pentagon is working to reduce the size and cost of drones while increasing their fuel efficiency and flight duration. Recently, Vanilla Aircraft, a small company funded by the Defense Advanced Research Projects Agency (DARPA), demonstrated some promising innovative technology by setting a record for drone flight time by keeping a small combustion-powered drone capable of carrying a 30 lb. payload in the air for two days at an altitude of 6,000 feet, and landing the craft with more than half of its fuel tank remaining. When the project is complete, such drones will be capable of flying at altitudes of around 15,000 feet for up to 10 days, with no need for refueling. According to DARPA program manager Jean-Charles Lede, "this capability would help extend the footprint of small units by providing scalable, persistent UAV-based communications and ISR coverage without forward basing, thereby reducing personnel and operating costs." (Engineering.com, January 6, 2017)

3D PRINTING WITH SUPER MATERIALS

Researchers at the Massachusetts Institute of Technology have achieved a breakthrough in composite material technology. Using graphene combined with a 3D printer, scientists have created a material that's lighter and stronger than steel. The new 3D printed substance has a "sponge-like" composition, with only 5 percent the density of regular steel and almost 10 times the strength. Previously, researchers had struggled to translate traditionally 2D graphene material into a usable 3D object. However, using a multi-material, high-resolution printer, the researchers were able to compress small graphene flakes into a cohesive whole. According to Markus Buehler, head of MIT's Department of Civil and Environmental Engineering, this material could be revolutionary in the design of new airplanes, cars, buildings, and potentially even advanced military technology. (Computer World, January 9, 2017)

THE EVOLUTION OF DRONE WARFARE

As part of the Pentagon's "Third Offset," its current strategy to improve and leverage the military's warfighting capabilities and cutting-edge technologies, DoD's Strategic Capabilities Office is fielding a new drone-centered projectwhich could usher in a new era of drone warfighting capability. The Perdix autonomous drone, a tiny and inexpensive drone that runs on a miniature lithium battery, operates independent of human control and communicates with other identical Perdix drones. The drones are deployed in swarms of 20 or more, and will be able to conduct extensive reconnaissance missions, radar/frequency jamming, and creating a large communications network for use in combat. They also have the potential to be weaponized and used in air-to-air or air-to-ground combat, to spoof enemy radars, or aid in missile evasion.

The U.S. military has already conducted successful demonstrations with the Perdix, ejecting the drones from a F-16 and F/A-18 Super Hornet during mid-flight (at speeds of up to Mach 0.6). Reportedly, the drone's collective decision-making, adaptive independent formation flying, and self-healing abilities could fundamentally change the landscape of drone warfare. (*Popular Mechanics*, January 9, 2017)

THE ETHICS OF FUTURE WAR

Advances in robotics and human enhancement technology have led researchers and ethicists to question the ethics and morality of their use in combat. Researchers' fears are largely based on two issues. First, there are major challenges associated with robotic systems making target selection during combat. Second, while the laws of war provide restrictions on human conduct of war, researchers increasingly fear that the use of robotic systems will change the traditional permissible parameters of warfare. As well, ongoing DARPA projects that focus on biologically modifying human soldiers have many researchers questioning the ethics of enhancing humans for combat roles. These developments have spurred calls for international regulation and the establishment of new norms regarding robotic systems and human enhancement alike. (*Harvard International Review*, January 16, 2017)

FROM PARLOR GAMES TO CYBERSPACE
When Google's DeepMind artificial intelligence software handily defeated the Go world champion Lee Sedol in a five game tournament, humans were put on notice that the field of machine learning had demonstrated major advancement. Now, a new AI system called Libratus is pushing the bounds of artificial intelligence by showing that it can beat some of the world's best poker players. Unlike previous machine victories over men in Chess, Jeopardy, and Go, the ability to consistently win in "Texas Hold'em" poker is extremely impressive because of the significant lack of information in the game. In poker, the computer does not know the opponent's cards or whether the person is bluffing, and the AI has to determine when it is appropriate to bluff without showing a discernable pattern.

The program's developers, Carnegie Mellon Professor Tuomas Sandholm and Noam Brown, programmed Libratus to be able to think as it operates and to adapt to the changes in its environment by anticipating an opponent's moves far in advance, despite having a dearth of information. The results are instructive - and significant for warfighting. If weaponized for military use, Libratus could fundamentally change the nature of offensive cyber-warfare by being able to anticipate adversary's moves and successfully maneuver against them in near real time. (Inc.com, January 27, 2017)