

Predators and Robots at War

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Wired for War: The Robotics Revolution and Conflict in the Twenty-first Century

by P.W. Singer

Penguin, 499 pp., \$17.00 (paper)

Predator: The Remote-Control Air War over Iraq and Afghanistan: A Pilot's Story

by Lieutenant Colonel Matt J. Martin with Charles W. Sasser

Zenith, 310 pp., \$28.00



Max Becherer/Polaris

The US Air Force's 62nd Expeditionary Reconnaissance Squadron launching an unmanned Predator drone with laser-guided Hellfire missiles mounted on its wings, Kandahar Air Field, Afghanistan, November 2009

Drones are in the headlines. We read daily about strikes against terrorist targets in the tribal areas of Pakistan using unmanned aerial vehicles (UAVs)—remote-controlled aircraft equipped with elaborate sensors and sometimes weapons as well. Earlier this summer the US sent Predator drones into action against militants in Somalia, and plans are reportedly afoot to put the CIA in charge of a drone offensive against al-Qaeda operatives in Yemen. NATO has dispatched UAVs to Libya. State-of-the-art stealth drones cased the house where Osama bin Laden was living before US Navy seals staged their now famous raid. And in a speech a few weeks ago, White House counterterrorism chief John Brennan made it clear that drones will continue to figure prominently in the Obama administration's counterterrorism

strategy. On August 22, a CIA drone killed the number-two al-Qaeda leader in the mountains of Pakistan.

Most of us have probably heard by now how extraordinary this technology is. Many of the UAV strikes in South Asia are actually orchestrated by operators sitting at consoles in the United States. US Air Force Colonel Matt Martin gives a unique first-person account of the strange split consciousness of this new type of warfare in his book *Predator*. Even as his body occupies a seat in a control room in Nellis Air Force Base in Nevada, his mind is far removed, following a suspicious SUV down a desert road in Iraq or tailing Taliban fighters along a mountain ridge in Afghanistan. “I was already starting to refer to the Predator and myself as ‘I,’ even though the airplane was thousands of miles away,” Martin notes ruefully.

Notifying Marines on the ground that he’s arriving on the scene in Afghanistan, he has to remind himself that he’s not actually arriving anywhere—he’s still in his seat on the base. “Although it was only shortly after noon in Nevada,” he writes, “I got the yawns just looking at all that snow and darkness” on the ground outside Kabul. He can hardly be blamed for the confusion. The eerie acuity of vision afforded by the Predator’s multiple high-powered video cameras enables him to watch as the objects of his interest light up cigarettes, go to the bathroom, or engage in amorous adventures with animals on the other side of the world, never suspecting that they are under observation as they do.

Even though home and wife are just a few minutes’ drive down the road from his battle station, the peculiar detachment of drone warfare does not necessarily insulate Martin from his actions. Predator attacks are extraordinarily precise, but the violence of war can never be fully tamed, and the most gripping scenes in the book document Martin’s emotions on the occasions when innocent civilians wander under his crosshairs in the seconds just before his Hellfire missile arrives on target. Allied bomber pilots in World War II killed millions of civilians but rarely had occasion to experience the results on the ground. Drone operators work with far greater accuracy, but the irony of the technology is that its operators can see their accidental victims—two little boys and their shattered bikes, in one especially heartrending case Martin describes—in excruciating detail. Small wonder that studies by the military have shown that UAV operators sometimes end up suffering the same degree of combat stress as other warfighters.¹

And yet the US military does little to discourage the notion that this peculiar brand of long-distance warfare has a great deal in common with the video-gaming culture in which many young UAV operators have grown up. As one military robotics researcher tells Peter Singer, the author of *Wired for War*, “We modeled the controller after the PlayStation because that’s what these eighteen-, nineteen-year-old Marines have been playing with pretty much all of their lives.” And by now, of course, we also have video games that incorporate drones: technology imitating life that imitates technology.

Drones are not remarkable because of their weaponry. There is nothing especially unusual about the missiles they carry, and even the largest models are relatively lightly armed. They are not fast or nimble. What makes them powerful is their ability to see and think. Most of the bigger drones now operated by the US military can take off, land, and fly by themselves. The operators can program a destination or a desired patrol area and then concentrate on the details of the mission while the aircraft takes care of everything else. Packed with sensors and sophisticated video technology, UAVs can see through clouds or in the dark. They can loiter for hours or even days over a target—just the sort of thing that bores human pilots to tears. Of course, the most significant fact about drones is precisely that they do not have pilots. In the unlikely event that a UAV is shot down, its operator can get up from his or her console and walk away.

So far, so good. But there are also quite a few things about drones that you might not have heard yet. Most Americans are probably unaware, for example, that the US Air Force now trains more UAV operators each year than traditional pilots. (Indeed, the Air Force insists on referring to drones as “remotely piloted aircraft” in order to dispel any suspicions that it is moving out of the business of putting humans into the air.) As I write this, the US aerospace industry has for all practical purposes ceased research and development work on manned aircraft. All the projects now on the drawing board revolve around pilotless vehicles. Meanwhile, law enforcement agencies around the country eagerly await the moment when they can start operating their own UAVs. The Federal Aviation Administration is considering rules that will allow police departments to start using them within the next few years (perhaps as early as 2014). Soon, much sooner than you realize, your speeding tickets will be issued electronically to your cell phone from a drone hovering somewhere over the

interstate. The US Customs Service has already used UAVs to sneak up on drug-smuggling boats that easily evade noisier conventional aircraft.

Robots that fly get most of the attention. In fact, though, UAVs represent only one small part of the action in military robotics. As Singer recently told me, there are already more robots operating on the ground (15,000) than in the air (7,000). The US Army uses its mechanical warriors to find and disarm roadside bombs, survey the battlefield, or shoot down incoming artillery shells. Though these land-based robots may seem a bit more primitive than their airborne cousins, they are catching up quickly. The models in development include the bizarre BigDog, an eerily zoomorphic quadruped designed to help soldiers carry heavy loads over difficult terrain, and BEAR, a vaguely humanoid machine on caterpillar tracks that can lift loads of up to 500 pounds.

The US Navy is experimenting with machines of its own. It recently unveiled a robot jet ski designed to sniff out attackers who might try to sneak up on US ships underwater. The Navy has developed harmless-looking (and environmentally friendly) sailboats packed with high-tech surveillance gear that can pilot themselves around the world, if need be. Robot submersibles, too, are in the works. Unconstrained by the life-support requirements of manned submarines, these automated spies could spend months on underwater patrol, parking themselves at the bottom of enemy harbors and observing everything that goes in or out. So battery life becomes the main constraint. Some scientists are trying to solve it by enabling the underwater drone to feed off organic matter lying on the sea floor (known as a “mud battery”).

So far none of these water-borne robots seem to be carrying torpedoes. The army, however, is already experimenting with robots that can shoot. In his book, Singer describes SWORDS, a tracked vehicle equipped with a suite of cameras that see farther than the human eye even while covering multiple angles. The machine can be armed with a 50-caliber machine gun or a variety of other weapons. The SWORDS zoom camera and its weapon can be perfectly synchronized, and the machine makes for a much more stable platform than a soft, breathing, frightened human body lying prone in the midst of a battlefield. Singer writes:

In an early test of its guns, the robot hit the bull’s-eye of a target seventy out of seventy tries. In a test of its rockets, it hit the target sixty-two out of sixty-two times. In a test of its antitank rockets, it hit the target sixteen out of sixteen times. A former navy sniper summed up its “pinpoint precision” as “nasty.” ... Since it is a precisely timed machine pulling the trigger, the “one shot” mode means that any weapon, even a machine gun, can be turned into a sniper rifle.

Singer described this system two years ago. In the feverish world of military robotics, 2009 already feels like a distant era, so we can only surmise how far SWORDS has progressed since then. Researchers are now testing UAVs that mimic hummingbirds or seagulls; one model under development can fit on a pencil eraser. There is much speculation about linking small drones or robots together into “swarms”—clouds or crowds of machines that would share their intelligence, like a hive mind, and have the capability to converge instantly on identified targets. This might seem like science fiction, but it is probably not that far away. At ETH in Zurich, Switzerland’s equivalent of MIT, engineers have linked miniature quadcopters (drones equipped with four sets of rotors for maximum maneuverability) into small networks that can deftly toss balls back and forth to each other without any human commands.

The technology transfixes. The capabilities are seductive; so, too, is the lure of seeming invulnerability. The Taliban has no air force. Its foot soldiers do not have night vision or the ability to see through overcast skies, but they can sometimes hear the drones circling in the sky above. David Rohde, the *New York Times* correspondent who was held captive by the Taliban for seven months in 2009, described in his account of the experience what it is like to be on the ground while Predators and Reapers are on the prowl. “Two deafening explosions shook the walls of the compound where the Taliban held us hostage,” he writes. “My guards and I dived to the floor as chunks of dirt hurtled through the window.” A missile fired by a US drone has obliterated two cars a few hundred yards away:

It was March 25, and for months the drones had been a terrifying presence. Remotely piloted, propeller-driven airplanes, they could easily be heard as they circled overhead for hours. To the naked eye, they were small dots in

the sky. But their missiles had a range of several miles. We knew we could be immolated without warning....

Later, I learned that one guard called for me to be taken to the site of the attack and ritually beheaded as a video camera captured the moment. The chief guard overruled him.²

This particular strike, it turns out, has killed seven militants, zero civilians. Most of the attacks are remarkably precise, as Rohde writes. Yet this is almost beside the point: “The Taliban were able to garner recruits in their aftermath,” he writes, “by exaggerating the number of civilian casualties.”

His point is borne out by a recent study conducted by Peter Bergen and Katherine Tiedemann, two analysts at the New America Foundation in Washington who have been tracking drone strikes in the tribal areas of Pakistan ever since the US began conducting attacks there in June 2004. Though reliable information from that part of the world is extremely hard to come by—the story of Rohde’s kidnapping explains why foreign journalists tend to steer clear of the area—Bergen and Tiedemann have carefully analyzed media reports for the details of each attack. While acknowledging the difficulties of obtaining reliable data (and the wildly divergent information issued by American and Pakistani official sources), they conclude that the attacks have grown steadily more accurate. According to Bergen and Tiedemann, “During the first two years of the Obama administration, around 85 percent of those reported killed by drone strikes were militants; under the Bush administration, it was closer to 60 percent.”³ At the same time the authors note that the strikes have probably been far less successful than US officials claim at killing militant leaders. Most of the dead, Bergen and Tiedemann conclude, are likely rank-and-file fighters. (A newer study by the Bureau of Investigative Journalism in London arrives at a somewhat higher overall civilian casualty rate.)

Though such statistics are remarkable when measured against the history of warfare, they are, of course, little consolation to the families of those innocent bystanders who have been killed along with the jihadis. And, as Bergen and Tiedemann rightly note, the precision of the killing is only one small part of the story. Polls show, just as Rohde suspected, that Pakistanis overwhelmingly believe that most of those who die in the attacks are civilians—a perception that is undoubtedly aggravated by the impunity with which the drones stage their raids on Pakistani territory. Dennis Blair, director of national intelligence from 2009 to 2010, recently made a similar observation in *The New York Times*: “Our reliance on high-tech strikes that pose no risk to our soldiers is bitterly resented in a country that cannot duplicate such feats of warfare without cost to its own troops.” (While the Pakistani government publicly expresses its disapproval of the strikes, in private Pakistani leaders have provided intelligence and logistical support for the campaign—a fact that they are eager to conceal from the public.) The number of terrorist attacks in Pakistan has risen sharply as the drone campaign has accelerated. Bergen and Tiedemann conclude that the broader political effects of the UAV campaign may well cancel out some of its tactical benefits.

One remedy they propose is to take control of the drone program away from the CIA, which currently runs the campaign in the tribal areas, and transfer it to the military.⁴ This offers several advantages. In contrast to the CIA, which denies the very existence of the program and accordingly reveals nothing about the criteria by which it chooses its targets, the US Department of Defense can at least be held publicly accountable for its conduct and is much more likely to respond to pressure to keep its use of UAVs within the bounds of international law. This cannot be said of the CIA’s use of drones for the purposes of “targeted killing”—particularly given that the strikes are being secretly conducted against targets in Pakistan, a country with which the United States is not at war, under ill-defined and murky circumstances.

The legal issues involved are complex. Philip Alston, an expert in international law appointed by the United Nations to examine the question, asserted in a report that, “Outside the context of armed conflict, the use of drones for targeted killing is almost never likely to be legal.”⁵ The trick, of course, is how we define “armed conflict” in an age of non-state-affiliated terrorist and insurgent groups operating from places where the writ of a central government does not extend. International law, some experts say, gives the US the right to protect its forces in Afghanistan against attacks staged by al-Qaeda and its allies in the tribal areas—while whether the drone strikes violate Pakistani sovereignty depends largely on agreements we have with the Pakistani government, a point that remains somewhat mysterious.

The Obama administration might help matters by providing an explanation of the legal rationale for the program. But so far it has declined to do so, aside from a brief statement by a leading State Department legal adviser that cited the

internationally recognized right to self-defense.⁶ In this respect it is only to be welcomed that scholars around the world are engaged in an active debate about the legal implications of the drone campaigns. Given that more than forty countries around the world are now experimenting with military robots of their own, the United States cannot rest on the assumption that it will retain a monopoly over this technology forever. The day when US forces are attacked by a drone—perhaps even one operated by a terrorist—is not far away.

Many of the recent books on UAVs predictably dwell on the technical specs and astonishing capabilities of these new weapons systems. Singer provides us with plenty of the same, but the great virtue of his book is precisely that he also devotes space to the broader questions raised by the breakneck expansion of military robotics. As he writes, the US government is using drones to conduct a military campaign against the sovereign state of Pakistan. Yet no one in Congress has ever pressed the President for any sort of legal declaration of hostilities—for the simple reason that the lives of American military personnel are not at stake when the Predators set off on their missions.

In fact, as Singer shows, the ethical and legal implications of the new technology already go far beyond the relatively circumscribed issue of targeted killing. Military robots are on their way to developing considerable autonomy. As noted earlier, UAVs can already take off, land, and fly themselves without human intervention. Targeting is still the exclusive preserve of the human operator—but how long will this remain the case? As sensors become more powerful and diverse, the amount of data gathered by the machines is increasing exponentially, and soon the volume and velocity of information will far exceed the controller's capacity to process it all in real time, meaning that more and more decision-making will be left to the robot.

A move is already underway toward systems that allow a single operator to handle multiple drones simultaneously, and this, too, will tend to push the technology toward greater autonomy. We are not far from the day when it will become manifest that our mechanical warriors are better at protecting the lives of our troops than any human soldier, and once that happens the pressure to let robots take the shot will be very hard to resist. Pentagon officials who have been interviewed on the subject predictably insist that the decision to kill will never be ceded to a machine. That is reassuring. Still, this is an easy thing to say at a point when robots are not yet in the position to take the initiative against the enemy on a battlefield. Soon, much sooner than most of us realize, they will be able to do just that.

We have only just begun to explore what this means. Singer quotes Marc Garlasco, a recognized expert on the law of war at Human Rights Watch. "This new technology creates pressure points for international law," Garlasco says. "You will be trying to apply international law written for the Second World War to *Star Trek* technology." Singer continues:

Another fundamental premise of the human rights group, and for broader international law, is that soldiers in the field and the leaders who direct them must be held accountable for any violations of the laws of war. Unmanned systems, though, muddy the waters surrounding war crimes. "War crimes need both a violation *and* intent," says Garlasco. "A machine has no capacity to want to kill civilians, it has no desires.... If they are incapable of intent, are they incapable of war crimes?" And if the machine is not responsible, who does the group seek to hold accountable, and where exactly do they draw the line? "Who do we go after, the manufacturer, the software engineer, the buyer, the user?"

Later Singer notes that the US has consistently applied an expanded right of self-defense for its aircraft operating in conflicts around the world. When an enemy radar "lights up" a US plane, the pilot has the right to fire first without waiting to be attacked. All fine and good. But then imagine that the aircraft involved is not a plane but a UAV:

If an unmanned plane flying near the border of another nation is fired on, does it have the right to fire back at that nation's missile sites and the humans behind them, even in peacetime? What about the expanded interpretation, the right to respond to hostile intent, where the drone is just targeted by radar? Is the mere threat enough for the drone to fire first at the humans below?

The answers depend on how wide the "self" in self-defense is defined.

It turns out, Singer explains, that the US Air Force currently operates according to the principle that a pilotless aircraft,

as an entity representing the people who sent it on its mission, “has the same rights as if a person were inside it,” and that this “interpretation of robot rights is official policy for unmanned reconnaissance flights over the Persian Gulf.” But the situation is evolving rapidly. The next generation of military robots is likely to have a high degree of operational independence without yet achieving the kind of intelligent self-awareness that entails responsibility. Luckily there is already something of a legal precedent for handling similar situations. “As odd as it sounds,” Singer writes, “pet law might then be a useful resource in figuring out how to assess the accountability of autonomous systems.”

This is a particularly thought-provoking conclusion given that the researchers now working on military robots seem especially eager to ransack the biological world for elegant solutions to the design problems that have to be overcome. There is a snake-shaped robot that can rear itself up in the grass when it wants to scan its surroundings. Tiny surveillance robots scuttle up walls like bugs, and robot flyers flap their wings. The Navy is testing submersibles that swim like fish. Researchers in the UK have developed a robot whose sensors mimic rat whiskers—since so far no engineer has managed to come up with a sensor system that is better at navigating in total darkness.

Whether we like it or not, war has often been a powerful goad to technological innovation. Now technology is on the verge of supplanting the human soldier altogether—with consequences that can only be guessed. The question in the case of military robotics, even at this relatively early stage, is the extent to which we will manage to retain control over the process. Whether we are ready or not, the answer will soon be clear.

—August 30, 2011

Letters

The Specter of Nuclear Drones October 27, 2011

1 See Scott Lindlaw, “Remote-Control Warriors Suffer War Stress,” Associated Press, August 7, 2008. ↵

2 “A Drone Strike and Dwindling Hope,” Part Four of “Held by the Taliban,” *The New York Times*, October 20, 2009. ↵

3 Peter Bergen and Katherine Tiedemann, “Washington’s Phantom War: The Effects of the US Drone Program in Pakistan,” *Foreign Affairs*, July/August 2011. ↵

4 The CIA operates its drones from control stations in or around its headquarters in Langley, Virginia. It is likely that many of the operators are actually civilian contractors. ↵

5 Philip Alston, “Report of the Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions,” United Nations, Human Rights Council, May 28, 2010. See also David Kretzmer, “Targeted Killing of Suspected Terrorists: Extra-Judicial Executions or Legitimate Means of Defence?” *The European Journal of International Law*, Vol. 16, No. 2 (2005). ↵

6 Harold Koh, the legal adviser to the State Department, devoted a few brief remarks to the subject in a speech last year, available at www.state.gov/s/l/releases/remarks/139119.htm. ↵