The 'Drone Wars' in Ukraine—And What it Means for America

Written Testimony of Dr. Paul Schwennesen

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Chairmen Pfluger and Gimenez, Ranking Members Magaziner and Thanedar, and distinguished Members of the Subcommittees, thank you for the opportunity to testify today about safeguarding the homeland from unmanned aerial systems.

Almost exactly a year ago, a sniper team I helped convene engaged a Russian machine gun position near Bakhmut. While a handful of drones in the sector (both Russian and Ukrainian) encouraged a certain discretion on our part, they operated in a surveillance role only—while artillery and infantry assault forces fulfilled their traditional roles. One year later, such an operation would be effectively impossible—the hyper-advancements in weaponized drone technology would make such a comparatively exposed position untenable. The implications of this shift in tactical realities on US and allied national security is only just beginning to dawn on the transatlantic defense establishment.

I confess it freely—I was a latecomer to recognize the enormous implications of drones (or "Uncrewed Autonomous Systems" if you must). I'd seen them deployed in Ukraine over nearly three years and felt (and wrote!) that while significant, drones represented merely an iteration in a manageable arms race. Like Stacie Pettyjohn and others, I felt that the hype risked overstating the case. Having once again observed firsthand the astonishing evolution in operations in Ukrainian-occupied Kursk, however, I think the message has finally sunk home: unmanned systems are not just an iteration, they are indeed a revolution in the application of lethal force.

The United States defense establishment does not appear equipped, technically or psychologically, to respond to this looming threat. I must emphasize—in the starkest terms—that the comparative advantage in modern weaponry has fundamentally and perhaps permanently shifted toward small, cheap, attritable, evolutionary systems. Expensive legacy weapons-systems, traditional procurement conventions, and standard training regimens are increasingly obsolete. The world's most advanced weapons and tactics are being developed and deployed (at scale) in the Ukraine-Russian front at remarkably low cost and without central direction—and these facts hold radical implications for the next major shooting war between great powers.

The United States is rapidly and unwittingly losing its strategic military advantage in this new technical environment. There can be little doubt that China, North Korea, Iran, and other emergent powers are eagerly sending observers and technicians to the frontlines in occupied Ukraine to carefully note the revolution in weapons delivery and to adopt it into doctrines which

seek to invert the military strengths of their larger, better equipped, better trained western geopolitical adversaries.

Technical advances, particularly in first-person view (FPV) drone deployment, mean that between 100 grams and 50 kilograms of high explosive can be delivered to within 50cm^2 from 10km away, practically anywhere on earth, indefinitely and from every direction on the compass; flying through trees and terrain at high speed and inches off the ground. Rapid advances in navigation technology mean that the primary counter to drone deployment (frequency jamming) is increasingly irrelevant. Artificial-Intelligence navigation modules that are capable of terrain navigating to their target are readily available. Small drones made of radar-transparent composites (even cardboard!) are likewise increasingly available, making drone interdiction an increasingly difficult prospect.

It is not just the technical advances that got my attention—the tactics of employment are equally striking. Ukrainians are, for instance, landing ambush drones on roads deep in enemy territory which can be activated to attack armored traffic when it appears. They use "carrier drones"—heavy-lift units that will carry four or more FPV drones into the battlespace to be deployed against multiple targets. They are using heavy drone decoys to draw anti-drone fire, then hit the source with smaller attack units. They have advanced laser-guided munitions being deployed at altitude. They are perfecting techniques to protect operators from counter-fire. They are dropping explosives, unseen and unheard from 5,000 feet directly into fighting holes by detecting body heat. There is no more "blending in with the terrain" – it is irrelevant. The cost of losing a drone is negligible and with zero loss of life

In short, the rules of the arms race have been fundamentally rewritten to favor small, cheap, easily mastered weapons systems. More important still, these disproportionate advantages are not a one-time effect—they *amplify* in a positive feedback loop through each iteration cycle. New tech *gets better exponentially faster and is deployed far more quickly than legacy countermeasures.*

In Ukraine, the source of this immense innovation reservoir is the highly adaptable, highly diffuse engineering base of Ukrainian technicians. Uncountable tech workers routinely work full days in their civilian capacity, then leave their jobs to work at pop-up tech facilities until late at night. They have created an ecosystem of invention, a web only loosely coordinated through the Ministry of Defense's newly minted Unmanned Systems Service (an independent branch of the Ukrainian military). The advances in hardware and software they produce are channeled into a robust system of decentralized training facilities which operate on state-managed "polygon" ranges and private testing facilities. In less than three weeks, an FPV drone operator can be mission-ready: Operators with no previous battlefield experience have been credited with as many as fifteen *hundred* confirmed kills. Again, the disproportionality is vast.

And this is perhaps the main takeaway in a total-war, peer-to-peer scenario: such wars are heavily defined by economic considerations—the side that produces more materiel while absorbing

material losses ultimately prevails. Training, *espririt de corps,* fighting spirit—all are dependent on the products of a functional economy. Look no further than the Confederate States Army or the German *Wehrmacht*—their legendary fighting spirits ultimately collapsed under the sheer mass of the other side's more efficient war machine. If technology allows one side of a conflict to impose extraordinary damage on the exquisite, expensive, difficult-to-master weapons systems of their adversary, and can do so at a fraction of the cost expended by their enemy—well, it doesn't require an economist to see where that leads.

It is easy to be a critic, but I am convinced that the United States and its NATO allies have a very narrow window of opportunity to address this major and growing shift in comparative advantage. Current operations in Ukraine have shown what a scrappy, innovative force can do to a large, hidebound military machine—it would be well to take note.

Scenarios:

Least Likely: The U.S. Department of Defense will quickly integrate UAS technology and training from Ukraine into its mainstream, operational-level, frontline units. It would take an unprecedented level of commitment from all levels of the command structure and an extraordinary degree of political cooperation to shift the status quo.

Most Likely: The U.S. will fall farther and farther behind the leading edge of UAS deployment and will only begin to respond in the aftermath of a crisis. My discussions with Capitol Hill legislators, frontline military leaders, defense analysts, and doctrine scholars lead invariably to the same independent conclusion: the American defense procurement system is too vast, and the regulatory frameworks too inscrutable, to meaningfully adopt UAS capabilities into existing defense doctrine or practice. An event akin to Pearl Harbor or 9/11, with the physical destruction of tens of billions of dollars of hardware and a substantial loss of life will be required to jumpstart the innovation cycle and break down the thickets of red tape which make initiative next to impossible.

Best Case: Conceivably, this kind of depressing scenario can be avoided through a well-managed artificial crisis. Historical examples, such as the famous sinking of the *Ostfriesland*, show that it is sometimes possible to break entrenched paradigms by publicly demonstrating the current system's vulnerabilities. When understood by the right audiences, these demonstrations can shift doctrine development and tactical training in new and constructive ways—preferably *before* the lessons are learned the hard way.