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Related Categories: Cybersecurity and Cyberwarfare; Military Innovation; Science and Technology; Warfare; Ukraine

CONSIDERING A SPACE CATAPULT
Developing cheaper and more secure methods of launching payloads into orbit will be crucial for accelerating the development of space. SpinLaunch, an American start-up, is currently testing a catapult-like system known as the Suborbital Accelerator which aims to make such launches more efficient. The innovative system works by spinning payloads in a vertical circle attached to a mechanical arm at a rate of 5,000 mph and launching them skyward through a tube, then inserting them into a specific orbit via a small rocket. The company recently completed a successful launch of a payload for NASA, which is seeking to diversify its launch options. The current SpinLaunch prototype is a 33-meter-diameter accelerator that is not capable of launching objects into orbit. However, the company hopes that a full-sized, 100-meter-diameter accelerator will achieve this feat significantly more efficiently than rocket launches, reducing the need for fuel and other resources by 70 percent. (*Interesting Engineering*, October 4, 2022)

UKRAINE'S DRONE DESTRUCTION APP
Ukrainian air defenses have already scored major successes in repelling Russian drones and aerial threats, but crowdsourcing the targeting of Russian drones is a new tactic worth exploring. According to the Ukrainian Ministry of Reintegration of the Temporarily Occupied Territories, “Enemy attack unmanned aerial vehicles (UAVs) are causing significant damage to our critical infrastructure. They also pose a significant danger to civilians: suicide drones can carry several tens of kilograms of explosives and create a powerful shock wave when hit." In order to combat Russian attacks, Ukraine has launched an app that empowers citizens to gather intelligence for the military concerning Russian aerial threats. Through the "ePPO" app, authorized citizens can log the location of an aerial threat, which is then communicated to the military to be targeted and shot down. (*Jerusalem Post*, October 17, 2022)

WIRELESS ENERGY TRANSFER INTENSIFYING
Power beaming, or wirelessly transferring energy, is an emerging technology with a potentially outsized impact on the future of drones. An effective power beaming network could theoretically power drones for indefinite periods of time, allowing them to travel constantly and never need to return to the ground for refueling. Moreover, power beaming would eliminate the need for drones to carry burdensome batteries or fuel, opening up space in the craft for weaponry and other more operationally relevant devices. DARPA’s Persistent Optical Wireless Energy Relay program (POWER) is currently trying to demonstrate effective aerial energy transfer capabilities. Though the concept sounds futuristic, the technology is similar to wireless communications. According to DARPA POWER program manager Col. Paul Calhoun, "you need a power source; you convert that power to a propagating wave, typically electromagnetic, send it through free space, collect it in through an aperture, and then convert it back to electricity." The long-term goal of successfully demonstrating this technology is to start building a network of power beaming in which drones can travel indefinitely. (DARPA, October 5, 2022; *Next Big Future*, October 18, 2022)

3D-PRINTED SOLID-STATE BATTERIES...
The U.S. military is incredibly dependent on lithium-ion batteries. These batteries, which are ubiquitous in today's technology, have a limited capacity to store power, a propensity to catch fire when damaged, and depend on raw lithium mined outside of the United States. Solid-state batteries are a promising area of innovation that could provide more efficient, stable, and domestically produced batteries to the military. One solid-state battery startup, Sakuú, is developing a method of 3D printing solid state batteries. 3D printing batteries would yield a multitude of advantages over traditional manufacturing, including the ability to print custom-shaped batteries and boost battery efficiency by packing more battery layers into a given volume. Nevertheless, Sakuú has yet to construct a full-size battery with its 3D printing technique. (*The Verge*, October 28, 2022)

...AND 3D-PRINTED METAL PARTS ON THE RISE
Current 3D printing technology mainly constructs objects using plastics and composites, and tends to produce porous structures. However, in many military applications, such materials are not strong enough to be used for the production of spare parts. Instead, metal is required as the primary manufacturing material. Recently, multiple startups have emerged aiming to meet this demand, each employing distinct methods. One manufacturer, Spee3D, prints metal objects by spraying metal powder at high pressure, prioritizing construction speed. Another company, Meld Manufacturing, prioritizes the strength of its metal printed objects; the company's printing technique involves heating up metal bars to high temperatures so that they can be formed into one shape and chemically bond with each other. These new metal 3D printing methods offer the military a way to reduce costs and transit times to get new parts, while offering similar reliability. (*Chemical & Engineering News*, October 18, 2022)
