"You've Just Been Disarmed. Have a Nice Day!"

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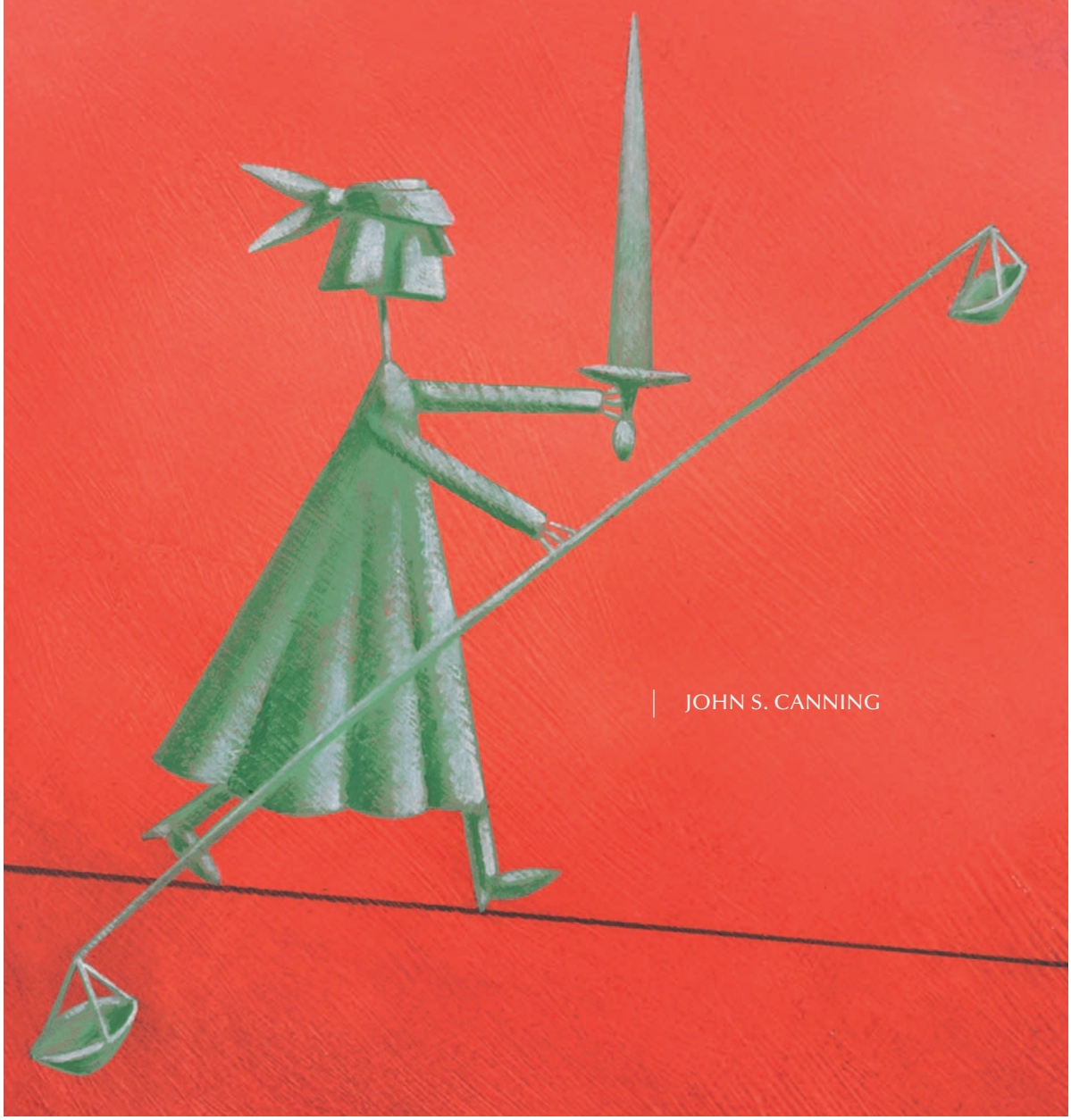

"Send lawyers, guns and money."

Warren Zevon, 1978

On September 23, 2003, the U.S. Naval Surface Warfare Center (NSWC) hosted a meeting in Dahlgren, VA, to explore the arming of unmanned systems. We were interested in what it was going to take to produce armed, fully-autonomous, unmanned systems that could decide for themselves when to pull the trigger. We invited personnel from the Navy's Office of the Judge Advocate General (JAG), International Law Division, and the Office of the Secretary of Defense's (OSD) Office of General Counsel to attend because we had concluded that the legal issues involved would likely be a major problem area. This was an historic meeting between lawyers and engineers!

We started the meeting by telling the lawyers, "We understand you have problems with arming unmanned systems. What are they?" The lawyers didn't miss a beat when they replied, "They could kill people." We thought about that response for a split second, and the thoughts that ran through our head in quick succession were 1) "War is hell," and 2) "People die." We immediately replied to the lawyers, "No, seriously. What are your concerns?" The lawyers then replied, "That's it—they could kill people!"

No pun intended, but the lawyers were deadly serious. During the remainder of the meeting, the lawyers proceeded to explain their stance to us, and more importantly, why they held it.

Law of War

Warfare is as old as mankind itself. From the earliest time, humans have targeted humans with the weapons of the day. As the destructive capability of weapons has increased, so has the potential for incidental injury to civilians and collateral damage to civilian property. The Napoleonic era brought the advent of the theory of "total war," where no parts of the enemy populations or infrastructure were exempt from targeting. At the turn of the last century, technology had outpaced tactics, and World War I brought the carnage of modern weaponry used in trench warfare. Following WW I, purportedly "the war to end all wars," was massive destruction wrought by WW II, and the use of the atomic bomb. The rebuilding and reconstruction of Europe and Japan following WW II drove home the consequences of disregarding the ramifications (physically and psychologically) of targeting a civilian population. The conclusion: Mass civilian casualties can make it difficult to end hostilities and transition to lasting peace.

Moving on in time, the Vietnam War, dubbed the "living room war" (the nightly news relayed televised coverage and casualty reports) changed the public perception of warfare and of its effect on both combatant and civilian. Casualties, whether civilian or soldier, now had a "face." We still see this today in Iraq and Afghanistan.

The result of the foregoing? Warfare is guided and controlled by a set of rules commonly referred to as the Law of Armed Conflict (LOAC), also known as the Law of War (LOW). Simply stated, the LOAC is a means by which humankind endeavors to reduce the damage caused by warmaking. Our ability to wage war is heavily constrained by legal and political concerns. Weapons and weapon systems are subjected to a mandated legal review, prior to large-scale production, to ensure compliance with the LOAC, and similarly, the employment of legal weapons and weapon systems on the battlefield are subjected to Rules of Engagement (ROE) designed to limit civilian casualties and damage.

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"Man-in-the-Loop" Capability

The lawyers told us that as long as we were designing systems that would target humans, then they were going to require a "man-in-the-loop" capability to perform target discrimination in order to meet LOAC concerns. This effectively welded an operator to each unmanned system, which cancelled one of the primary benefits we were looking for: reduced manpower. Given the above information relating to the Law of War, we did understand why they were insisting on human operator, however.

Targeting "Things" vs. People

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concern for systems that targeted "things," instead of "people." In fact, when we pulled that thread we found many systems that had been previously designed and fielded that automatically targeted (and engaged) either the "bow," or the "arrow," but not the human "archer." A few examples: The Aegis weapon system when placed in "Auto-Special" mode for anti-air warfare targets; the Captor mine system that would automatically fire a torpedo at a detected submarine but not surface ships; and the old anti-ship version of the Tomahawk cruise missile that would automatically identify and attack specific enemy warships at over-the-horizon ranges.

As counterpoint to these examples consider the case with landmines: There are two general types of landmines to consider—anti-personnel, and anti-tank. The use of anti-personnel landmines has been outlawed by the international community because they indiscriminately target humans. (They don't care if the human is a soldier, or a child.) However, the use of anti-tank landmines is still allowed because they target tanks. (Yes, the current ones will also go off when triggered by trucks and cars, but they don't directly target people.)

This paradigm of targeting and engaging the weapons of war represents a potential method for armed unmanned systems to determine legitimate targets on the modern battlefield. Additionally, if the human holding or manning a weapon is compliant in disarming instructions, his life may be spared. This method of determining what a legitimate target is may assist in determining if an armed unmanned system is in fact a discriminate weapon under LOAC. It specifically identifies and targets weapons or weapon systems—not the person(s) manning them.

Dream Machine

Our "dream machine" is one that would confront an enemy combatant on the battlefield, physically remove the rifle from his hands, saw the rifle in half with a diamond-tipped saw, hand the two halves back to him, and then tell him to "Have a nice day!" The issue in disarming the human enemy is then reduced to the question of if he is carrying the "bow," such as with a rifle, pistol, or grenade, or if he is riding on it, such as a tank, warship, or helicopter gunship.

In the former case, he possibly may be easily separated from his weapon before we destroy it. In the latter case, he has chosen to be onboard his war-making machine. He may also choose to get off, which may or may not be an easy thing to do, but we *are* going to kill his war hardware in any event. This scheme should help to keep collateral damage to a minimum.

Collateral Damage

Large weapons can cause large amounts of collateral damage. Conversely, smaller weapons tend to cause less collateral damage. In our approach, one must be willing to rethink what a "weapon" is altogether. We are not trying to kill anyone, and our armed unmanned systems have no lives to lose, so they have less at stake with taking the fight to the enemy than our human warriors would have.

Our biggest concern is with separating the human enemy from his own weapons so that we may render them unusable. As noted, our "weapon" could be a diamond-tipped saw, or it could be a laser welder, or something else altogether. It does not have to be a traditional gun or missile.

Our approach to armed unmanned systems described above is one of a number approaches that have been put forward in the wider international community. These range from a (possibly temporary) ban on weaponized unmanned systems [1], to armed unmanned systems that have been equipped with an embedded "ethics module" that will allow them to better understand and execute ROE than people are capable of doing, thereby allowing them to target and kill humans [2]. Let's take a comparative look at the ethics involved in these approaches.

Ethics of Each Approach

Starting with a ban on weaponized unmanned systems: This is effectively an extension of today's battlefield ethics, with neither improvement, nor degradation. Now, look at armed unmanned systems with an "ethics module": This could be an improvement over today's battlefield situation, if implemented properly, since the ROE could be applied more even-handedly, but people would still die if directly targeted. Now look at armed unmanned systems that attempt to disarm a foe: This clearly represents an improvement over today's battlefield ethics in that we are attempting to preserve human life—not take it.

But does it represent an improvement over an armed unmanned system equipped with an ethics module? We would pose this question to you: Would you prefer to be ethically targeted and killed, or merely disarmed? We think that most people would vote to live for another day.

Dial-a-Level of Autonomy

As the JAG lawyers pointed out to us in 2003, the final military objective is not to kill the enemy, but to quickly end the war, bringing it to a final and lasting peace. You don't do this by killing people. This is why our operational military commanders currently have lawyers on their staffs, looking over operational plans, and making LOAC/ROE judgment calls on specific targets.

Given this, we think that our approach of having our machines automatically target weapons, instead of people, is reasonable. However, we also recognize that in some circumstances it may be necessary to target people. For those situations, we have defined what we like to call a "dial-a-level" of autonomy. You don't want your machine getting into a logic "dither" where it can't decide what to do in rapid fashion, since delays on the battlefield can be costly, so we provide a method by which our machine can call for help from a human supervisor, if needed to make a judgment call, on what (or who) should be targeted, or other course of action. Once the human has made the necessary decision, control can be returned to the machine.

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Resolving Ethical Issues

Lastly, the debate over the legality, ethics, and morality of armed unmanned systems at this time is very appropriate. Vast sums of money are beginning to be spent on unmanned systems technology for the military. Right now, that money is mostly being spent for Intelligence-, Surveillance-, and Reconnaissance-related missions, but we like to remind people that the purpose of the military is not to surveil the enemy, but to be a threat to him, and that takes weapons. We think that weaponization of unmanned systems will be the "killer app" for military robotics in the same way that the advent of spreadsheet programs was the "killer app" for personal computers. We need to get these ethics issues resolved before we get too far down what may be a wrong, expensive, path.

And while Warren Zevon wasn't thinking about armed robots when he wrote and sang "Lawyers, Guns and Money," we can't help but smile every time we hear it.

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Disclosure Statement

The views or opinions expressed in this article are those of the author and do not represent the official position or policy of the United States Navy.

References

[1] N. Sharkey, "Grounds for discrimination: Autonomous robot weapons," *RUSI Defence Systems*, p. 89, Oct. 2008; http://www.rusi.org/downloads/assets/23sharkey.pdf.

[2] R. Arkin, "Governing lethal behavior: Embedding ethics in a hybrid deliberative/reactive robot architecture,"Georgia Inst. of Technology, Tech. rep. GIT-GVU-07-11, 2007; http://www.cc.gatech.edu/ai/robot-lab/online-publications/formalizationv35.pdf.