The development of aerial drones, smart bullets and laser guns all point to a future of global conflict resembling science fiction. **Crispin Andrews** takes aim.

SMART WARFARE

AFTER THE Normandy landings and the Soviet Union's invasion of Germany, it took the Allies almost a year to get their hands on Nazi leaders and end the Second World War. It cost all sides millions of lives – many of them civilian. Ever was it so: the previous century, Napoleon had marched into Russia, lost 70,000 men and hadn't even got past Moscow's gates; the USA faced similar problems shutting down the enemy in Vietnam, as did the Russians in Chechnya.

However, one technological revolution later, if the US wants to take out a suspected Al Qaeda leader, it sends in an unmanned drone aircraft to drop a bomb from 50,000ft. No risk of US casualties. Less risk, they say, of civilian deaths. And no pitched battle through the streets of the town in which target is living. With no pilot, it doesn't even really matter if the drone crashes.

Throughout recorded history, the weak have used hit, run and hide tactics to fight the strong. Now the strong have developed the technology that they hope will one day render these tactics obsolete. They have smart bullets, programmed to explode above their enemies' heads when under cover, a naval gun that can hit a target hundreds of miles away, and a missile that can strike any target on Earth in less than three hours.

While Napoleon, Eisenhower and Wheeler had minimal intelligence about their operations, today's military commanders have aerial drones gathering real-time information about enemy capacity and movements.

"Today and into the future, war is and will be increasingly about knowledge, precision and speed," says James Lewis, a senior technology expert at the Centre for International and Strategic Studies in Washington. "With good information," Lewis explains, "a commander can take decisions without hesitation or uncertainty. An operation that used to take hundreds of bombs now only needs one or two."

The latest technological advances seem to have made waging war a less risky business. But only for the big guns.

You wouldn't catch the US sending drones over Beijing or deploying smart bullets against the Russians. The world's great powers have political, economic and psychological battles. If China wants to get at the US, it squeezes the dollar. In return the US will sponsor media stories about China's appalling humanitarian record. That they don't go to war against each other is nothing to do with modern leaders' greater enlightenment and humanity. Each country still has its interests and pursues them by the most effective means. However, in the post-nuclear age, such are the forces involved; all-out war between two world powers would achieve nothing more than stalemate and destruction.

Much easier, then, to pick on those who aren't strong enough to fight back. And if these countries or groups do find a way to stand up for themselves, or even pick a fight themselves, with new smart technology expertise you don't even have to smash them and all they stand for. Today, for Western powers, security is about threat-removal. And the best place to fight those sort of battles is your enemy's doorstep.

Dawn of the UAV

The US first used armed, unmanned aerial vehicles (UAVs) in 1995, during the Yugoslavia civil war. Since the 2001 war against the Taliban began, it has used Predator MQ 1 (and, since 2007, the more advanced MQ9 Reaper), to kill suspected Al Qaeda insurgents in Pakistan and Afghanistan as well as to patrol the Indian Ocean and Somalia for pirates and rebels. Israel and Britain have also used armed UAVs to target enemy insurgents. This year, the Iraqi government bought US drones to protect oil platforms and the Turks are trying to buy some to fight Kurdish separatists.

Remote-controlled from the ground, the Reaper's turboprop engine is eight times more powerful than its predecessor's piston arrangement. The new craft can carry three times more bombs and cruise three times the speed of a Predator. Reapers carry Hellfire missiles or laser-guided bombs. They have a 3,200 nautical mile range and can operate from 50,000ft.

"At the moment, the drones aren't reliable enough to work without their human operators," Lewis says. "There are still a lot of crashes, although not as many as there used to be." He adds that the Patriot air defence system is programmed to react to certain threats. "The question is when we are going to give UAVs more autonomy?" >

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Supporters of drone warfare point to it as a more efficient method of combat than sending in foot-soloiders, incurring fewer civilian casualties

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An MQ-1 Predator unmanned aerial vehicle hooks up for maintenance at Balad Air Base, Iraq

< Aerial drones were originally designed to collect surveillance and reconnaissance information, and have also been used to transport supplies into war zones. They supposedly conform more closely to the Geneva Convention that requires combatants to minimise collateral damage. The friends and families of the 391 to 780 Pakistani civilians allegedly killed by drones since 2001, might not agree. Neither would the families of those killed in the Mumbai, Bali and London terrorist attacks, be too sympathetic to the argument that their loved ones died in an a reprisal attack on the capitalist West, carried out by freedom fighters. To the victims, any attack is an act of terror. At least the Americans try to target enemy combatants. Or so they'll claim.

Whatever might be said in the media, nations or groups go to war for one of two reasons: to get something, or to stop someone else taking something. Drone technology might make the act of getting or stopping less morally objectionable. But sometimes what the participants want or want to stop is, in itself, morally objectionable. It is nearly always politically objectionable – particularly from the perspective of the other side. That's why wars start.

Political war

The 1830s saw the publication of Carl Von Clausewitz's 'On War'. The book wasn't finished when the German officer died, but it would still become a bible for generations of military leaders. Ever since, in the western world, Clausewitz has been revered as the greatest philosopher of war.

Clausewitz was writing in the aftermath of the Napoleonic conflicts where the military ran wars relatively free of interference from politicians. But he saw underneath the skin of war as an extreme form of human interaction – between states, national leaders and individual combatants. "War," he famously wrote, "was an extension of politics by other means."

Today, democratic politicians are more reluctant to hand things over to unelected military commanders. The political nature of war remains, however. "Many believed that nuclear weapons removed the politics from warfare," says Professor Beatrice Heuser from Reading University, author of 'Evolution of Strategy: Thinking War from Antiquity to the Present'. "How could a war have an identifiable political objective when the resulting nuclear holocaust would obliterate everything, it was said?"

Professor Heuser says that since the Second World War, war and politics have co-existed in different forms. Non-nuclear, or limited wars, in Korea, Vietnam, Afghanistan, Chechnya, Iraq and other places. Numerous, equally bloody, civil wars. Technology, it seems, doesn't separate war from politics. It simply enables combatants who have the best of it to fight more efficiently.

"Leaders have to calculate the costs and benefits of going to war," Lewis says. "How many losses are you prepared to take to achieve what you want? With the latest tech, some might think twice before taking military action."

Bullet intelligence

In the past, guerrilla forces could hold off or even defeat superior forces. If the terrain was right, a few hundred faceless men could attack from the safety of cover, and disappear into the communities they sought to protect. But while these Robin Hood tactics worked for the Vietnamese, Che Guevara and the Taliban against the Soviet Union in the 1980s, technology makes guerrilla warfare risky.

Smart bullets can now get at undercover guerrillas. The US military's XM25 rifle uses bullets programmed to explode when they've travelled a set distance. Designed by ATK and Heckler and Koch, the gunman shines a laser rangefinder at whatever is shielding the enemy combatant and works out the distance. The soldier can also add or subtract up to 3m so bullets can clear the barrier and explode above or beside the target.

Each bullet is on a timed fuse. Inside is a small magnetic transducer that interacts with the Earth's magnetic field, generating a tiny alternating current every time it spins. Measured against the gun's specially calibrated rifling, this means the bullet can keep track of how far it has travelled. The computer counts the number of rotations it makes, and when the round has flown far enough, the computer issues the instruction to detonate, releasing a burst of shrapnel.

The US is keen to let everyone know how high-tech its forces are, and will soon be. The US military now has electrons powerful enough to make laser guns, and has even asked companies to apply invisibility technology. Aerial drones can, of course, assassinate insurgent leaders in their homes. And soon it will be no use hiding out in the oceans either. The US navy is currently testing a rail gun that uses an electric-powered launcher to fire a 40lb shell at 4,500 to 5,600mph over 50 to 100 miles. Navy commanders hope to deploy rail guns by 2020 against ocean threats.

In 1832, Clausewitz said that striking the enemy's centre of gravity at the decisive point, with superior force, would win a war. At the time, this meant defeat your opponents' armies in the field by amassing more men, with better weapons and training, at a time and place where defeat will cripple the opposing force. "New military tech enables those who have it to aim a more precise surgical strike at the enemy's centre of gravity," says Heuser. In today's world, she explains, this could be its command and control centre, electricity supply or even its political leadership.

It's an old adage. Cut off the head or restrict the blood flow and the body stops working. But increasingly, high-tech forces can bypass a costly ground-conflict and strike directly where it matters.

Information gathering

The little guys are far from helpless, though. Lewis explains that the group who bombed Mumbai in 2007 had high-tech communication, intelligence on Indian police movements, navigation tech and satellite devices. "Non-governmental forces aren't bogged down by purchasing procedures, they can quickly get what they need from the consumer market," he says, adding that as younger, more tech-savvy officers rise up the command chain, western forces too will embrace the latest social media and hand-held devices to support their operations in a more efficient manner.

Dr James Canton, a self-professed futurist, believes that information gathering is one of the keys to future warfare. "Thousands of tiny sensors that look like dust, that are small enough to travel through the human body," he says. "Soon, devices like these will collect military data."

Dr Canton, chairman and CEO of the Institute for Global Futures, sees a time maybe 10 or 20 years ahead when nano-, bio-, neuro- and eventually quantum technology, will make warfare with soldiers and guns obsolete. "Imagine machines that can self-heal and self-assemble, robot armies, satellite systems that can switch weapons off or affect the mood of a group of angry insurgents," he says. "This is the future of warfare. One day we'll be able to manipulate time and space at a quantum level, giving armies such stealth capacity that there will be no point fighting them with conventional weapons."

The last word must go to Clausewitz. Technology, however advanced, he says, needs humans to design it. Also to decide when to deploy it, and how to counteract it. War is bad but, for many subjugation and an enemy's dominion is worse.

Technology will change how wars are fought, or, if Dr Canton is right, how they are not fought. But war will continue to be an extension of politics by other means. And as technology plays an ever greater role in the interactions between actors on the international stage, an extension of economics, too.

The military don't have a monopoly on high-tech solutions. While there's a consumer market out there, and as long as they can afford it, the little guys will use consumer technology to their advantage to face off against the big guns. However much military tech the US and its allies stockpile. *

MILITARY HISTORY

CARL VON CLAUSEWITZ

By 1818, Carl von Clausewitz had risen to the rank of Major General in the Prussian army. He had fought Napoleon at Jena, and when the Prussians allied themselves with France for a short while, he fought him again, with the Russians. At the battle of Waterloo, he was chief of staff to the third Prussian corps, but it is for his work as a military theorist that he is remembered.

Like other German philosophers Hegel, Kant and Marx; Clausewitz saw his subject through dialectical eyes. War, he believed, was a series of interactions between diverse factors. Often conflicting, and sometimes unexpected; these factors could combine to undermine even the most meticulous planning.

"War," he wrote, "was an act of force designed to compel our enemy to do our will." It was "a continuation of politik by other means". He saw war as a trinity of violence, chance and reason. Before Clausewitz, military experts spoke only of armies and battle plans. Clausewitz saw war as human interaction.

Clausewitz's ideas quickly became popular and European military elites soon latched on to them. Generals, however, tended to misinterpret concepts intended for philosophical study, as blueprints for action. Before and during the First World War, German and French commanders in particular, twisted round Clausewitz's ideas to add credence their plans, or simply selected the parts they liked the sound of to justify what they already planned to do. The Western front trench stalemate was a misinterpretation of Clausewitz gone badly wrong. And when, decades later, 20th century military strategists spoke of total war, they'd once again turned an abstract Clausewitzian principle into a plan of action.

Some say that technological advances and the proliferation of non-state actors on the international stage have made Clausewitz's ideas obsolete. But as a theoretical approach to the study of war as human interaction, his works remain valid, even if thinking needs to be adjusted to today's changing realities.

Military academies still use Clausewitz's work. Let's hope by now they get what he was trying to say all those years ago.