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Armchair Warfare 'on Terrorism'.
On Robots, Targeted Assassinations and Strategic Violations of International Humanitarian Law

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Abstract
In the 21st century, militaries are not competing for military dominance through specific superior weapon systems alone but also through networking these systems via information and communication technologies. The „Revolution in Military Affairs" (RMA) relies on network centric warfare, „precision" weaponry and „intelligent" systems such as uninhabited, modular, globally connected robot systems. While some Western forces (and the U.S. Central Intelligence Service C.I.A.) claim that robots help to avoid the death of one"s soldiers (respectively agents), NGOs point out the increase of killed civilians. In my paper, I discuss the deployment of uninhabited combat aerial vehicles (UCAV) in Western „wars on terror" and their political and techno-ethical consequences. The question arises whether the new military philosophy, network centric (armchair) warfare, targeted assassinations and robot technology work towards the weakening of international humanitarian law.

Keywords:
Robot, Uninhabited Aerial Combat Vehicle (UCAV), International Law / International Humanitarian Law, Civilians / Killing of Civilians, Revolution in Military Affairs, war „on terror", targeted assassination / targeted killing, military philosophy

Introduction

In the 21st century, militaries are not competing for military dominance through specific superior weapon systems alone but also through networking these systems with the help of information and communication technologies (Kaufmann, 2006). In the course of the „Revolution in Military Affairs", concepts of network centric warfare, transparent battle space, a logic of precision strikes with autonomous resp. „intelligent" systems and munitions are becoming dominant in western warfare. In the configuration of high-tech militaries, robotic systems play a decisive role. Uninhabited, modular, globally connected, and tele-operated as well as increasingly autonomous, multi-mission systems are regarded as crucial means of warfare. They are faster, cheaper and supposedly more adaptable systems which are claimed to help avoid the death of one"s soldiers and cope with non-conventional/asymmetric wars. Rarely anybody considers that armchair warfare with tele-operated robots firing missiles from thousands kilometres away from the battlefield has severe consequences with regard to human rights and mirrors problematic changes in recent military philosophy. However, robotic precision weaponry such as uninhabited aerial combat vehicles (UCAVs) not only poses a permanent threat for local populations in everyday life, but leads to an increase of the

number of killed civilians (Münkler 2002). The „revolution in military affairs" (RMA) as well as the invention of network centric warfare seem to come with a new military philosophy that works towards the weakening of human rights standards in laws of war and rules of engagement which could in the long run endanger international humanitarian law.
In my paper, I will discuss the deployment of uninhabited combat aerial vehicles (UCAV) and their political, sociocultural and technoethical consequences.

Killer Robots Targeting Civilians?

Today, UCAVs are deployed by the US and the NATO militaries in the war in Afghanistan, Iraq and Pakistan, and by the Israel military for targeted killings in Palestinian occupied territories. The deployment of new robotic technologies for aerial attacks intensified massively in the last years (Cordesman, 2008; Fischer, 2008; Singer, 2009; Weber, 2009) and the number of killed civilians is rising (UN News Center 2009). Especially interesting is also the deployment of US drones in Pakistan, where not only the military but also the C.I.A. operates uninhabited combat aerial vehicles: "it represents a radically new and geographically unbounded use of state-sanctioned lethal force. And, because of the C.I.A. program's secrecy, there is no visible system of accountability in place, despite the fact that the agency has killed many civilians inside a politically fragile, nuclear-armed country with which the U.S. is not at war." (Mayer 2009, 39)
Estimates of killed civilians differ widely. According to the survey of Peter Bergen and Katherine Thiedemann from the think tank „The New America Foundation" 82 drone attacks were undertaken in Pakistan between January 2006 and mid October 2009 in which between 750 – 1000 people were killed. Bergen and Thiedemann (2009) estimate that 250 – 320 of these had been civilians (31-33%). „The News" – a Pakistani newspaper – reported in April 2009: "Of the 60 cross-border predator strikes carried out by the Afghanistan-based American drones in Pakistan between January 14, 2006 and April 8, 2009, only 10 were able to hit their actual targets, killing 14 wanted al-Qaeda leaders, besides perishing 687 innocent Pakistani civilians." (Mir 2009, np). There are diverse counts of killed civilians in Pakistan as official numbers are not available and Pakistan"s tribal areas have become largely forbidden terrain for media organizations.
The number of US air strikes in Iraq rose from 285 to 1119 (per year) between 2004 und 2007 and from 6495 to 12,775 in Afghanistan. As the number of flying hours of uninhabited combat aerial vehicles (UCAVs) tripled between 2003 und 2007, while the number of surveillance flights in Iraq and Afghanistan rose only very slightly, it is very likely that air attacks by UCAVs in Afghanistan and Iraq also massively increased lately (see also Cordesman 2008, Rötzer 2008).
A study on the weapons that killed civilians in the Iraq war from 2003-2008 (using the detailed and extensive data base of Iraq Body Count) published in the internationally renowned *New England Journal of Medicine* states: "*Female Iraqis and Iraqi children constituted the highest proportions of civilian victims when the methods of violence involved indiscriminate weapons fired from a distance: air attacks* and mortars. That air attacks, whether involving bombs or missiles, killed relatively high proportions of female civilians and children is additional evidence in support of the argument that these weapons, …, should not be directed at civilian areas because of their indiscriminate nature." (Hsiao-Rei Hicks et al. 2009, 1587; my emphasis)

With regard to the deployment of UCAVs in the Palestinian occupied territories, Guardian reporter Clancy Chassay states: “During the [Israeli] 23-day offensive, 1,380 Palestinians perished, 431 of them children, according to figures published by the World Health Organisation. A Guardian investigation into the high number of civilian deaths has found Israel using a variety of weapons in illegal ways. Indiscriminate munitions, including shells packed with white phosphorus, were fired into densely populated areas, while precision missiles and tanks shells were fired into civilian homes. *But it is the use of drones in the killing of at least 48 civilians that appears most reprehensible. The drones are operated from a remote position, usually outside the combat zone. They use optics that are able to see the details of a man's clothing and are fitted with pinpoint accurate missiles. Yet they killed Mounir's family sitting in their courtyard, a group of girls and women in an empty street, two small children in a field, and many others*. … The attack on this home in Gaza City is just one of more than a dozen incidents recorded by Amnesty International where Israel's unmanned aerial vehicles (UAVs) – or drones – killed one or more civilians.*”* (Chassay 2009; my emphasis; see also Human Rights Watch 2009)

Trying to explain the increasing killing of civilians in western war „on terror‟, some theorists point to the aggressive Israeli or US conduct of war as responsible , while others claim a broader and problematic shift in military philosophy. For example, the former head of the International Law Division (ILD) of the Israeli Army, Colonel Daniel Reisner, conceded – according to the already mentioned report in The Guardian – that ILD is “pushing the boundaries of what is acceptable in war. „What we are seeing now is a revision of international law," Reisner said. "If you do something for long enough, the world will accept it. The whole of international law is now based on the notion that an act that is forbidden today becomes permissible if executed by enough countries. International law progresses through violations. We invented the targeted assassination thesis and we had to push it."
(Chassay 2009; my emphasis)
Targeted assassinations of terrorist suspects without juridical investigations are especially easy to conduct with the help of UCAV technology. These assassinations are frequently conducted in the Western war „on terror‟ – not only in Palestine Occupied territories but in Afghanistan, Pakistan and Iraq. They undermine international law and human rights issues and come with a reconfiguration of military philosophy in the course of the Revolution in Military Affairs. While some philosophers, peace researchers, military personnel and roboticists discuss the ethical consequences of combat robots and problems of arms control (Altmann 2009, Arkin 2007, 2008, Asaro 2008, Blackmore 2005, Capurro / Nagenborg 2009,
Cerqui / Weber / Weber 2006 ; Lin et al. 2009, Singer 2009, Sharkey 2007, Sparrow 2007, Tamburrini 2009, Weber 2009), the complex of RMA, high-tech weaponry and the
weakening or „revision‟ of international humanitarian law is still rarely discussed.[Finn 2008,, Zwanenburg et al. 2005). Only recently Philip Alston, the UN Special Rapporteur on extrajudicial, summary or arbitrary executions critisized in a report to the US government the increasing usage of CIA drones for attacks in Pakistan and asked whether they are compatible with international humanitarian law (Alston 2009)
Given the biased character of western media coverage of U.S. / NATO and Israeli wars „on terror‟, adequate public attention and discussion of the juridical, ethical and sociocultural problems of these wars are missing.

A Short History of Western UCAV Technology

In 2001 when military technology boomed massively, the US Congress decided that the armed forces should develop remote control techniques so that in 2010 one third of the attack aircraft and in 2015 one third of the ground combat vehicles can be operated uninhabited. Today, 50 countries all over the world are working on the development of uninhabited systems (Altmann 2009). At the same time, uninhabited systems, which were used before for surveillance only, got armed with air-to-ground and air-to-air missiles (Weber 2009). In 2007 the first unmanned combat aircraft wing, the 432nd Wing of the U.S. Air Force, had its first inauguration, operating the MQ-1 Predator and MQ-9 Reaper drones from their basis in the United States (Hanley 2007).

The second biggest developer of UCAVs is Israel. Israel deployed UCAVs from the Hermes series (Elbit Systems Ltd.) in 2006 in the war against Lebanon, but also for surveillance, targeted killings and war operations in the West Bank and the Gaza strip. The Israeli Air Force also has its own UAV squadron, equipped with Hermes 450s.

Today, uninhabited aerial vehicles for surveillance as well as combat are extensively used in NATO and military operations and are regularly deployed and used by the U.S. Forces in the Afghanistan and Iraq wars (Barry/Zimet 2001; Sparrow 2007, Weber 2009)

Recently, the Department of Defense (2009) released its twenty five year research plan for military robots, the „Unmanned Systems Integrated Roadmap 2009-2034", for which expenditures of $21 billion are foreseen for the first five years of research.

The development in military robotics in Europe is immensely influenced by the US Forces. Now, the air forces of the U.K., Italy, Germany and some other European countries deploy uninhabited aerial vehicles but also develop first prototypes of uninhabited combat aerial vehicles[1]. Uninhabited aerial vehicles are the majority of already existing military robots (Sparrow 2007). More than 250 types are already in service or market-ready.(van Blyenburgh 2008). "At present, more than 50 countries develop or produce UAVs. Armed UAVs are possessed by the USA (Predator, Sky Warrior, Hunter, Reaper), Israel (Harpy, CUTLASS), Iran (Ababil-T). Unmanned combat air vehicles (UCAVs) proper are in development in the USA (UCAS-D); Great Britain (Corax), France (nEuron, with partner countries [Greece, Italy, Sweden, Spain and Switzerland]), Germany (Barracuda), and Russia (Skat) (Jane"s 2007). One need not be a prophet to predict that other producers of military aircraft and UAVs, e.g. China, India, Pakistan, Brazil will put weapons on UAVs or develop full-blown UCAVs, also for export." (Altmann 2009, 72) UCAVs are predicted to be the future of military aircraft (Sparrow 2007).

A Vaccuum? STS and Technoethics of Military R&D

A discussion of uninhabited military systems (UMS) in general and especially of Uninhabited Combat Aerial Vehicles (UCAVs) is urgently needed from a technoethics and science and technology studies (STS) perspective: Not the least because "in-depth technology assessment

[1] It is probable the case today that aerial vehicles can easily be switched from the remote control mode to one of full autonomy. Full autonomy means either that route and target details are pre-programmed and the assassination is conducted without the help of human operators or that UCAVs are provided with software that enables the system to search a given space for valuable targets and „decides" on possible lethal attacks on the basis of its program (see chapter on „Autonomous Killer Drones?").

of military uses of cognitive science and IT, and studies of preventive arms control are missing. Due to its time urgency, in particular the area of autonomous combat systems should be investigated." (Altmann 2006?).

The social pervasiveness and technoethical problem that come with the robots are immense: With regard to arms control, peace studies expert Juergen Altmann points out that "[t]he history of technological arms races, in particular the Cold War, shows many examples where after one side had introduced a military innovation, potential opponents followed suit after only a few years. In many such cases, *the mutual threat had increased, warning and reaction times had decreased, and stability was reduced*. In those few cases where such developments could be reversed, it took many years for negotiations to begin and many more to come to a treaty." (Altmann 2009, 71; my emphasis) In the introduction I pointed out that UCAVs increased the number of killed civilians in the so-called war on terrorism (Boes 2006, Rötzer 2007a, 2007b, Sparrow 2007, Weber 2009). It is also the question whether the increased usage of UCAVs – which makes targeted assassinations a relatively safe „business" – lead to the undermining of international humanitarian law.

The Technology of Uninhabited Air Vehicles (UAVs)

Uninhabited Combat Air Vehicles are aircraft which can be operated by remote control or autonomously.. UCAVs consist of three components: an airplane with sensors and weapon systems, a ground control station from which it is tele-operated and a communication infrastructure such as radio communication or satellite link. As Altmann points out, „flight control is done by on-board processing, but general directions and in particular attack decisions are given by remote control, often via satellite link from hundreds to many thousands of kilometres away." (Altmann 2009, 69). As an integral part of network centric warfare, UCAV video images are transferred to ground troops, helicopters or ground vehicles. For example, the MQ-9 Reaper of the U.S. forces is an up-graded and enlarged version of the UCAV MQ-1 Predator, with 11 meters length and 20 meters wingspan. Possible payload mass is 1702 kg. The MQ-9 Reaper is capable of 14 hours non-stop flying – the traditional jet fighter-bomber F-16 is capable of 2-3 hours flying but at much faster speed. MQ-9"s maximum speed is 400 km/h, service ceiling is 15,000 meters. Most of these UCAVs are guided from bases in the United States – thousands of kilometres away. Only the take-offs and landings are operated from Afghan or Iraq bases. One Reaper system (a ground station and 4 planes) costs about 69 million dollars. The tactical aim of UCAVs is described by the military to threaten the local population as well as to hold a huge amount of ammunition on call for short-notice strikes. They are used for targeted killing missions and „precision attacks" and thereby combine surveillance and combat tasks.

The „Unmanned Systems Roadmap" of the U.S. Department of Defense states that the latest US wars have been a most welcome test bed for the weapon technologies for engineers and military strategists and that they support further development and fund raising "For defenserelated unmanned systems, the series of regional conflicts in which the United States has been engaged since the end of the Cold War has served to introduce and expand the capabilities of unmanned systems technology to war fighters. *This conflict-driven demand has ensured the technology's evolution and continued funding, with each new conflict reinforcing the interest in such systems.* Global Hawk owes its appearance over Afghanistan to the performance of Predator over Bosnia and Kosovo, which in turn owes its start to the record

establishes by Pioneer in the Persian Gulf War." (Department of Defense 2007, 47; my emphasis).

Tele-Operated Combat Drones and International Humanitarian Law

Uninhabited aerial combat systems are advocated by the military because of their efficiency, speed and low costs. Another advantage is seen in the possibility to spare or save the lives of one‟s own soldiers and to more efficiently kill insurgents (Barry/Zimit 2001, Arkin 2007, Asaro 2008, Lin et al. 2009).

While *tele-operated systems* today can supposedly distinguish reliably between soldiers, surrendering soldiers and civilians (Altmann 2003, Boes 2005, Sparrow 2007, Weber 2009), some also argue that *future autonomous systems* may even be able to discriminate reliably between civilian and military targets, therefore using them might be morally superior to ordinary weapons – as well as human beings (Meilinger 2001, Arkin 2007).

But when you look closer at recent developments, the picture given by the military is turned upside down: With the excellent cameras of today‟s tele-operated systems it is possible to monitor the battlefield very closely. The already mentioned Guardian investigation quotes the report of the Israeli Major Gil, deputy commander of the first Israeli UAV squadron, in the online version of an Israeli Army magazine, where he describes drone attacks during the 23days Gaza offensive against .... "„We were able to monitor each of the soldiers at any minute and identify any threats to them," he said. He also *describes being able to clearly distinguish fighters from women and children and other civilians*: „When there were innocent people around, we would wait for the terrorist to leave the child and then hit him," he said. Lieutenant Tal, an operator and intelligence officer in the UAV squadron, describes the details the drone cameras can see. „We identified a terrorist that looked like an Israeli soldier. Our camera enabled us to see him very clearly. He was wearing a green parka jacket and was walking around with a huge radio that looked exactly like an army radio. It was very clear he wasn't a soldier." (Chassay 2009)

On the one hand, there is the obvious problem of a „correct" interpretation of the data and images – how does wearing an army radio indicate that someone who looks like a soldier is a terrorist? On the other hand – if there is no doubt that the (tele-)operator of a today‟s UCAV can easily differentiate between soldiers, surrendering soldiers and civilians, one has to wonder why the number of killed civilians permanently increased in the last years of Western wars „on terrorism" – especially with regard to air attacks. While Hsiao-Rei Hicks et al. 2009 argue that the indiscriminate nature of air attacks either with bombs or missiles causes civilians deaths, one could get the impression that UCAV and guided missiles– despite their discriminate nature - were used in the Gaza offensive for killing them on purpose. This might be an indicator of the weakening of the international humanitarian law in western wars „on terror".

At the same time, the highly sophisticated possibilities of UCAV technology might pose a seduction to today‟s armed forces to use it for eliminating „disobedient" or unwanted persons – let it be terrorists, surrendering enemies or civilians – exactly because it is a perfect means for remote-controlled killing which doesn't endanger one's own life. Controlling UCAVs from beyond the battlefield via computer game-like interfaces seems to lower the threshold of killing or even encourage a practice of of push-button killing.

Therefore, given these developments in western wars on terror in Palestine as well as in Afghanistan, Pakistan and Iraq, it is highly questionable that UCAV technology helps to reduce the killing of civilians. On the contrary, it seems that the usage of UCAVs and other means of digital warfare come at the same time with a neglect of international humanitarian law. In some cases one gets the impression that these armchair warfare weapons are used on purpose and quite effectively to terrorize and kill not only enemy soldiers but also the civilian population.

The targeted killings of Palestine terrorist suspects is not a new phenomenon. Between 2000 and 2006 three hundred people characterized as terrorists were killed together with 129 civilians (Case 2008). In face of this development, Israeli Human Rights Groups filed a lawsuit against the government. They argued that 'targeted killing' is an illegal use of force – according to Israeli as well as international law. To kill suspects without trial is not acceptable. "In December 2006, the Israeli Supreme Court issued a landmark decision in the case. While the court stopped short of an outright ban on Israel's assassinations program, it ruled that international law constrains the targeting of terror suspects. Currently, in order to
justify a strike, Israel must have reliable information that the suspect is actively engaged in hostilities (such as planning a terrorist attack) and must rule out an arrest as being too risky. The court also requires that there be an independent investigation after each strike." (Case 2008; my emphasis)

Amnesty International protested to George W. Bush against targeted killings by the U.S. forces and the CIA in Iraq, Pakistan and Afghanistan – very often deployed via UCAVs. Amnesty International claims that extrajudicial executions are prohibited under international human rights laws (Alston 2009). Beyond the question of the juridical status of targeted assassinations, it is important to remember that air surveillance mostly takes place several times before the targeted killings. Therefore it is highly likely that those who ordered the attacks were very well aware of the presence of women, children and other innocent people close to the envisioned target. In many cases the proportionality of the military aim of the attack and the collateral damage is questionable when you think of the bombing of a double marriage, of a school and other incidents in Pakistan (Weber 2009).

This situation has not changed under the new U.S. presidency of Barack Obama – regardless of the Nobel Peace Prize award – because he did not stop the practice of targeted killings in the U.S. war on terror. On the contrary, since he took office the number of UCAV deployments and targeted killings has risen (Mayer 2009) and Obama explicitly supports the development of robots and their increasing deployment in Afghanistan and Iraq.

Autonomous Killer Drones?

Tele-operated UCAVs are frequently used to spare the lives of friendly soldiers, but at the same time it seems that the deployment of UCAVs does not only lead to the increasing accidental killing of civilians but that it can also result in the wantonly negligent or even intentional killing of civilians. In face of the rising numbers of killed civilians in the IsraeliPalestine conflict as well as in the western „wars on terror" in Afghanistan, Iraq and Pakistan, the question arises whether RMA, network centric warfare and high-tech weapon technology such as tele-operated UCAVs come with a weakening of international humanitarian law. Tele-operated UCAVs are equipped with excellent cameras so that pilots can very well differentiate between adults and children, between combatants and civilians. The new hightech weaponry is often used either to assassinate suspect terrorists seemingly

without regard for civilians nearby or even to kill not only soldiers but civilians on enemy territory without any differentiating. In other cases, UCAVs are used as easy pushbutton weapon to blow up houses with little regard for the possible civilians inside and for operating them in regions which are not even declared enemy‟s territory – such as Pakistan where the government at least officially withdraw its acceptance of US-UCAV attacks in the beginning of 2009.

The next question is how this scenario would look like with the use not of tele-operated but autonomous UCAVs? The question already discussed by ethicists, peace activists and military is, whether they can be deployed according to international humanitarian law at all. Autonomous UCAVs work on the basis of object recognition systems which can only differentiate between the members of one‟s own army and everybody else – with the help of identification friend-foe systems. Insofar as autonomous systems can‟t differentiate between soldiers, surrendering soldiers and civilians, they contradict the laws of war. As many pro and con arguments for autonomous weapons are related to the autonomy of the weapon systems, we need to have a closer look at what „autonomy‟ means here and how it influences the ethical discussion on UCAVs.

As the state of military development is kept at least partially secret, it is difficult to judge the degree of autonomy already realized and deployed in recent UCAVs. General Atomics – producer of MQ-9 Reaper – states that the system has "robust sensors to *automatically find, fix, track and target critical emerging time sensitive targets*." (General Atomics 2007; my emphasis)

At the moment there seems to be no fully operational autonomous systems with software enabling them to make autonomous decisions on their targets on the basis of pre-given information and variables. But there are discussions on humans „on‟ the loop instead of „in‟ the loop which might become a reality in a few years. Up to now, UCAVs are „only‟ able to act independently in the sense of calculating their own trajectory towards the target as already known from long-range systems[2]. Up to now, the U.S. Department of Defense claims that until the resolution of certain legal and safety concerns, killing will not be fully automated: "Because the DoD complies with the Law of Armed Conflict, there are many issues requiring resolution associated with the employment of weapons by an unmanned systems. For a significant period into the future, the decision to pull a trigger or to launch a missile from an unmanned system will not be fully automated, but it will remain under the full control of a human operator." (DoD 2009, 24)

This statement suggests that the state of art in UCAV technology already would allow the deployment of autonomous ones at least in principle. Only for legal and safety issues the (U.S.) military (says it) can‟t. Given the interest in autonomous UCAVs, the tendency towards the weakening of international humanitarian law and the well-known effects of arms race, the danger that autonomous killer drones might become a reality (soon) is quite high. The introduction of the „Unmanned Systems Roadmap‟ of the U.S. Department of Defense of 2009 consequently states: "In response to the Warfighter demand, the Department has continued to investigate aggressively in developing autonomous systems and technologies. That investment has seen unmanned systems turned from being primarily tele-operated, single-mission platforms to platforms into increasingly autonomous, multi-mission platforms.

[2] Key representative practitioners from the U.S. Departments of Commerce, Defense, Energy and Transportation are working on a "Framework for Autonomy Levels for Uninhabited Systems (ALFUS)" see Huang et al. 2005

The fielding of increasingly sophisticated reconnaissance, targeting, and weapons delivery technology has not only allowed unmanned systems to participate in shortening „the sensor to shooter kill chain", but it has also allowed them to complete the chain by delivering precision weapons on target." DoD 2009, xiii)

If UCAVs will be entrusted with decisions about target identification and destruction, severe problems with regard to the question of responsibility – and therefore international humanitarian law – will arise: Who should be held responsible for the death of civilians or soldiers that had surrendered in case of faults and atrocities? Many ethicists and peace researchers arguing from diverse theoretical backgrounds have pointed out that responsibility for killing is a main condition for jus in bello[3]: "If the nature of a weapon, or other means of war fighting, is such that it is *typically* impossible to identify or hold individuals responsible for the casualities that it causes then it is contrary to this important requirement of *jus in bello*. (Sparrow 2007; emphasis given). If responsibility is no longer considered a critical issue, this might have severe consequences for the way wars with autonomous weapon systems (AWSs) will be fought

As I already stated, to avoid the accusation of undermining international humanitarian law via autonomous robots, the U.S. forces claim that UCAVs will only be deployed under the supervision of human (military) operators[7]. There is an internal tension to this claim. On the one hand, why should one want to build fully autonomous systems and only use them as more or less remote-controlled systems? One of the main reasons for building autonomous systems is to heighten the speed on the battlefield. So why would you stay with human operators who slow down fully autonomous network-centric warfare? Consequently, the United States Air Force write in their latest Unmanned Aircraft Systems Flight Plan 2009-2047: "The vision is the USAF [United States Air Force; JW] postured to harness *increasingly automated*, modular, globally connected, and sustainable multi-mission unmanned systems resulting in a leaner, more adaptable, and efficient air force …" (United States Air Force 2009, 14, emphasis J.W.)

On the other hand, it is also very likely, that from the moment an enemy will deploy totally autonomous systems, its enemy will also use them. In this case, the battle could get out of control very easily.

Last but not least there is a strong technical reason to use fully autonomous UCAVs because remote control requires a communication infrastructure which might be threatened by the enemy. It is highly probable that hostile forces will engage in disabling the robot systems by jamming or hacking its communication infrastructure – one of the vulnerable spots in autonomous systems (see Altmann 2003, Sparrow 2007; Weber 2009). Hacked autonomous systems would be highly dangerous not only to the soldiers of one"s own forces but also to civilians. As the military is also aware of this great danger, it is also likely that uninhabited combat vehicles will be used in full autonomy in the near future so that they are not dependent on communication systems.

This development is not only highly problematic with regard to the question of responsibility, but also with regard to the heightened speed of warfare where wrong decisions can no longer be cancelled or changed.

But there are several other propositions by the military how to ensure responsibility with regard to autonomous systems – either to address responsibility towards the programmer, the machine or the commanding officer. As autonomous systems will show unpredictable

[3] Jus in bello is about the ‚proper" conduct of war, while jus ad bellum is about acceptable justifications to enter war. Both are part of the laws of war. [7] See also Marsiske 2007, Sparrow 2007

behaviour, some argue that the responsibility lies with the programmer and / or manufacturer. Yet if the manufacturer were to give appropriate information about the risks of autonomous weapons, the manufacturer cannot likely be held responsible for a machine‟s failure. Think for example of the destruction of the wrong target as an outcome of the autonomous behaviour of the system. If a system is supposed to act increasingly autonomouslyy and the system does so, the programmer cannot be held responsible for the negative outcome of the unpredictable behaviour of an autonomous system. The programmer could only be held responsible – at least in a legal sense – in the case that autonomous weapon systems will be banned internationally (for example by an appendix to the Geneva Convention) (Nagenborg et al. 2008, Weber 2009). To hold an autonomous machine responsible in the literal sense doesn‟t make sense as the system is always pre-programmed by human beings – even if it is programmed to execute unpredictable behaviour.

The preferred approach of the military is to attribute the responsibility to the commanding officer – as it is the case with long-range weapons. This seems to be a non-satisfying and possibly incorrect solution of the problem because autonomous systems choose their targets on the basis of their programmed parameters, categories and variables. Thus it would seem that officers should not be held responsible for weapons which they do not control. (Sparrow 2007, 71)

In the face of the immense ethical and juridical problems of military robots and their possible prohibition under international humanitarian law, research on ethics for military robots as well as so-called „ethical‟ software is sponsored by the U.S. Army Research Office and the U.S. Office of Naval Research (Arkin 2007, Arkin 2008, Canning 2006; Moshkina/Arkin 2008, Lin et al.2009). For example, Ronald Arkin, a roboticist at the Georgia Institute of Technology, in a project funded by the military, proposes that *future* robots will be more ethical than humans because they don‟t have emotions or a drive for self-preservation (Arkin 2008). He is facilitating the idea that *future* robots might have a better technical equipment – such as better sensors, processor, rules, memory etc. – to decide whether a target is legitimate. Astonishingly, he makes the point that robots do not suffer under the pressure of „scenario fulfilment‟ – they don‟t interpret their input according to a given schema, fixed expectations and a pre-given frame of thought. But that is exactly how software programs work – on pregiven schemes, values and perspectives which in action can‟t be put into question. Even behaviour-based robotics which (partly) builds on emergence, unpredictability and systemenvironment coupling nevertheless builds on pre-programmed software. And robots are not able to question their own framework and decisions while humans in principle have the potential to do so.

Arkin doesn‟t argue that robots might become perfect – but that they will perform better than humans. He makes the point that robots compute more information in shorter time. Therefore they would have more time for reasoning about lethal decisions (Arkin 2007, 6f).

In the face of the massive violations of the laws of war during western war „Operation Iraqi Freedom‟ (Surgeon General‟s Office 2006[4]), Arkin argues for a technological fix: In the face of advanced weapon technology he calls for an „automated ethics‟ instead of reflecting the failure of the U.S. forces to train their soldiers in a way to respect and apply the international

[4] The report interviewed Army soldiers and marines with regard to their battlefield ethics. No more than 47% of Army soldiers and 38% of marines agreed that non-combatants should be treated with respect, less than half of the respondents would report a team member for an unethical behaviour and over a third of them thought that torture should be allowed if the life of a fellow soldier could be saved or important information about insurgents obtained.

and national humanitarian law. To think of ways to change this behaviour in principle to make warfare more secure for civilians, surrendered insurgents, etc. seems to be out of sight. What is usually left out of this approach is the underlying epistemological and ontological foundations. For example, Arkin takes for granted that robot systems have at least as much information as soldiers. He does not discuss the meaning of „information" and whether information is identical with meaning, knowledge or even understanding. Second, he proposes systems that can resist unethical acts and even explain why. If the resistance is overridden by the commanding officer, the latter is responsible for the system"s actions. This approach either suggests *highly intelligent* systems that will not become reality in the next decades (Sharkey 2007, Tamburrini 2009) or this mechanism of resistance works on a very reductionist level. The third assumption of Arkin"s approach is the capability of autonomous weapon systems to distinguish between soldiers, surrendering soldiers and civilians – an assumption that is highly unlikely at least in the near future.

Implicitly he also takes for granted *that every possible complex situation can be formalized correctly and computed in real time – a very old fairytale of Artificial Intelligence*. He does not discuss problems of navigation, object recognition as well as the scaling-up problem (parallel computing of many behaviours in one system) in real and complex worlds; these problems of robotics will not be solved in a satisfying manner soon. But nevertheless, being aware of some difficulties, Arkin proposes that a system should never be allowed to make lethal decisions in situations which are not covered by ethical prescriptions. *But how do you make sure that a system is applying its rules adequately to a given situation?*

Arkin also avoids the *problem of formal verification –that is the problem of software mistakes or bugs*. How can you make sure that there are no bugs in the software of autonomous lethal systems? Formal verification of software for systems as complex as combat robots is not possible in a reasonable amount of time – if at all. So how can one think of „ethical" warbots? The uncritical discussion of ethical software for killer robots produces the impression that it is mostly about raising the acceptance in western countries for these new weapon systems rather than to solve the humanitarian problems of high-tech automated warfare which does not only endanger the lives of many civilians but also destabilizes the military situation between opponents and contributes to further arms races, proliferation of weapons, and undermines international law of warfare.

In contrast, Noel Sharkey, British roboticist, calls for more responsibility of computer scientists and engineers to make the unsolved and profound technical problems of military robotic systems visible for the public. Engineers and computer scientists should resist generous funding for military robots and criticize the old salvation stories of AI. As Sharkey writes: "Computer professionals and engineers have a duty to ensure that the funding bodies , policy makers and – if possible – end users know the current limitations of AI technology, including potential mishaps in the complexity of unpredictable real-world events. *Do not be tempted to express your opinions or future predictions of AI as if the technology were already in place or just around the corner.* The consequences of playing the funding game are too serious. Ultimately, we must ask if we are ready to leave life-or-death-decisions to robots too dim to be called stupid." (Sharkey 2007, 123; my emphasis).

Economy, Technology Development and Codes of Ethics

But traditionally, international professional associations such as the IEEE or ACM (Association for Computing Machinery) have avoided the topic of the intertwinement of engineering and the military. For example, in their „Codes of Ethics", engineers declare themselves as

responsible for their systems, products and artefacts so they will not threaten the safety, health and welfare of the public. The Code of the ACM even states: „When designing or implementing systems, computing professionals must attempt to ensure that the products of their efforts will be used in socially responsible ways, will meet social needs, and will avoid harmful effects to health and welfare." (ACM Code of Ethics and Professional Conduct 1992, 1)

It seems too easy to put the burden of the ethical solution of this highly complex problem primarily on the shoulders of engineers (von Schomberg 2007). Nevertheless, it is necessary to discuss these conflicts also in reference to the Code of Ethics of professional associations. Up to now the field of autonomous combat systems is virtually ignored by ethics in general and therefore roboticists should have a strong motivation to develop professional technoethical regulation in this new and emerging field. We know that technology assessment and ethics are effective means to construct our technological future. Techno-ethical analyses and regulations are partly instruments to govern policies, to shape research strategies as well as to prepare legal certainty for research, development and commercialization of new products and systems (Schaper-Rinkel 2006). These aspects need to be kept in mind with regard to the discussion of techno-ethical issues.

In robotics – as in many other technosciences – we have no clear-cut borders between the technoscientific, military, economic and the industrial complex. For example, there are rarely any US robotic labs which are not funded directly or indirectly by the military in the US. This is also a problem in Europe – but the impact of the military is (still) lower.

Financing and Motivating (Future) High-Tech Armchair Warfare

The political and ethical problems of UCAVs are related to issues of arms control. One might expect arms control to become a minor issue after the end of the Cold War in 1989, but after a short decline of military expenses in R&D, the latter grew rapidly since the mid90s – especially in the US. The US military budget comprises nearly half of the world‟s total expenditures on the military. By the fiscal year 2008, the U.S. military budget had "doubled since Bush took office in 2000 and is now higher in real terms than any other year in the last half-century." (Kumar Behera 2008). Robert Higgs, U.S.-American economist and political scientist at The Independent Institute in California considers the real defense budget of the USA for 2006 – to include not only the budget of the Department of Defense ($499.4 billion), but also defense-related parts of the Department of Energy budget ($16.6 billion), the budget of the Department of Homeland Security ($69.1 billion), the budget of the Department of State and international assistance programs for activities arguably related to defense purposes ($25.3 billion), the Department of Veterans Affairs ($69.8 billion), the Department of the Treasury (Military Retirement Fund of $38.5 billion) as well as the National Aeronautics and Space Administration‟s outlays which are at least as indirectly defense-related. "When all of these other parts of the budget are added to the budget for the Pentagon itself, they increase the fiscal 2006 total by nearly half again, to *$728.2 billion*." (Higgs 2007; my emphasis) During the presidency of Barack Obama, a decline of the US military budget is expected in general (Mayer 2009), but at the same time Obama is known for favouring military robots. For Fiscal Year 2009 the US Congress originally approved 3.6 billion dollars for the Future Combat System (FCS) alone (Washington Post, 13/10/2008). Now the FCS was determined but the research on sensors, unmanned aerial and ground vehicles, the Non-Line-of-Sight Launch

System, and a modified FCS network was shifted to the New Army Brigade Combat Team Modernization strategy (https://www.fcs.army.mil/).
On the economic level UCAVs are regarded as a key technology for the future global market. The USA already sold and still sells their MQ UCAVs to France, Italy and other countries.
The USA spent several billions every year on drones. For example, one of the mentioned MQ-9 Reaper systems (with four aircraft) costs about 70 million dollars. Experts estimate that UCAVs will be sold from 2015 on for about five billion dollars every year (Nikolei 2005). *Given the huge techno-ethical problems, Europe should engage in preventive arms control to regulate the development of this market and to hinder an arms race in the near future and to work against a further increase of the numbers of killed civilians.*
One important question underlying others is: Do robot systems fall under the categories of existing arms control. Arms control expert Jürgen Altmann describes the problems of UCAVs for example with regard to the Conventional Forces in Europe Treaty in the following way: "The Treaty on Conventional Armed Forces of 1990 limits the holdings in five major weapons classes for the NATO member states and Russia; its definitions of battle tanks, armoured combat vehicles, artillery, combat aircraft and attack helicopters intentionally do not mention personnel on board, so that crewless versions would fall under the same rubrics, would count in the national holdings, would have to be notified to the Treaty partners, would be subject to inspection etc. However, *one can foresee a debate which types of armed UAVs would constitute a combat aircraft.* Whereas the definition is quite general, arguments might be made that converted surveillance drones or very small crewless aircraft do not fall under this heading. The situation with respect to "combat helicopters" is similar. […] Thus, a grey area of uncounted and unlimited combat systems might develop. A fundamental problem is that similar limitations of conventional armaments are not in force in other continents."
(Altmann 2009, 74-75, emphasis J.W.)
One of the more pressing socio-political concerns about autonomous combat systems is that they might make going to war much easier. Up to now in Western democracies, politicians had to convince their people to participate in a war. How will this change if it is only or mostly about pushing buttons from a remote place? Also deciding whether to disobey inhumane orders will no more happen in robot wars and this is (or was?) a crucial part of at least a bit more human way of warfare. We know of soldiers who pointed their guns into the air because they didn‟t want to kill. Robots will always execute what they are programmed for aside from systems failure. Many philosophers such as Paul Virilio or Friedrich Kittler also ask how our self-understanding, and more generally the relation between human and machine might change, if weapon systems decide on their targets and when to destroy them (including human beings). The autonomy of a weapon system comes with the depersonalization and anonymization of power and control. Following the argument of Virilio and Kittler, some are concerned that autonomous weapon systems might gain the status of subjects as they are the ones in power (Kittler 1988, 355; Virilio 2000). This would mean a clear shift of power in the relation between humans and machines where the latter are the autonomous ones. I think that we need a closer analysis of these processes.
STS and ethics today must address the consequences of unintended side-effects as well as societal and political decisions in our highly complex societies. These techno-scientific issues cannot only be addressed by single engineers and philosophers, but must be integrated in a broad sociotechnical discussion including a broad public debate on socio-political and technoethical issues, deliberative technology assessment procedures like consensus conferences (von Schomberg 2007) as well as international political actions and policies for

the integration of issues of military robotics into preventive arms control. In the field of autonomous weapon systems more interdisciplinary research is needed "on the risks of misuse of new technologies and consequences for international security, explicitly including military applications and civil-military interaction/exchanges, considering also the capabilities of small groups and second-level arms-producing countries." (Altmann 2006, 44)

But of great importance is also to analyse further the relation between contemporary warfare and the killing of civilians in the context of the „Revolution in Military Affairs" and high-tech weapons (such as combat robots). High-tech weaponry seems to make possible and probably increasingly intense extra-judicial killings (organized, targeted assassinations) in the IsraeliPalestine conflict as well as in western wars on terror. In case this is leading to a silent „revision" of international humanitarian law, urgent action is needed. To ban UCAVs could be a first step to secure international humanitarian law.

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