New technology and war

Carol Turner

Technological advances impact on us all, and many improve the quality of our lives. In health care, digital monitors help control diabetes; the use of robots aids surgical procedures; patient-specific cancer treatments are starting to be developed. Even the driverless cars of the future will include health monitoring technology (though some of us remain to be convinced this form of transport will reduce rather than increase driver stress or traffic accidents!)

Like other societal shifts, however, the digital revolution has brought many equivocal, sometimes downright negative, results. Robocop is still in the realm of fantasy, but Big Brother can and is monitoring, collecting, storing and sharing more data on us than ever before. We know it thanks to investigative journalists such as Duncan Campbell, who has exposed the existence of secret UK surveillance systems over decades.

The 1991 Gulf War allowed the military to validate then new technologies such as unmanned aerial vehicles (UAVs, or commonly 'drones'), precision-guided munitions, and enhanced communications capabilities. The 2003 invasion of Iraq did likewise for the next generation of battlefield technologies such as target acquisition and satellite use – changes which are turning science fantasy into fact.

The majority of military systems are now automated to some extent. A new report from Drone Wars UK, *Off the leash*, argues that UAVs are likely to be the first truly autonomous weapons systems, that not only fly themselves for extended periods but may also 'select, identify, and destroy

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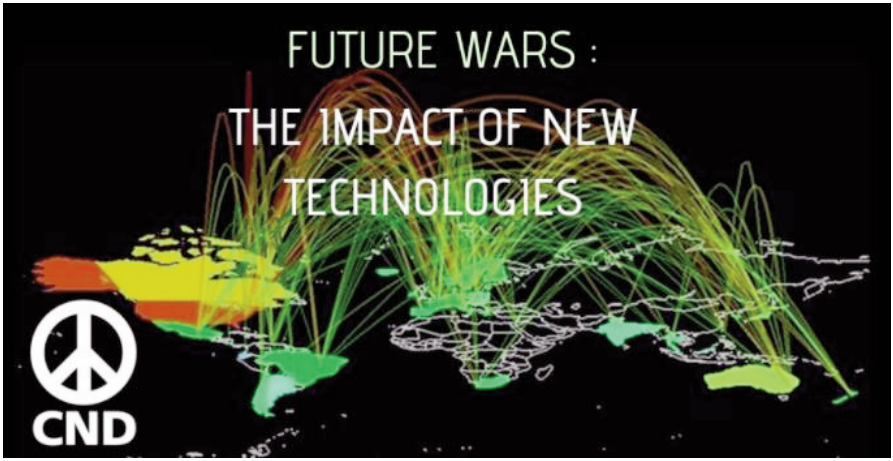

targets without human intervention'.

Artificial intelligence (AI) expert Pere Brunet of the Delàs Centre for Peace Studies adds another warning for the future. We are heading for a new scenario in which 'robotic weapons can be easily assembled from on-the-shelf components by almost any country or organization,' he says.

What governments say and what they do on these issues are different. The British government expresses opposition to developing armed autonomous systems, for example, though it has not supported UN moves to ban them. Leaders of Britain's armed forces, on the other hand, have endorsed such systems.

Meanwhile, the military is moving in on UK universities, as are major arms manufacturers such as BAE systems and Rolls-Royce. University funding from the Ministry of Defence and UK arms companies has grown since the turn of the century. And, as Stuart Parkinson of Scientists for Global Responsibility points out, military funding 'tends to be concentrated in engineering departments' and mainly directed towards applied work rather than research.

Developments in the field of nuclear weapons systems parallel those of conventional weapons, and are led by the United States. The Pentagon wants to speed up development of a new generation of so-called low-yield nuclear weapons – smaller and more accurately targeted nukes, made possible by technological advances. Low yield, of course, is a relative – not to say downright misleading – term. The atomic bombs the US dropped on Japan in 1945 would be 'low-yeild' according to modern definitions.

At the same time, the US has enlarged the scenarios in which it will consider using nuclear weapons to include 'significant non-nuclear

strategic attacks'; in other words, in a 'conventional' war. Taken together, the development of more accurately targeted and 'smaller' nuclear weapons systems and the expansion of the conditions in which nuclear weapons might be used have served to breathe new life into an old debate of the 1980s: the possibility of fighting and winning a limited nuclear war.

President Ronald Reagan's 'Star Wars' project was central to the debate back then. It proved a no-goer – the costs were enormous, and the technology inadequate. Put on the back burner, it never quite went away. No surprise then, in June 2018, that President Trump announced the development of a new branch of the military, a 'Space Force', with provision in next year's military budget for developing space-based missile interceptors to protect America from nuclear strikes.

Not only do these developments increase the possibility of nuclear confrontation, as Professor Dave Webb of Leeds Beckett University points out, they will also tend to drive up global military spending as other states compete to develop similar 'protection'. 'The possible consequences are extremely serious. The US intention to dominate is clearly shown by the Space Command uniform badge which declares wearers to be "Masters of Space".'

For these reasons and more, CND stepped in to the debate on new technologies with a day conference at Birkbeck College, University of London, *Future Wars: the Impact of New Technologies*. The specialists mentioned above were joined by an impressive array of experts on US security policy, neurowar, surveillance, militarisation of space and more. The following papers document some of these contributions.

'Science may be a boon if war can be abolished and democracy and cultural liberty preserved. If this cannot be done, science will precipitate evils greater than any that mankind has ever experienced.'

Bertrand Russell
Boredom or Doom in a Scientific World
September 1948

Donald Trump's Space Force

Dave Webb

US President Donald Trump's June announcement that he had directed the Pentagon to develop a 'Space Force' – a new branch of the US military, "*separate but equal*" to the US Air Force – to ensure the "*American dominance in space*" has proved to be highly controversial. Not that controversy is particularly unusual for Mr Trump's ideas, or for his defence and foreign policies but the possible consequences are extremely serious. The US defence budget for 2019 included funding for the development of space-based missile interceptors which could lead to a major increase in global arms spending and edge the world even closer to a nuclear war.

The idea of a sixth branch of the US armed forces to deal with space is not new. In June 2017 the House Armed Services Committee voted to create a US 'Space Corps' to incorporate the current space missions of the US Air Force (USAF). In fact, the USAF Space Command was established as long ago as 1985 to coordinate the space forces of the Army, Navy and Air Force. In June 2002 it was merged into US Strategic Command (STRATCOM) in Nebraska under a scheme to transform the military by then Secretary of Defense Donald Rumsfeld. Rumsfeld had previously chaired a "Space Commission" which released a report in January 2001 recognising the vulnerability of military space assets and warning of a "*Space Pearl Harbor*", a reminder of the dangers of a lack of preparation in 1941. The recommendation of the Commission's report was to weaponise space!

The US intention to dominate is clearly shown by the uniform badge of the Space

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Command which declares them as "*Masters of Space*". The same slogan is also proudly displayed above the entrance to their building at Schriever Air Force Base in Colorado and emphasised in their 1998 'Long Range Plan' (LRP) and their 'Vision for 2020' (the year that US Vice-President Mike Pence recently announced for the establishment of the new US Space Force). These documents spoke of *"new military capabilities for operation to, from, in and through space"* and "*full spectrum dominance*" of the US in the air, on land, at sea, in space and of information – as if Mr Trump had written them himself!

How did space become so important to the military? The first significant use of space technology for war fighting was probably during 'Operation Desert Storm' in Iraq in 1991, when satellites were used to target and guide so-called 'smart' weapons. This use was extended during the war in former Yugoslavia in 1999 and the aerial bombardment of Serbia has been described as the first "space-enabled" war. From the War on Afghanistan in 2001 through to 'Operation Iraqi Freedom' in 2003, space technology has been tested and used for battle management, intelligence gathering, reconnaissance, targeting and weapons guidance. The US has spent billions of dollars on militarising space – on satellites, ground based stations and new technologies such as armed drones, controlled through satellites. The US military (and that of other states) has become almost totally dependent on space technology.

It is perhaps surprising then that Donald Trump's Space Force announcement attracted so much media attention? It may have been the staged flamboyant and macho delivery that created the impact – in any case it has demonstrated the level of importance that is attached to military space activities. It also brought to light some major disagreements over the issue.

The idea of a new Space Force has been ridiculed in the US media and has not been widely welcomed in Washington or in some areas of the US military. There has been some support, however, from advocates such as Republican Congressman Mike Rogers from Alabama, a state that includes Huntsville (the US military space capital). Rogers has received hundreds of thousands of dollars in donations from aerospace contractors in his state and a former executive of Boeing, US Undersecretary of Defense Patrick Shanahan, is another supporter. Shanahan was responsible for Boeing's $5 billion Airborne Laser project – a laser mounted on a Boeing 747 supposedly to intercept missiles in their boost phase (soon after launch) – which failed and was cancelled in 2012. A major push for a Space Force is coming from the corporations who will profit from increased spending on military aerospace projects irrespective

of whether they are needed or will ever work.

Cost is one of the major issues cited by those arguing against the Space Force. The detailed plan for its implementation prepared by the USAF estimates that it would cost $12.9 billion for the first 5 years. The Trump administration and Congress have already increased defence spending to $716 billion and further increases would be difficult to justify to a population already suffering from severe public spending cuts. The USAF is also worried that Space Force funding would be found at its expense. So, while those with ties to military space contractors have been pushing for a Space Force, the Air Force has taken an opposite view. They want to retain control of space and the funding that goes with it. Some key players from the aerospace industry not involved in space technology have also come out against the force, for similar reasons.

However, the most worrying development in all of this is that Congress has approved spending on the development of space-based missile interceptors and are expecting a working prototype by 2022. The past development of space weapons has proved expensive and has been plagued with failures. President Reagan's space-based laser project, part of his 'Strategic Defense Initiative' (and proposed by Edward Teller, the 'father' of the H-bomb), cost billions and was cancelled in 2002. In 1993 President George H.W. Bush cancelled "Brilliant Pebbles" – a space-based project to defend against an all-out ballistic missile attack from the Soviet Union. It proved to be too difficult to do and too expensive. Instead, a smaller space-based system called Global Protection Against Limited Strikes (GPALS) was undertaken to protect against limited ballistic missile threats from smaller powers like Iraq, Iran, and North Korea. The current US land and sea-based missile defence systems positioned in Europe, South Korea and Japan use space technology for missile detection and targeting but the interceptors are Earth bound.

It is not clear whether Congress will agree to creating a Space Force, but Donald Trump seems determined to push for it to please his supporters, his ego and parts of the military-industrial complex. The call on the Pentagon "*to develop a space-based intercept layer*" seems to ignore a 2012 study by the American Physical Society (APS). They estimated that 650 space-based missiles, at a cost of $300 billion, would be needed to keep a particular launch site in range and intercept even a small number of missiles in their boost phase. Placing such weapons in space would also likely lead other powers to assume that their satellite and deterrent systems were at risk, resulting in the extension of anti-satellite systems and an increase in nuclear arsenals. Such an arms race would increase the chances of mistakes occurring in systems on hair-trigger alert and risk a disastrous

nuclear exchange.

In addition, placing anti-satellite weapons and/or missiles in space undermines what is left of international arms-control agreements, increasing suspicion and increasing tension. If dealing with threats from space is an issue, then Congress should consider engaging with (not disengaging from) and strengthening international agreements. In 1967, just 5 years after the wake-up call of the Cuban Missile Crisis, the US and the Soviet Union signed the Outer Space Treaty that banned the siting of weapons of mass destruction in space and, together with 120 other nations, designated space a Global Commons – reserved for peaceful purposes. Since then there have been attempts in the UN to expand the Treaty further. In the 1980s Canada, Russia, and China pushed hard for a Treaty to Prevent an Arms Race in Outer Space (PAROS) and to ban all weapons from space. However, no US president has been willing to sign it. In 2008 China and Russia submitted an updated draft to the UN General Assembly which the US has continued to oppose.

If nuclear weapons are the problem, then the US should be encouraging (not discouraging) states to sign the Treaty on the Prohibition of Nuclear Weapons. In 1986, at the height of the Cold War, Presidents Reagan and Gorbachev met in Reykjavik and eventually agreed to scrap thousands of intermediate and short-range nuclear weapons. This meeting came about because of the wide-spread protests against the siting of Pershing and Cruise missiles in Europe. A similar outcry is needed now to bring world leaders together. To really increase security the Trump Administration must meet and work with other nations on a treaty to demilitarise space and redeploy the skills and knowledge of scientists and engineers to tackle the global threat of climate change.

Every year the 'Global Network Against Weapons and Nuclear Power in Space' calls for a particular week of action and education on these issues – "Keep Space for Peace Week" – in 2018 it was 6th to 11th October and we focused attention on the problem and protests took place at the places in the UK that form part of the US military space programme. The US interception, intelligence gathering and targeting base at Menwith Hill; the missile defence and space radar at Fylingdales (both in Yorkshire); and the communications, data gathering and analysis centre at Croughton near Oxford are centres of attention.

See www.space4peace.org for more information on these and other protests around the world. We need to continue to show the strongest opposition to the weaponisation of space!

Weaponization of Space

A French Perspective

Patrice Salzenstein

Mouvement de la Paix was founded in 1948 and, in 2018, celebrated its seventieth anniversary. It was created after World War II by prominent personalities such as Pablo Picasso, Frédéric Joliot-Curie and Raymond Aubrac, to oppose wars, and especially nuclear wars. It organises for peace locally and globally, joining the fight against racism, standing up for human rights and opposing nuclear weapons.

This paper examines French attitudes to weapons and nuclear power in space, and surveys peaceful action against it. The first three sections focus on France's current level of participation or not in the militarization of space.

According to non-classified defence information, France runs programmes – either parallel to, or in total collaboration with – other NATO countries in the following areas: 1. Nuclear weapons, 2. Anti-satellite systems, 3. Satellites used for military information and spatial electronic warfare.

Note that France does not participate with NATO on nuclear weapons, even after becoming reintegrated within NATO. It is also important to remember that France is the 5th or 6th biggest arms exporter in the world.

France is a leading country for the use of nuclear power to generate electricity. Technologies that have 'dual use' applications, i.e. for military and civilian purposes, are of increasing importance to research and development in the development of nuclear, imaging and electronic systems and devices.

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Nuclear weapons

Programmes for a new generation of nuclear weapons should involve the *Commissariat à l'energie atomique*, although some changes could be expected after the 'Brexit' vote.[1] One of the major research projects is the Megajoule Laser, part of the simulation programme, which became operational in 2014. This powerful laser is used to study materials under extreme conditions, comparable to those of a nuclear explosion, in a hyper-confined structure. It is currently being used to complete development of the new generation of French M51 missiles.[2] These are short, medium and long range ballistic missiles as well as those with an intercontinental range for use on French nuclear submarines. The first M51 missile was fired from a submarine in 2016. It should be noted that the French peace movement is fighting against these expansive and dangerous programmes and proposes their abolition.[3]

Anti-satellite systems

The 1967 Outer Space Treaty forbids placing weapons of mass destruction in orbit around the Earth and, to date, only three nations (USA, Russia and China) have projects to develop anti-satellite weapons. France seems not to have such a programme. There are many risks involved in destroying satellites in space, which include possible damage by debris impact on other satellites or on the International Space Station, which has cosmonauts on board. Some analysts have argued that the 2015 US Space Act[4] violates the Outer Space Treaty, which states that "outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means".

Satellites used for military information and spatial electronic warfare

There are no international laws or agreements on the use of intelligence gathering or observational satellites for military purposes.[5] France still has two second generation military satellites – Helios 2A and Helios 2B.[6] The first of the previous generation, Helios 1A, was launched in 1995. Two other satellites with imaging systems useful for gathering information are Pléiades 1A and Pléiades 1B.

The 'Multinational Space-based Imaging System for Surveillance, Reconnaissance and Observation' (MUSIS)[7] has six partners – France, Italy, Belgium, Germany, Greece, and Spain – which allows them to share imagery from various military satellites. As a project of the European Defence Agency (EDA), it is managed by the *Organisation conjointe de coopération en matière d'armement* (or OCCAR, the Organisation for

Joint Armament Cooperation) which facilitates and manages collaborative armament programmes through their lifecycle between Belgium, France, Germany, Italy, Spain, and the UK. MUSIS was intended to provide access to a number of missions:

* the successor of French Hélios 2 called *Composante Spatiale Optique* (CSO – a French military Earth observation satellite programme);
* the successor of German SAR-Lupe called SARah;
* the successor of Italian COSMO-SkyMed called COSMO Second Generation (CSG);
* the Spanish wide area optical satellite Ingenio (formerly known as Seosat).

The first two systems are entirely military, but the other two are dual-use. One satellite, COS 1, was due for launch in 2018 and two others, COS 2 and COS 3, are due for launch in 2021. All of these satellites will be under the control of the French Ministry of the Armed Forces. They could provide information to be used for modelling the terrain, for producing maps for guiding missiles and drones, and helping plan and execute airstrikes by military airplanes.

The battle for public opinion

What does the French population think about these programmes? Are the French still attached to nuclear weapons? The national daily *La Croix* and the French Peace Movement commissioned a survey of 1001 people, the results of which were published on 5 July, 2018. The main lesson from this poll is that a majority of respondents (67%) want France to ratify the treaty to "ban" nuclear weapons. It must be emphasized that French public opinion is generally not very interested in questions concerning nuclear weapons. This result shows that there is an important base who want France to abandon its nuclear forces.

Rather than just trying to convince the countries that have nuclear weapons to reduce their stocks, French peace activists have changed their strategy. They are now trying to convince countries that do not have nuclear weapons to impose a prohibition of this type of weapon of mass destruction.

The French government could always say that it will not be constrained by the ratification of an international treaty for the abolition of nuclear weapons. But there is a precedent that should make French authorities think. This is the *Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water* that France has not signed. This treaty is

known as the *Partial Test Ban Treaty* (PTBT). It was started in 1963. Faced with the fear of international trials France has, however, stopped its nuclear tests in the atmosphere. In concrete terms, the peace activists strategy of change on a global scale aims to force countries like France, which possesses nuclear weapons, to sign the Nuclear Weapon Ban Treaty (NWBT).

Real concern over plans for the militarization of space

Is France preparing to violate the universal principle that prohibits the militarization of space?[9] Florence Parly, Minister of the Armed Forces, would justify such violations following alleged spying against a French military intelligence satellite revealed in September 2018. Is France following in the footsteps of the US, which has just created its sixth army corps dedicated to the militarization of space? Parly declared on 9 September, 2018, that "my objective is not to make war in space", but to "protect ourselves". In September 2018, President Emmanuel Macron announced his intention for France to define "a defence space strategy". A Ministry of the Armed Forces working group was expected to make proposals on the subject by November 2018.

The US Administration's decision to create a space force is a dangerous precedent and the lifting of a taboo which calls into question the efforts of China and Russia in the ongoing negotiations on a treaty to prohibit weapons in space. It is essential that France does not follow the path of US policy in terms of space armament, but instead advances the draft treaty calling for the prohibition of weapons in space.

Conclusion and perspectives

The NWBT is already of great value in our campaigns against nuclear weapons. French involvement in space programmes with military connections makes it important to establish a real debate on the need to preserve peace in space. Initiatives against the militarization of space are an essential means of winning the battle of opinion to oppose French militarization programmes in space, and to advance the cause of space as a zone of peace, making France an example for other countries.

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Armed robots, autonomous weapons and ethical issues

Pere Brunet

Robotic military systems: Algorithms, automation, deep learning and autonomy

Robots are programmable or self-controlling machines that can perform complex tasks automatically, usually using sensors to analyze their environment. The concept of robotic military systems arises when these robots are used in the military. Fully-automated lethal autonomous weapon systems are known as LAWS.

Many robotic military systems are now automated in some sense. Automation algorithms can be found in their geo-location and driving systems, in the control of their sensors, actuators and weapons, in their health management, but also in targeting, deciding and attack processes. Algorithms, in turn, can be reliable, heuristic or massively heuristic. We have examples of all of them also in our daily life. The problem with autonomous, machine-learning based systems (LAWS but also non-military systems) is that they are massively heuristic algorithms, based on hundreds of millions of parameters. It is well-known that they have a guaranteed probability of failure, as published in scientific journals. They use obscure algorithms which also tend to suffer the consequences of cultural data biases.

Insofar as artificial intelligence (AI) is fuelled by data, AI-based weapons inherit some of its ethical challenges from the debate on data governance, especially consent, ownership and privacy. Also, AI-based weapons, as other AI-based systems, are not reliable and data sensitive. Moreover, humans should be able to understand and explain to third parties the

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whole decision process that is hidden in learning-based deep neural networks.

In Boulanin (2017) a weapons classification is proposed, based on the degree of human intervention: robotic weapons can be classified according to those requiring a human person in the decision circuit ("human in the loop"), those including some mechanism of human supervision ("human on the loop") and those that, being autonomous, do not require any human intervention ("human out of the loop") as is the case with LAWS. Robotic weapons that require a human person in the decision circuit are the most widespread. They include systems and drones with remote control such as the Terminator of Lockheed Martin (USA), the SkyStriker of Elbit Systems (Israel), the Warmate of WB Electronics (Poland), the XQ-06 Fi of Karal Defense (Turkey), the CH-901 from China and many others. Some of them are already used in surveillance, control and attack tasks on people at borders, such as Super aEgis II in the demilitarized zone between the two Koreas. Use in surveillance functions in walls and borders is increasingly widespread. In any case, there is currently an important ethical debate (N. Sharkey) on the use of this type of system that require a human person in the decision circuit. While some authors defend the opportunity of its use, authors like Medea Benjamin consider that when military operations are carried out through the filter of a far-off video camera, the possibility of visual contact with the enemy disappears, decreasing the perception of the human cost of the possible attack. On the other hand, Markus Wagner explains that disconnection and distance creates an environment in which it is easier to commit atrocities. And, in any case, as Philip Alston indicates, "the use of drones to selectively kill out of concrete armed contexts, will almost never be legal". Also, Alex Leveringhaus says that the intentional or unintentional use of distance to obscure responsibility in situations of conflict in which weapons are used, indicates a profound lack of respect for the rights of persons, and by extension to the moral dignity of persons and individuals, since we all deserve equal consideration and respect. And Noel Sharkey refers to the automation bias of "human on the loop systems", which undermines their ethical support. International campaigns such as Stop Killer Robots are calling for a global ban on LAWS.

In this context, and as defended by Tony Jenkins, Kent Shifferd and others in the 2018-2019 report of World Beyond War, the prohibition of all militarized drones by all nations and groups would be a great step on the road to demilitarized safety.

A new scenario is arising where robotic weapons can be easily assembled from on-the-shelf components by almost any country or organization.

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An extended version of this document with more references and active links is available at: https://goo.gl/Wh9NRm

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Neurowar

Steven Rose

We are living in dark and uncertain times. A few years ago, it would have seemed that the most likely future wars would be asymmetric: technologically sophisticated and militarised States versus popular uprisings, insurgent movements and guerrillas of the sort that wrack the Middle East. However, Trump and Putin have torn up that rulebook, revoking or ignoring arms control treaties and initiating new forms of traditional great power arms races.

Meanwhile one of the oldest and hitherto sacrosanct of such treaties, that banning chemical and biological warfare, dating back to the 1920s, and in its modern forms ratified by almost all States on the planet (exceptions: Israel, Egypt, N Korea and S Sudan), has been systematically eroded. In Syria, the Assad regime, having surrendered its stock of modern agents, has reverted to one of the oldest chemical agents, chlorine.

In targeted assassinations around the world, Russia and Israel – and maybe others – have used newly created chemicals, such as upgraded nerve agents, so-called 'novichoks'. As the novichoks appear to have been first synthesized in Russia in response to classified documents leaked to them from the US as part of a convoluted false flag operation, it is a reasonable assumption that they are part of US chemical warfare preparations also.

So we see chemical warfare agents used in two roles, against civilian populations in asymmetric wars and in specific covert missions. The prohibitions against biological weapons seem still to be holding, at least in part because of the military uncertainty about the efficacy and control

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of disease-causing bacteria and viruses.

Meanwhile, the rapid technology-driven advances in neuroscience, in understanding and manipulating the brain, are being weaponised. It is noteworthy that the 4.5 billion dollar BRAIN program (Brain Research through Advancing Innovative Technologies) launched by President Obama in 2014 included a substantial sum allocated to DARPA (Defense Advanced Research Project Agency), whose military interest extends beyond just novel chemical and psychopharmacological agents to cognitive, behavioural and social neuroscience.

Beyond the novichoks research is active into both lethal and non-lethal psychochemicals. Potential lethal agents include not only natural toxins (like the ricin used against the dissident Bulgarian writer Georgi Markov) but also genetically engineered variants and the often rumoured but still probably fantasy ethnic weapons. The non-lethals (sometimes called riot control agents and available not just to the military but to police forces) include not only traditional and enhanced tear gasses like the British invented CS but newly synthesized substances.

Amongst those which have been or are being researched are both 'on the floor' and 'off the rocker' agents, incapacitating or calmatives like thiopental, sedatives and hypnotics, anxiolytics and convulsants, disorienting (hallucinogens), paralysing and anaesthetic agents like the opioids. In addition there is research into 'memory erasers' and 'trust inducers.' There are also drugs such as Ritalin and Modafinil widely used by the military to enhance cognition, attention and wakefulness among so-called 'war fighters' particularly pilots.

The rapid advances in IT and robotics are also leading to physical means of both enhancing and degrading brain processes in the interests of the military. DARPA funds research into direct brain-computer interfaces to assist and speed decision-making and intelligence gathering for flyers and drone pilots, as well of course as techniques to degrade the enemy. Long-standing interest in the use of microwave radiation at a distance to disorient an enemy and disrupt communication systems remains, reinforced by the potential of more powerful laser and magnetic technologies.

Closer at hand are the uses of these technologies as interrogation/surveillance and control techniques – 'mind reading' through EEG, MRI and MEG signals (so called 'brain fingerprinting') and disorientation/mind modification through transcranial magnetic stimulation and low frequency microwaves.

It is important to recognise that many of these developments are dual-use technologies, with civil and medical uses, often pioneered by the

military in the effort to treat the frequent mental and physical scars of the past decades of imperial and neo-colonial wars amongst the veterans. These include both immediate and slowly manifesting brain damage from improvised explosive devices (IEDs) and the like, and post-traumatic stress disorder (PTSD) from the horrors of fighting as an occupying power in other people's countries. Such multiple actual and potential uses make the possibility of effective arms control measures, even were the international environment for such treaties more conducive, particularly problematic.

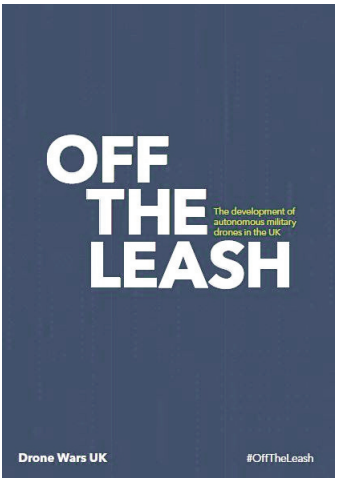
* * *

The Russell Committee Against Chemical Weapons launched an appeal entitled 'Oppose a New Chemical Arms Race' in 1982. The appeal called on scientists and technicians not to participate in the production of chemical weapons; for the UK government to forgo the stockpiling and production of such weapons; and for the continued participation in treaty negotiations to prohibit chemical weapons. Steven Rose was an initial signatory of the appeal, which was published as a Spokesman Pamphlet.

Off the Leash

The development of autonomous military drones in the UK

Drone Wars UK



Drone Wars UK works towards an international ban on the use of armed drones.

Unmanned Aerial Vehicles (UAVs), commonly known as drones, are likely to be the military system which develops into the first truly autonomous weapons systems. Powered by advances in artificial intelligence (AI), machine learning, and computing, we are likely to see the development not only of drones that are able to fly themselves – staying aloft for extended periods – but those which may also be able to select, identify, and destroy targets without human intervention. In many ways, the increasing use of remote controlled, armed drones can be seen as a kind of 'halfway house' towards the development of truly autonomous weapon systems. The incremental way in which drone technology is developing, and the ability to 'bolt on' new features, means that drones are ideally suited to morph into autonomous weapon systems.

This study looks at current initiatives which are under way in the UK to marry developments in autonomy with military drone technology, examines the risks arising from the weaponisation of such systems, and reviews government policy in this area. Autonomous weapon systems are defined using the definition proposed by International Committee of the Red Cross (ICRC) as: "Any weapon system with autonomy in its critical functions – that is, a weapon system that can select and attack targets without human intervention."

Two separate uses for AI and autonomous technology are becoming increasingly important in the military world. Firstly, autonomous systems can be used to process and analyse large amounts of raw intelligence information in order to

find targets. Secondly, AI can be incorporated into the weapons themselves as well as to execute operational missions. The extent to which autonomy within a drone raises concerns will depend upon the level of human control over the targeting and launch of weapons and the use of force in general. Although existing armed drones have a degree of autonomy in some of their functions – for instance in relation to flight control – at present human control is maintained over the use of force, and so today's armed drones do not qualify as fully autonomous weapons. Many question whether systems with the capability to make autonomous targeting decisions would be able to comply with the laws of war.

Our research has found that a number of public organisations, private companies, and government agencies in the UK are involved in undertaking research and development work into autonomous technology, AI and drones. The Ministry of Defence (MoD) sees autonomous technology and data science as "key enablers" for the future, and the Defence Science and Technology Laboratory (DSTL) and its Defence and Security Accelerator programme have extensive research programmes in this field.

The Engineering and Physical Sciences Research Council (EPSEC), too, is a significant funder of research in these areas and a number of universities are working on autonomous technology programmes with military applications, often in collaboration with private sector military contractors.

Investment and innovation in artificial intelligence is being led by the civil sector and not by the world's militaries. Autonomous technologies, originating in the civil sector but adapted for military applications, are likely to become key components of the autonomous drones and weapons of the future. Military planners are aware of the civil sector's lead in developing artificial intelligence and autonomous systems and are keen to have a slice of the cake.

Although the military technology research sector is smaller than its civil counterpart and has fewer resources, it is in a position to adapt existing military systems and is adept at anticipating military needs and pursuing military contracts. The Ministry of Defence's favoured contractors for work on drones and autonomous systems appear to be BAE Systems, QinetiQ, and the Thales Group. BAE Systems, for example, has built 'Taranis', an advanced prototype autonomous stealth drone.

Current Ministry of Defence policy states that the UK opposes the development of autonomous weapon systems and has no intention of developing them. However, the Ministry of Defence has been accused of a sleight of hand here by defining autonomous weapons systems differently

from other governments and institutions. Although the UK states that it has "no intention" of developing such systems, this does not sit comfortably alongside endorsements for autonomous weapons from senior members of the UK armed forces. The claim that "the UK opposes the development of armed autonomous systems" also appears to be at odds with the evidence. Since 2015, the UK has declined to support moves at the United Nations Convention on Certain Conventional Weapons aimed at banning autonomous weapon systems.

As a nation which considers itself a responsible and leading member of the international community, the United Kingdom has a duty to use its influence and powers to ensure that the weapons of the future are never used outside boundaries set by the laws of humanity and the requirements of the public conscience. Our recommendations are summarised as:

- The UK should support the introduction of a legal instrument to prevent the development, acquisition, deployment, and use of fully autonomous weapons.
- The UK should make an unequivocal statement that it is unacceptable for machines to control, determine, or decide upon the application of force in armed conflict and give a binding political commitment that the UK would never use fully autonomous weapon systems.
- The UK should introduce measures to ensure that human control must be exerted over all attacks in armed conflict.
- The government should realign the UK's definition of autonomous weapons to be the same, or similar, as that used by the rest of the world.
- The government should publish an annual report identifying research it has funded in the area of military autonomous technology and artificial intelligence.
- MPs and Peers should investigate the impact of emerging military technologies, including autonomy and artificial intelligence, and press the government to adopt an ethical framework.
- The government should fund a wide-ranging study into the use of artificial intelligence to support conflict resolution and promote sustainable security.
- The government should initiate a broader public debate on the ethics and future use of artificial intelligence and autonomous technologies, particularly their military applications.

A full copy of the report can be downloaded from:
https://dronewars.net/2018/11/10/off-the-leash-autonomous-drones/

Military-university collaborations in the UK

Stuart Parkinson

There is a long history of military involvement with UK universities. This involvement began to change after the end of the Cold War – and especially in the early 2000s – as the government started to privatise its research laboratories, leading to a more commercial environment for military-university collaborations. During this time numerous new 'partnerships' were founded involving the universities and the Ministry of Defence (MoD) and/or major arms corporations, such as BAE Systems and Rolls-Royce. These schemes have evolved in the years since, but official enthusiasm for university-military collaboration continues, and some government advisors are actively pushing for it to be expanded.

Every university?

There have been several studies of military involvement in UK universities over the past decade – the most detailed being led by Scientists for Global Responsibility (SGR),[1,2,3] Campaign Against Arms Trade (CAAT),[4,5] and the Nuclear Information Service (NIS).[6] These studies have examined a range of public and private-funded research and teaching programmes involving military interests in 59 universities across the UK – nearly half the total number.

All but one of the universities examined have received at least some military funding since 2000 – be it from the UK Ministry of Defence (or one of its research laboratories), a UK arms company, or an overseas military source. Based on these studies, it is reasonable to conclude that the

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overwhelming majority of UK universities have at least some links to military interests – and some universities have extensive links.

How much military funding?

Using the Freedom of Information Act, several of the studies listed above were able to obtain specific information on funding levels at individual universities, although the data has been patchy due to incomplete record-keeping or, in some cases, outright obstruction by university administrators. Universities which have tended to receive the highest levels of military funding include Cambridge, Cranfield, Imperial College London, Oxford and Sheffield.

As an example of the levels of funding per university, a 2012 study[7] found that 17 of the UK's leading research universities received a total of over £83 million (about $140m) over the three years up until 2011. The amounts provided to each university varied from £15.2m for Imperial College London down to £67,000 for Durham University. Six other universities – Birmingham, Glasgow, Liverpool, University College London, Manchester and Warwick – refused or were unable to provide data on their military collaborations. This lack of transparency is especially poor for publicly-funded universities.

From this data, the average military funding per university per year for the period 2008-2011 can be estimated to be around £1.5m ($2.4m). This level is somewhat lower than the £2.1-2.2m found in previous reports by SGR and CAAT,[8] but given variations in the methodologies of the different studies and uncertainties in the data, it is not too dissimilar.

A 2014 study[9] looked specifically at funding from the Atomic Weapons Establishment (AWE), which develops, manufactures and maintains the UK's nuclear warheads. Disturbingly, it found that over 50 UK universities received AWE funding during the period 2010-12. Furthermore, five of these universities – Bristol, Cambridge, Cranfield, Heriot-Watt and Imperial College London – had formed a 'strategic alliance' with AWE, receiving a total of £15m (about $24m) over the period.

Where does the funding come from?

Military funding for UK universities is provided by:

1. UK government military organisations – principally, the Defence Science and Technology Laboratories and the Atomic Weapons Establishment;
2. major arms companies, both UK and overseas – such as BAE

Systems, Rolls-Royce, Boeing, and Lockheed Martin; and

3. other overseas organisations – such as the US Department of Defense.

The funding levels of the first two groups have been investigated more deeply than the third in the six studies listed earlier. Also of note is that academic funders – such as the Engineering and Physical Sciences Research Council (EPSRC) – co-fund numerous research projects with military funders.

What is the funding used for?

Funding from military sources at UK universities tends to be concentrated in engineering departments – covering aerospace, civil, electrical, electronic, marine, mechanical and chemical – with computing, physics, maths and chemistry departments also receiving significant amounts.[10] The research funded tends to be mainly applied work, although basic research is also funded. It is claimed[11] that in general the work is not classified, as secret work is carried out in government or industry laboratories.

The SGR, CAAT and NIS studies provide numerous examples of the research funded by military interests. For instance, one large research programme was FLAVIIR,[12] jointly funded by BAE Systems and the EPSRC, to investigate the aerodynamics of unmanned aerial vehicles ('drones'). Total funding was over £6m and it involved ten universities including Cranfield, Cambridge, Imperial College London, Manchester and Southampton. Another example is the Institute of Shock Physics (ISP), a multi-million pound research centre at Imperial College London part-funded by AWE.[13] The ISP researches the physics of shock waves, high velocity collisions, and heat and pressure extremes. This can help improve the understanding of nuclear and conventional explosions, but it can also be useful in understanding earthquakes and extreme weather events.

Justifications?

UK universities that receive funding from military sources generally justify their actions using one of more of the following arguments:

1. The funding is only a small percentage of the university's total funding, so it has little effect on its overall research agenda.
2. The military-funded projects benefit Britain's national security.
3. The funding is for research that has a number of applications, both military and civilian.

But do these arguments stand up to scrutiny? For claim (1), it has to be

remembered that the military funding is targeted on particular departments, especially engineering and computer science. In some university departments, the military funding can represent a large proportion of the annual budget and so this can shape the research priorities of that department – gearing them towards a more militaristic agenda. It also important to bear in mind that even small amounts of funding can be influential within a university department, creating sympathy for the funders' perspective – something which is especially important for companies with controversial ethical records.

Regarding claim (2), about Britain's national security, it should be remembered that the arms corporations that fund university R&D are generally major exporters. Official documents[14] have shown how UK military equipment has been exported to governments with poor human rights records – including those which brutally suppressed protests during the Arab uprisings in 2011, such as Libya, Bahrain and Saudi Arabia. It is therefore very suspect to claim that a given piece of military research will necessarily be good for Britain's security.

Regarding claim (3), concerning 'dual-use' technologies, it is certainly true that to say that research can lead to a number of applications. However, if key funding is provided by a military organisation, then it is much more likely that the application will be for military purposes.

UK funding for military R&D

Of course, behind the military funding for universities is the much larger question of military funding for research and development as a whole. By far the biggest recipients of this funding are the R&D labs within industry. Most military science and technology funding in the UK comes from the Ministry of Defence, and most of this goes directly to arms companies, with much of the remainder going to the publicly-owned Defence Science and Technology Laboratory.

In the UK, the latest official statistics show that public funding for military R&D in 2012 amounted to approximately £1,460 million.[15] While this is a very large figure, the good news is that the level of this funding has been falling for much of the last 25 years.[16] In contrast, in the last decade, public funding for civilian R&D has grown significantly, meaning that military R&D funding has fallen to 16% of the total public spending on R&D rather than around 50% at the height of the Cold War.

However, there is still a lot to be concerned about. To begin with, recent government policy has been aiming to reverse at least some of the fall in

post-Cold War spending. The first evidence of this is a rise of over £150m in government military R&D spending between 2011 and 2012, while public civilian R&D budgets were cut by a similar amount.[17] The second is the increase in spending on civilian R&D on 'security technologies' – which includes crowd control and surveillance, as well as cyber security. The military is in a strong position to make use of such technologies for supporting its own activities. The third concern is the increasing pressure on universities to take military funding. One particularly worrying development is the recent call from the Defence Scientific Advisory Council for the Ministry of Defence to fund more 'opportunity-led' research in universities.[18]

So the military influence on UK universities – and science and technology more broadly – remains powerful. Groups such as SGR and CAAT – especially through its universities network[19] – are very important in helping to keep up the resistance to this influence.

Notes

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Doomsday Clock 2019

'A new abnormal'

It is still two minutes to midnight

On 24 January 2019 the *Bulletin of the Atomic Scientists* announced that the 'Doomsday Clock', first set in 1947, remained at two minutes to midnight. They write:

'Humanity now faces two simultaneous existential threats, either of which would be cause for extreme concern and immediate attention. These major threats — nuclear weapons and climate change — were exacerbated this past year by the increased use of information warfare to undermine democracy around the world, amplifying risk from these and other threats and putting the future of civilization in extraordinary danger.'

The full statement can be accessed at **thebulletin.org**

Engaging with scientists and engineers

Lucas Wirl

Albert Einstein stated that "one cannot simultaneously prevent and prepare for war" and that he "would rather be torn to shreds than be part of so base an action! It is my conviction that killing under the cloak of war is nothing but an act of murder." Today, scientists who strongly despise war and strongly speak out against it or strongly engage in strengthening peace are not publicly visible.

Science in a neoliberal society

To engage scientists and engineers in a discussion about 'real security' one has to examine the environment in which they work. Science is part of society and, as such, it is heavily exposed to the driving force of society, namely the capitalist system.

The economization of science in Europe was significantly determined by the Bologna Process, under the pretense of securing the comparability in standards and 'quality' of higher education qualifications. On the Bologna Process, Chris Lorenz of the University of Amsterdam pointed out that higher education's "new proponents represent universities as 'enterprises' and academics as 'entrepreneurs'.

Simultaneously, real entrepreneurs are now represented as the evident 'stakeholders' of the universities, and entitled to determine its course directly … [T]he domain of knowledge production is economized: *homo academicus* is now modeled after *homo economicus*."[1] This represents a paradigm shift in science whereby universities have been subjugated by neoliberal concepts: precarious

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employment, dependency on third party funding, fixation on tech-fixes, economic competition between scientists and scientific institutions, management mentality and entrepreneurship, and a valorization of scientific knowledge.

Currently, the economization of science can be seen by efforts to replace the precautionary principle[2] with an innovation principle. The precautionary principle states that if an action or policy has a suspected risk of causing harm to the public, or to the environment, in the absence of scientific consensus that the action or policy is not harmful, the burden of proof that it is not harmful falls on those taking the action. Opponents of the precautionary principle aim at replacing or at least introducing the innovation principle alongside it.[3] They argue that the innovative benefits of the introduction of a new technology have to be accounted for and balanced with the harm it may do. While the precautionary approach is based on scientific knowledge's soundness and foresight of application, the innovation principle is based on the political slogan that economic growth promotes prosperity.[4]

In his speech on the military-industrial complex, Dwight D. Eisenhower warned: "we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military-industrial complex. The potential for the disastrous rise of misplaced power exists and will persist."[5] He continued: "The prospect of domination of the nation's scholars by Federal employment, project allocations, and the power of money is ever present and is gravely to be regarded. Yet, in holding scientific research and discovery in respect, as we should, we must also be alert to the equal and opposite danger that public policy could itself become the captive of a scientific-technological elite."[6]

Eisenhower understood the dynamics of technology and industry interests and their power on politics and society. Today more than 70% of all electrical and mechanical engineering research in the USA is paid for by the Department of Defense[7] and the Group of Personalities on Defence Research managed to set up a preparatory action for a European Defence Action Plan of the European Union which has a budget of 30 billion Euros until 2027.[8] It was introduced by the EU Commission as follows: "For the first time, the Commission is now tabling a European Defence Action Plan which focuses on capability needs and supports the European defence industry."[9]

Economic interests, even of one sector of economy, hold a grip on science and political agenda setting today. The economization of science massively undermines freedom of science and democratic processes in the scientific community and between the scientific community and society.

Science serves the economy and not the people or the planet. It is guided by profit maximization and not by serving the common good. In this environment it is difficult – yet not impossible – to work towards human and environmental security.

How to engage scientists and engineers

Even though there is massive economic pressure and interest in science there are many alternatives to industry-guided science and military research.

Responsibility of Science
Since the Manhattan project there have been vivid examples of scientists taking responsibility for peace. Joseph Rotblat left the Manhattan Project, Bertrand Russell and Albert Einstein released the *Russell-Einstein Manifesto* warning of the potential destructive power of scientific knowledge, the Pugwash movement, and the scientists' initiatives in the Nuclear Freeze and simultaneous European movements. The tradition of scientists taking responsibility, speaking out and acting against their own creations can be built on. Scientists connect with civil society and speak out against killer robots[10] or against the EU's Defence Action Plan.[11] Individual scientists occasionally take up individual responsibility by blowing the whistle and speaking out against wrongdoings in research and development, Subrata Ghoshroy[12] for example. Google staff wrote an open letter demanding a stop to engagement in "Project Maven",[13] a project in cooperation with the Department of Defense on machine learning for military purpose – collective whistleblowing. Joseph Rotblat renewed the idea of a Hippocratic oath for scientists[14] in 1999. The American Association for the Advancement of Science even identified 16 scientific oaths asking: "Should there be an oath for scientists and engineers?".[15]

Civil Clauses
In addition to an individual responsibility there should also be structural responsibility. Academic institutions should adopt legally binding texts forbidding military research. In Japan and Germany these are so-called Civil Clauses. Initially a voluntary commitment by academic institutions to engage exclusively in civil (non-military) research, Civil Clauses were introduced after World War II. In Germany the Civil Clause has had a revival over the last 10 years and more than 50 universities have introduced them into their basic constitutions.[16] Personal and structural commitments for research and teaching for peace are tools to engage with

students and university staff and start a democratic process about what science is for and what science should and shouldn't do.

Conversion

"Swords into Ploughshares" is an idea as old as the Bible and more important than ever. We are seeing the beginning of a new spiral of armaments, new heights of military spending, and are discussing newly emerging weapons technologies. Germany has experiences in the field of conversion of military bases from the Cold War era. Military bases of the allied forces were abandoned over the last decades. Politicians, civil society, and scientists developed projects to convert these military bases for civilian use. Science parks, housing projects, nature reserves, or airports were created.

But how do you convert research and development from military into civilian use? You may shift resources to research areas which are important to peace and are under-funded. To name a few: relationship of conflict and climate change and vice versa; scientific analysis and research on conversion of military infrastructure and military industry, migration and the right to stay; role of the military in conversion processes; conflict prevention mechanisms; impact of sanctions on war and peace; saving biodiversity; feeding the world; effective verification instruments for arms control in new areas such as autonomous killer robots; scientific analysis on the dissolution of NATO. The list could easily be continued.

Scientific priorities need to be adjusted and thus money for research and development needs to be shifted from military projects and 'light house' projects to those facing the challenges of the 21st century. For this a deep breath and broad cooperation among different actors is needed to create the grounds for political change. A step in the right direction is the German Advisory Council on Global Change's series of reports on *A world in transition*[17], in which transformative steps towards a more peaceful, just, and sustainable world are being analyzed. Their flagship report *World in Transition – A Social Contract for Sustainability*[18] gives food for thought and offers steps towards a more sustainable and peaceful world. Nevertheless, direct peace issues are not sufficiently represented.

International exchange

There needs to be increased contact and exchanges between the scientific community and, in particular, the critical scientists' organizations and citizens interested in scientific impact on military research and on how to overcome it.

Notes

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