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Robots and Drones

The Three Laws of Robotics, from the "Handbook of Robotics, 56th Edition, 2058 A.D.":

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.

ISAAC ASIMOV, 'Runaround', 1942[1]

In the Star Wars series the most formidable of all weapons was the Death Star, a moon-sized battle station constructed by the Galactic Empire. It had one weapon—a superlaser capable of destroying planets. The aim was to suppress the rebels by confronting them with an irresistible force, demonstrated when the planet Alderaan was destroyed. But the rebels got hold of the Death Star's plans and noticed that it had one vulnerability, a small thermal exhaust port linked to the main reactor. Leading a desperate attack the young Jedi Luke Skywalker managed to fire a torpedo through the port and destroy the whole system[2]. The Galactic Empire then went on to construct a second, and even larger, Death Star but the programme was subject to severe delays, prompting great anger from the evil Darth Vader.[3]

This was also taken out by the rebels and this time before it had a chance to fire its weapon. In 2012 a petition was placed on the White House's website urging that a real Death Star be built in order to stimulate the economy and defend the nation. The Obama Administration offered three reasons for rejecting the petition. First, the cost would be $850,000,000,000,000,000. Second, it was not policy to blow up planets. Third, why 'spend countless taxpayer dollars on a Death Star with a fundamental flaw that can be exploited by a one-man starship?'

Dan Ward, a specialist in defence acquisition, saw the Death Star as a metaphor for what had gone wrong with weapons design in the Pentagon. It would always be a challenge to build such a large and complex system without overlooking some critical vulnerability.[4] Only one of these could be built at a time so that if the vulnerability proved fatal there was no benefit at all from the investment. By contrast, he noted, the simple, inexpensive and small droid—R2D2—was constantly showing its value. Whereas Death Stars were about brute force, droids were about finesse.[5]

The charge that the fixation with mighty and intimidating platforms would lead to unnecessarily complicated and unaffordable weapons was familiar. As the digital revolution progressed there were constant warnings that far too much attention was still being paid to expensive platforms, which were vulnerable to relatively cheap missiles, and not the long-range weapons systems that they were supposed to carry and which would enable them to operate at some distance from danger. The military attachment to its big-ticket items was hard to shake off. In 1984 Norm Augustine plotted the exponential growth of unit costs for fighter aircraft since 1910 and then pointed to an absurd conclusion:

> In the year 2054, the entire defense budget will purchase just one tactical aircraft. This aircraft will have to be shared by the Air Force and the Navy 3½ days each per week except for leap year, when it will be made available to the marines for the extra day.[6]

The $1.5 trillion F-35 programme, leading to unit costs of $100 million per aircraft, suggested that the problem was a real one, and that eventually the qualitative edge that might be provided by the most advanced platforms and missiles would be lost by reduced quantity. While the US

Navy and Air Force budgets grew in real terms at 22 per cent and 27 per cent respectively from 2001 to 2008 the number of combat ships declined by 10 per cent and combat aircraft by 20 per cent. Eventually, when faced with numerous targets, the military would run out of weapons. One response was to look to droids equivalents. 'Uninhabited systems' could 'help bring mass back to the fight' by expanding 'the number of sensors and shooters in the fight' at relatively low cost. With a lower premium on survivability a greater emphasis could be put into having large numbers of systems in action at any time.[7]

EARLY IN THE TWENTY-FIRST CENTURY THE FIRST UNINHABITED systems to attract wide notice were unmanned aerial vehicles, or drones, carrying deadly missiles. They could hover above targets, relaying information back to a distant operator who could then decide whether to unleash a missile. Rudimentary drones had existed since the First World War, used for example for target practice as well as intelligence gathering. The modern concept of drones could be traced back to an Israeli designer Abraham Karem who was convinced that they could be used to provide real-time intelligence. After the *Gnat*, which was deployed in the Balkans, came the *Predator*.[8] After 9/11 *Predator* was armed with *Hellfire* air-to-ground missiles and deployed to Afghanistan. At the same time, the Bush Administration adopted legal guidelines that gave the CIA wide powers to kill al-Qaeda terrorists anywhere in the world. Places where the US had little to work with on the ground, such as Yemen, Somalia, and parts of Pakistan, attracted particular attention. In November 2002, a drone struck a suspected al-Qaeda leader and five of his associates in Yemen, signalling that the United States was prepared to take out its enemies beyond a recognised combat zone. In 2007 the *Reaper*—described as a 'true hunter-killer'—came into service.

Drones brought together many critical technologies: highly efficient engines, advanced sensors, the global positioning systems, and instantaneous communications. Their operators could identify, monitor, and then strike a target thousands of miles away, without putting American lives in direct danger. Because they hovered over their targets for hours there was greater confidence than there could be with manned aircraft that

appropriate targets were chosen, with innocent civilians hopefully out of the way. They were nonetheless criticized on two grounds. First, they created situations of complete asymmetry. The drone pilots faced no dangers and could live a relatively normal life in their free time, picking up their kids from school after killing someone on the other side of the planet: their victims knew nothing about their impending doom and could not challenge their covert death sentences, let alone fight back. Second, targeted killing was ethically and legally dubious, and of uncertain strategic value.

The first issue had been raised from the start of air power. It was thrown into relief once Western air power enjoyed freedom of the skies. Michael Ignatieff described the 1999 Kosovo War as a 'virtual' conflict, at least for citizens in the NATO countries. Such one-sided fighting he complained was too much like a 'spectacle,' which aroused 'emotions in the intense but shallow way that sports do.'[9] Yet, if anything, drone pilots knew their human targets better than most, as they watched them before striking and then, after the strike, were able to see what was left of the victim and whoever else stepped into the frame at the last minute. Though the stress might be less than that experienced in actual combat, the drone pilots were not just playing glorified computer games. Yet on the second issue there was a question of impunity and moral hazard. Was it too easy to mount attacks without worrying much about the ethical implications?

The practice of targeted killing was developed by the Israelis after they had withdrawn from the Gaza Strip and were trying to find ways of coping with the threat posed by Hamas. The Bush and then Obama Administrations picked up on the idea as a way of dealing with radical Islamist groups, especially those operating in territories where it was difficult to reach them on the ground. This reflected a sharp focus on hostile groups prepared to attack the US homeland as well as its citizens and assets abroad. The numbers involved were small and the casualties caused by terrorism were not in themselves large, but their randomness and viciousness meant that the danger could not be ignored. The most important responses involved good intelligence, domestic policing, and addressing the social position of Muslim communities in Western countries. But even those militants living in the West gained their

inspiration, and sometime recruitment and training, from countries in which there were active Islamist groups. The objective was to degrade them by taking out identified individuals, either because they were leaders or had specific skills, such as bomb-making. Here drones seemed to be the perfect weapon for personalised killing.[10]

There was evidence that decapitating an insurgent group could reduce its effectiveness, while relentless attacks on key cadres would leave them weakened.[11] Occasional attacks, however, risked creating gaps that would quickly be filled, possibly with leaders who might be even more ruthless.[12] In addition, finding the right people to kill was not always straightforward. There were, therefore, significant civilian casualties, resulting from haphazard intelligence, local tipsters providing false information to help eliminate rivals, or excessive confidence in 'signature' strikes, in which individuals were killed because their behavior suggested that they were up to no good, even though there was no definite proof.[13]

While the number being killed was comparatively low, at least compared with what else was going on in these conflicts, individual incidents (such as wedding parties being struck) caused anger. The 'blowback' from killing civilians was said to be counterproductive, risking a loss of local support and inspiring more recruits to join insurgent groups, thereby outweighing any gains from killing particular militants. The temptation to use drones to gain tactical victories even though they provide scant strategic benefit was described as addictive.[14] There was little evidence of addiction. Perhaps because the benefits were hard to confirm, while profound ethical and legal issues were being raised, the Obama Administration cut back on their use in Pakistan in 2012, and then worked to develop guidelines on targeting. As the number of drone strikes in Pakistan and Yemen fell, so, too, did civilian casualties.[15]

Unmanned systems had other roles in counter-insurgency, for example in dealing with Improvised Explosive Devices (IEDs). All this harked back to the early expectations of robot war, with all the anticipated advantages: 'They don't get hungry. They're not afraid. They don't forget their orders. They don't care if the guy next to them has been shot. Will they do a better job than humans? Yes.'[16] Yet while they might allow their operators to stay out of harm's way they still needed to be controlled. So-called

unmanned systems appeared to require large numbers of people to operate them effectively. Moreover these systems were flattered when dealing with insurgencies. Against more capable opponents, drones, with their slow speed, low altitude, and vulnerability to air defences and electronic countermeasures, would be more restricted in their use. In conventional war the effectiveness of existing systems would be limited because of the the speed with which an automated system might process and act upon evidence of danger or a vulnerable target, and the risks of malfunction and enemy interference.

Under the Obama Administration, the US adopted a strategy (described as the 'Third Offset' to capture the idea that it must use technological strengths to compensate for the advantages of its opponents) based on 'collaborative human-machine battle networks that synchronize simultaneous operations in space, air, sea, undersea, ground, and cyber domains'.[17] To the fore was artificial intelligence allowing decision-making authority to be delegated to machines. This strategy looked forward to systems capable of managing big data, supporting human decisions so that they were better and faster, and also humans in combat, for example with wearable electronics and apps, and getting better cooperation between manned and unmanned systems. Defensive systems might work 'at the speed of light' to respond to attack while offensives would be more efficient, so that the lead rocket in a salvo could ensure that those following were sent to the best targets.

How far could this go? Nanotechnology, the manipulation of individual atoms and molecules, particularly important in biomedicine, offered the prospect of extraordinary miniaturisation. It was possible to imagine insect-like drones taking pictures at will and even injecting individuals with poisons, perhaps after checking their DNA, or else uniforms that could sense danger nearby, alert medics of injury, and even begin treatments of their own. In one particularly alarming account a physicist described how nanoweapons might destabilise the balance of power, with dramatic scenarios of 'nano-electronics guiding hypersonic intercontinental ballistic missiles or millions of insect-sized nanobots [nano-scale robots] capable of assassinating the population of a nation', leading mankind to extinction. Louis Del Monte envisaged a line of

development from computers designing nanoweapons, within parameters set by humans, to a ‘singularity computer’, one more intelligent than the whole human race, in place by 2050.[18] All this required enormous technical problems to be solved in miniature—including the furnishing of these tiny robots with a power source, antennae, communication, and steering.[19]

Well before such issues arose there were still troubling matters to be addressed. Artificial intelligence referred to computer systems capable of performing tasks normally requiring human intelligence, such as visual perception, speech recognition, and decision-making.[20] This could involve quite mundane tasks. At issue therefore was the level of complexity that could be achieved. In war this would require selecting and engaging targets without meaningful human control, so that their behaviour would vary according to circumstances even in the same broad operating environment. The levels moved from systems that were human operated, to those where humans delegated and then supervised, to full autonomy. The system’s reasoning ability and choices would depend upon the quality of its sensors and the algorithms through which information was processed. It would not be following a standard script but would make up its own scripts as situations developed. The ‘Terminator Conundrum’, referring to the robotic assassin played by Arnold Schwarzenegger in a series of movies, described the issues raised by an independent machine able to decide whom to kill. The choices would require not only good information but also an ethical sensibility. ‘Should a drone fire on a house where a target is known to be hiding, which may also be sheltering civilians?’[21]

In practice it was likely that machines would remain ‘teamed’ with humans, who would remain ‘in the loop’, able to countermand the notionally autonomous systems if they made poor choices. As with any soldiers the problems were likely to result not so much from formal command arrangements as from the contingencies of battle. Ideal subordinates in any military command chain were sufficiently obedient to follow orders as given but also capable when necessary of taking decisions on their own, perhaps because communications were down or senior commanders had been killed. In such circumstances soldiers might run

away or fight on their own initiative. So might robots, except they would turn off rather than run away. Control might also break down when distant human controllers could no longer cope with the speed and fluidity of a battle so that decisions on targets had to be delegated to the machines. This could escalate a confused situation, so that fire from a friendly source could rapidly lead to a fratricidal fight.

IT WAS ONE THING TO HAVE FAR BETTER SITUATIONAL AWARENESS or logistics, and even a degree of automatic protection when a unit or individual might be caught by surprise. It was quite another to have systems leading themselves with the humans playing supporting roles. And then there were the obvious nightmares about rogue systems turning on their supposed masters or just deciding against a critical mission. One way to interfere with drones (especially the simpler, commercial models) was to develop means of interfering with their electronics. Given the concerns about hacking, how much reliance could be placed on systems that might be 'turned' if penetrated by a foreign power? There was a logical interaction with the developing debate on cyber-war, which was all about a constant struggle between the offence and defence over the security and integrity of information, and this debate which often presumed that great trust could be put in the programmed decision-making of autonomous systems.

The future may not arrive so quickly. There were always obstacles to technological advances. The introduction of new capabilities, especially without the urgency of an ongoing war, was usually far slower than futurists supposed or enthusiasts found acceptable. Military organisations had been known to resist anything which threatened human redundancy, for example in the 1950s Strategic Air Command resisted ICBMs as alternatives to manned bombers. In addition the record of turning exciting new technologies into actual systems was less impressive than often supposed, with funding, bureaucratic, and engineering issues often causing severe delays.[22]

Another factor affecting the introduction of autonomous vehicles was that the lead with the new technologies was taken by the private sector. The most developed example was a driverless car, a much more

challenging machine than a drone and one expected to have much more autonomy. As it moved forward on the ground it had to be aware of numerous potential obstacles and other vehicles with their own dynamics. The challenge grew the more urban and dynamic the operating environment. Driverless cars were first developed as a Pentagon programme in 2004 but resources were only poured into it as a commercial venture, which not only meant that the advances were out of state control but also that the state took second place in competition for the skilled engineers and software developers needed to take the work forward. Competition for a mass market and vast R&D expenditures moved driverless cars to viable products while military programmes for autonomous vehicles lagged behind.

A key feature of many of the vital systems introduced for the digital age, including Internet providers, search engines, hardware manufacturers, and software developers, was that they were owned and operated by private companies with global interests. Smartphones carried capabilities such as satellite imaging, navigations, data stores, and instant, encrypted communications of a quality once available to only the most advanced military organisations. Even drones were mass-produced, for aerial surveillance of local neighbourhoods and carrying items over distances, and so opened up the possibility of also delivering crude explosives.

These readily accessible systems made it possible for individuals and small groups to hurt others. They also showed how individuals and communities, living in apparent safety, were becoming exposed to new risks. Attacks could come without reason and notice, from across hemispheres yet with extraordinary speed, taking in the innocent as well as intended victims.[23] Here the fears about new technology became linked with developing concerns about terrorism. With many examples of extreme Islamist groups, or just ‘lone wolf’ supporters, ready to attack random civilian targets in Western countries, it was natural enough to worry about what might be done with access to the most lethal technologies. This had been high on the security agenda since 9/11. Yet for extremist groups the most obvious advantages of the Internet were found in their smartphone apps: the ability to disseminate messages to vast audiences around the world without interference, harass opponents, post

videos of their victims and martyrs, while they took advantage of encrypted communications. When it came to killing one feature of many terrorist atrocities was the simplicity of their methods—knives, bombs and guns, or driving trucks into crowds. These weapons were crude but effective, well understood by those using them and with proven capabilities, demanding no special expertise to make them work.

So while the new technologies were developed with large wars in mind their applications were found in the context of insurgencies and social disorder. The team of Arquilla and Ronfeldt offered a conceptual way forward that might link the two types of warfare. They described an approach to battle based on 'swarming', distinguished from 'the chaotic melee, brute-force massing, and nimble maneuver' of the past. This required a progressive improvement in the ability to coordinate and command individual units. With swarming targets were attacked from all directions by 'myriad, small, dispersed, networked maneuver units'. It was relevant, they argued, to anything from social activism to high-intensity warfare yet to gain the greatest advantage (so that action did not degenerate into a melee) there would need to be some central strategic control.[24] At a basic level this could be observed with guerrilla warfare. At a higher level, technological developments might make it possible to synchronise attacks undertaken by devolved robots to ensure maximum effectiveness. It was a natural approach for a networked organisation because it could gain the maximum advantage from the ability of a number of separate units to communicate with each other and execute complex movements and patterns of fire.

As attention moved to robotic systems, Paul Scharre noted how well they were suited to swarming. This would require moving from having individual units each with their own operators to a central command being able to manage many at a time, although at some point it was possible to imagine the individual units being self-coordinating while seeking to disrupt the capacity of an incoming enemy swarm.[25] Conceptually the idea of swarming, and its potential applications in war-fighting, was not difficult to grasp. It offered new ways to defeat an opponent. As with much of the military thinking of the digital age, it was easier to imagine swarming in the air or at sea (as in fighter aircraft or submarine wolf

packs of the Second World War) where there would be fewer obstacles or sources of confusion than there would be on land. What it could not do was provide an answer to the problem of holding territory and especially cities in the face of a hostile population.

It was territory that still mattered most. The most serious danger posed by Islamist groups, for example, came in 2014 from their control of chunks of Syria and then Iraq, to the point of proclaiming their own state.[26] The Islamic State of Iraq and Syria (ISIS) attracted activists from around the world to join its ranks and potentially offered a base which would allow them to train these activists and send them around the world to cause trouble. Drones had a role to play in the campaigns to dislodge them, not least in streaming real-time intelligence, but little could be done without ground forces provided by local powers. Though the technology would improve, the basic limitation of air power still applied. Territory could not be won or controlled from the air, whether by drones, helicopters, or jets, without the benefit of supporting ground forces. The idea of robot armies had a certain appeal, but they would struggle with counter-insurgency when the enemy mingled with the local population, or if the militants learnt how to confuse the sensors of the systems coming after them.[27] It was a constant temptation to believe that there were technical fixes for what were essentially political problems, but they often turned out to be sub-optimal in their effects. In her history of the Defense Advanced Research Projects Agency (DARPA), Sharon Weinberger noted that 'press releases tout devices that can help soldiers scale glass skyscrapers, while American forces fight in a country dominated by mud houses'.[28]

Thus while the weapons demonstrated the possibility of attacks of ever-greater complexity, precision, and speed over ever-greater distances, with reduced risks to the operators, they did not answer the question of exactly what was being achieved. Numbers were still needed to take and control territory, and it was the effort this required that put a strain on Western countries. After 9/11 President Bush accepted that if the United States neglected unstable parts of the world it could get caught out. 'We will fight them over there so we do not have to face them in the United States of America.'[29] By 2014 President Obama, after being faced with a

decision on Syria in 2013, decided that the public's tolerance for expeditionary warfare of the sort seen in Iraq and Afghanistan had been exhausted: 'the time of deploying large ground forces with big military footprints to engage in nation-building overseas, that's coming to an end.'[30] The reliance on drones to engage in targeted killings was part of that determination. It was also possible to note that defences in the form of intelligence and police work had not done a bad job in preventing another 9/11. Indeed, for all the talk about developing vulnerabilities and the erosion of distance, defensive measures along with natural barriers—such as oceans and mountain ranges—could still make a difference. Even a country as potentially exposed as Israel put as much effort into improving its means of defence, from security walls to anti-missile systems, as it did perfecting new means of attack. Despite the common assumption about globalised war, geography still made a difference. Technology did not necessarily 'trump terrain'.[31]

From Israel came proposals for another way of approaching threats emanating from territories that would be difficult to control directly. Instead of re-occupation of territory which had been relinquished because past occupations had resulted in substantial harm and upset over the years, an alternative was to rely on raiding. This had traditionally been a transient strategy, knocking back an opponent, while lacking both the benefits and costs of taking full control.[32] Looking back at the Lebanon War of 2006, which been judged a failure at the time, it seemed that enough had been done to dissuade Hezbollah from further provocations (although it could also be noted that Hezbollah were stretched in Syria trying to preserve the Assad regime). The point of a raiding strategy was to make it hard for hostile groups to assume that they had sanctuaries from which to mount their attacks:

> Raids offer a valid way to curb the threat and contain it at minimum risk and cost. In addition to continuous small raids from the air and by special operations forces, larger raids with heavy ground forces are needed periodically to "mow the grass", that is, to inflict heavy losses and impair the opponents' capabilities.[33]

At the heart of the exploration of this alternative was the search for a

way of avoiding the grief and cost of prolonged occupation. Arguably if US forces had left Iraq soon after Saddam Hussein had been toppled in 2003, then most of the US goals would have been accomplished. To be sure there could have been mayhem in Iraq as a consequence, but that was hardly absent with the occupation.[34] But leaving behind disorder and chaos without any effort to set the society on a more stable path would have just stored up trouble for the future. In 2011 Western countries helped defeat President Gaddafi in Libya but refrained from getting involved on the ground to help stabilise the situation in the aftermath.[35] The result was vicious faction fighting, opportunities for Islamists, and refugees desperate to get to the West by any means available.

Raiding could wear down an opponent's resitance and remove some capability, but it was unlikely to do more than contain a problem, as Israel's own history demonstrated. It was one thing when used against a relatively stable opponent (Hamas in Gaza) but another when the consequences could only be chaotic. H. R. McMaster saw raids as being of short duration and limited purpose, unable 'to effect the human and political drivers of armed conflict or make progress toward achieving sustainable outcomes consistent with vital interests'.[36]

AS RESEARCH PROJECTS MOVED INTO CYBER WARFARE, artificial intelligence, and robotics, science fiction was a natural place to go for insights.[37] In 2015 journalist August Cole combined with policy analyst Peter Singer in *Ghost Fleet*, a novel that combined concerns about China with energy scarcity with the developing technologies of war. Their inspiration was Tom Clancy's *Red Storm Rising*.[38] Their aim with this 'useful fiction', based on extensive research (the book had 400 endnotes), was to wrestle with the issues surrounding a future great-power conflict in order to 'help prevent such a confrontation from straying from the novel to the actual battlefield.'

Ghost Fleet described an old-fashioned geopolitical war with China. It opened with a surprise attack designed by the Chinese leadership, and so in the tradition of attempted knockout blows. The trigger was an energy crisis, resulting from the aftermath of an Iran-Saudi war, a combination of crashed global markets and a vastly inflated oil price. The Chinese

leadership, a military-industrial elite, were irritated at the way that the US, secure in its own energy supplies, interfered with China's ambitions, and threatened economic sanctions to get its way. A large gas field, which only China could reach and exploit, promised economic security but needed protection. The theme of the admiral who drove the war policy, as with his Japanese counterpart in 1941, was that there was no choice. The Americans must be made to come to terms with China's rise. This was not the time to 'grow meek on the brink of the next great step.' It was 'a simple question of the arc of history: If now is not the time, then when?'

The surprise attack plan was complex. It involved taking out supporting infrastructure (including space-based elements), and neutralising the most advanced components of the US Navy and Air Force. This included disabling the software packages on the US F-35s (which unfortunately for the Americans included a Chinese microchip) and tracking nuclear submarines. The plan also depended on an alliance with Russia, which was otherwise assumed to be on the brink of war with China. This all required skillful orchestration, reliance on untried methods, and also a massive failure of American intelligence. It was also a gamble because it was assumed that nuclear weapons would not be used. American ballistic-missile carrying submarines were not attacked although they might have been. Sparing them signalled to Washington that there was to be no escalation to the highest level. According to one of the key characters, by the time the government worked out what was going on, there was no point: 'going nuclear would just be revenge to the point of suicide'. They could not even be sure that the orders would get through.

The Chinese were still left with the problem that the United States was not actually defeated. The three classic problems with a surprise attack that fell short of a knockout blow manifested themselves. First, popular resistance developed on Hawaii, which had been occupied by the Chinese. Second, not all American forces were destroyed. The situation was saved by the 'ghost fleet' of the title, referring to mothballed ships kept in reserve, which could now be revived and refitted for duty, just as old aircraft were found to replace the sadly ineffectual F-35s. Third, while most allies had been pathetic and no help at all to the Americans, the Anglosphere of Britain and Australia were still supportive. The country still functioned and was able to work out how to retrieve the situation.

Manufacturing resumed, in part due to 3-D printing. In the end the US fought back sufficiently to regain something of the old order. The conclusion was a messy stalemate, both sides having 'shown they could pound each other into a weakened equilibrium' with 'most of each other's fleets' now sunk.

Ghost Fleet warned of the over-reliance on advanced technologies and a failure to think through their software vulnerabilities, and reminded of the importance of patriotism, heroism, and individual initiative. The preference of Singer and Cole was simpler and more agile systems, with quick impact, such as drones, rail guns, and lasers. They also show how personalised war could become, including individual aids to fighting whether in the form of stimulants that make it possible to cope with fatigue and strain, or a version of Google glasses which enabled immediate access to information. In its core scenario for the surprise attack, *Ghost Fleet* fitted in with what *The Economist* described as a distinctive feature of the genre that began with *The Battle of Dorking*, by presenting 'new technologies as decisive, both a thrilling idea and a necessary device if… dominant nations were to be portrayed, initially at least, as victims,' and as a means of imparting a stark message 'of the wrongheadedness of politicians or senior officers, of national decline, of geopolitical change'.[39]

Cole was to the fore in an Atlantic Council project encouraging authors to generate insights in its 'Art of Future Warfare Project'.[40] One early product was a slim volume of short stories to demonstrate how fiction might alert policymakers to future possibilities. The themes varied from an American senator making an effective political pitch by encouraging crowdsourced cyber-attacks on Russian and Chinese systems to British intelligence analysts attempting to profile the population to pick out likely terrorists (in this case missing the brother of one of the analysts), to drone operators who could see distant battles better than those fighting them and so advise constantly on coming dangers and vulnerable targets. The heroes, male or female, achieved their goals because of their mental rather than physical toughness. They tended to be super-smart graduates of the best universities, grasping the powerful technologies at their command. Following the long traditions of military literature they were often

mavericks, unimpressed by authority yet patriotic to the core.

The origins of their wars were often traced back to previous wars, the details of which were dimly remembered though they had left the world unstable and prone to yet more conflict. Despite this wretched history of chaos and mayhem, somehow the science of war had progressed and even more ingenious methods found for taking out the enemy. The drama came from the tactical and operational, as these super-smart people made their complex systems do whatever they needed them to do. The strategic picture remained murky. They were fighting the evil and malign because they could not let them win. Behind all this lay some great political failure, but that was not where the story was to be found.