Unmanned & Uncontrolled

Proliferation of unmanned systems and the need for improved arms export controls

PAX Peace. Are you in?

www.paxforpeace.nl

Colophon

PAX means peace. Together with people in conflict areas and concerned citizens worldwide, PAX works to build just and peaceful societies across the globe. PAX brings together people who have the courage to stand for peace. Everyone who believes in peace can contribute. We believe that all these steps, whether small or large, inevitably lead to the greater sum of peace.
If you have questions, remarks or comments on this report you can send them to info@paxforpeace.nl
See also www.paxforpeace.nl

Augustus 2015

Author: Wim Zwijnenburg and Katja van Hoorn
Contact: Zwijnenburg@paxforpeace.nl

Editor: Elke Schwarz
We would like to thank the following people for their feedback and help: Jürgen Altmann, Frank Slijper, Mark Gubrud, Mark Bromley, Elke Schwarz, Michelle de Gruijl, Miriam Struyk, Sandra Jansen.

Index

1. Introduction **8**
1.1 Background 9
1.2 Why are improved controls needed? 11
1.3 Non-State Actors and UAVs 14
1.4 Criticism on use (armed) UMS 16

2. Categories of unmanned military systems **18**
2.1 Nano/Micro UAVs 19
2.2 Mini UAVs 20
2.3 Tactical UAVS 20
2.4 Medium/High Altitude Long Endurance UAVs (MALE/HALE UAVs) 21
2.5 Next Generation and Developments 21
2.6 Other UMS 21
2.7 Dual-Use 22

3. Existing Control Mechanisms for UAVs **24**
3.1 Arms Control/Trade Treaties 24
3.2 Agreements 25
3.3 National legislation 32

4. Conclusion **34**

5. Recommendations **38**

Endnotes **40**

The future of repression?

A low humming noise disturbs the nightly silence in the suburbs of City X. Five micro drones are hovering over the rooftops of this rebellious neighborhood. In a building in one of the streets, a group of political dissidents have gathered to discuss their next campaign steps to call for government reforms. For years, they have been protesting and pushing for political change and have now been placed under surveillance as they have managed to create a strong movement demanding more openness and democracy of the repressive government. So far the group has had little success and has met with severe prosecution, random arrests and a number of key figures have mysteriously disappeared. On this night, the secret service has tracked down several of the dissidents' cell phones and decided to reign in with full force. New technologies provide them with live tracking capacity and tracing of phone calls, and enable them to zoom in on the dissidents' location. The neighborhood is too dangerous to enter on the ground, as several policemen have already lost their lives in shoot-outs with armed factions of the dissenters. Key electronic surveillance gathering was used in real-time mapping of the whereabouts of the rebels and provided the opportunity to take out the leadership once and for all. A small swarm of bird size unmanned aerial vehicles home in and surround the building, ready to engage with small diameter rockets, able to take out the entire floor. When the target is confirmed, and command is given, the rockets slam through the windows. 10 seconds later, all that remains is smoldering metal nodes reaching up to heaven.

The future of terrorism?

Three hooded men are sweating profusely while preparing explosives and canisters filled with chlorine gas. They are huddled in the back of a small truck, located in an alley in the centre of City Y. Small explosive blocks and spray canisters are attached to three drones. The drones have been assembled from parts purchased in various hobby shops and from private firms, that sell larger and robust UAVs for a range of civilian and agricultural purposes. The devices are able to carry a wide variety of payloads, such as cameras, sensors and lifting mechanisms. With financial and technical support from regime Z, this small terrorist group aims to create mayhem and destruction among civilians during a political rally in a Western State. More importantly, their aim is to set fear and panic into the hearts of the population, as drones have become a common tool for a range of commercial and industrial purposes in City Y and were increasingly populating the skies over other towns and cities. So far, the terrorists' plot is going according to plan. They undertook some test flights on the countryside, which confirmed that the drones could deliver their deadly payloads with accurate precision. With a semi-autonomous programmed flight path, the drones wouldn't be noticed by the police as they would slalom their way along buildings to the intended area of attack. The flight path is programmed via a laptop; the explosives and canisters are armed. A GoPro camera attached to one of the drones is recording the attack, directly streaming it to the laptop, so the video can be used for propaganda purposes, demonstrating that the group can strike anywhere. The roof of the truck opens. The rotors of the drones slowly lift up the devices and set course for destruction.

1. Introduction

Unmanned systems are rapidly gaining popularity amongst a range of actors, including civilians, corporate business, law enforcement, armed forces and the intelligence community. The novelty of unmanned systems is slowly giving way to a normalization of the technology for a growing spectrum of military activity, giving a greater range of options for technologically enhanced military engagements. However, along with the normalization of the technology, new challenges arise from the systems' capabilities and capacities. Whether the use is civilian or military, new regulations and export controls are needed.

This paper focuses on the implications of the proliferation of unmanned systems (UMS), the application of existing (arms) export control mechanisms and the resulting expanding military application of these systems within and outside of contexts of armed conflict. To date, the most common type of unmanned system for military use are unmanned aerial vehicles (UAVs), also known as drones, named after the buzzing sound they make. Since the introduction of lethal UAVs by the Bush administration in 2002[1], as a means to find and kill 'high value targets' in the War on Terror, armed forces across the globe are rapidly developing and acquiring UAVs for intelligence-gathering, surveillance, targeting, attacking, and for reconnaissance purposes. Unmanned military systems come at a relatively low cost, in terms of risk to service personnel, as well as financial costs. They are able to access areas where troops or armed groups are not easily able to operate and thereby expand the realm of operations considerably.

With new technological possibilities at the disposal of militaries, and potentially other armed groups, urgent questions arise: Are existing arms and export control mechanisms sufficient to prevent UMS from ending up in the hands of human rights abusers or terror groups? There is a growing trend to apply unmanned systems for a range of both military and civilian applications, and gaining access to this technology is likely to become less difficult, making

it more tempting for both State and non-State actors to utilize these tools. And, if that is the case, will existing rules and regulations be adequate to address the core of one the most challenging military developments of the 21st Century? This is particularly pertinent when considering future developments of unmanned systems, as these they will become smaller, faster, easier to operate; they will be used in swarms, and become increasingly autonomous. Anticipating these developments is necessary in order to address existing and future loopholes in arms export controls in time. Furthermore, the question arises whether we are in need of a more fundamental debate on the use of armed UMS, considering the legal, ethical and military strategic questions surrounding new ways of remote control warfare now that this technology is gaining ground.[2]

This policy paper explores current trends in the production and proliferation of UMS, with a focus on UAVs. In particular it will analyze the current trends in use and developments of UMSs that fall out of existing categories that are already controlled by arms export agreements and controls. It will demonstrate that there are major future challenges with the booming dual-use market and how States and non-State actors are seeking opportunities to utilize these new technologies, which could reshape the way conflicts are being fought. This paper therefore will specifically focus on existing unmanned platforms, whereby the term unmanned clearly will refer to (semi)remote controlled existing unmanned systems and upcoming (semi)remote controlled unmanned systems that will likely enter the market the next five to ten years. It will not address concerns over lethal autonomous weapons.[3] The paper aims to ignite the debate on where improvements in the control of UMS are warranted, and what the broader implications of the growing proliferation of the technology are. It recommends to close existing loopholes and stimulate debate over shifting norms in the use of unmanned systems in and outside regular battlefields

1.1 Background

Over the last 10 years, the production, proliferation and use of unmanned systems (UMS) has seen a major increase. It is estimated that global spending on UAVs will double in the next decade, to $11.3 billion annually in 2020.[4] The term 'unmanned military systems' refers to the entire assemblage of the system. This includes the platform or actual vehicle, which is controlled by remote access, as well as the 'payload' attached to the vehicle. The vehicle can be an air, water or ground platform, while the 'payload' comprises sensors, cameras, communications devices, electronic warfare equipment or weapons. The most commonly known unmanned military systems are unmanned aerial vehicles (UAVs) also known as 'drones', which are proliferating at a rapid pace. According to a 2012 report to the US Congress, more than 77 states are now using UAVs for a variety of purposes. This number has grown since, with currently 90 States using drones, and will continue to grow in the coming years:

> *'Currently, there are over 50 countries developing more than 900 different UAV systems. This growth is attributed to countries seeing the success of the United States with UAVs in Iraq and Afghanistan and deciding to invest resources into UAV development to compete economically and militarily in this emerging area. (...)The majority of foreign UAVs that countries have acquired fall within the tactical category. Tactical UAVs primarily conduct intelligence, surveillance, and reconnaissance missions and typically have a limited operational range of at most 300 kilometers. However, some more advanced varieties are capable of performing intelligence collection, targeting, or attack missions. Mini UAVs were also frequently acquired across the globe during this period.'*[5]

A group photo of aerial demonstrators at the 2005 Naval Unmanned Aerial Vehicle Air Demo held at the Webster Field Annex of Naval Air Station Patuxent River. Pictured are (front to back, left to right) RQ-11A Raven, Evolution, Dragon Eye, NASA FLIC, Arcturus T-15, Skylark, Tern, RQ-2B Pioneer, and Neptune. U.S. Navy photo by Photographers Mate 2nd Class Daniel J. McLain

Clearly, the global market for UMS is expanding rapidly. This is to a large extent owed to an increased demand from armed forces to incorporate these systems into their military operations:

> *'In the air domain, projected mission areas for UAS (Unmanned Aerial Systems) include air-to-air combat and suppression and defeat of enemy air defense. On the ground, (Unmanned Ground vehicles) UGVs are projected to conduct missions such as non-lethal crowd control, dismounted offensive operations, and armed reconnaissance and assault operations. In the maritime domain, (Unmanned Underwater Vehicles) UUVs and (Unmanned Surface Vehicles) USVs are projected to be particularly suited for mine laying and mine neutralization missions.'*[6]

With projections like these, increased investments in UMS for both use and export seem to be an inevitability in military affairs. UMS provide improved capabilities for armed forces to increase situational awareness on the battlefield, by collecting visual, digital and audio data, track movements of troops and individuals and provide Close Air Support (CAS) in military operations. Ground robots are ideal for clearing unexploded ordnances and landmines. Armed ground robots have been reported to be used as base protection in Iraq[7], and will likely see deployment on various battlefields in the near future. These increased functionalities will lead to a growing proliferation of UMS as military equipment in general, but it is predominantly the spread of *armed* UMS that should be met with apprehension. Indeed, numerous experts have expressed concerns over the fast proliferation of armed UAVs and other armed robotic systems in the next decade. Currently, 23 countries possess or are in the process of acquiring armed UAVs, demonstrating the popularity of this technology.[8] Estimations are that by 2024, every country has the capacity to use armed UAVs.

The emerging UAV industry is well aware of the potential of UAVs for a range of civilian and military applications, and is aggressively promoting all types of UAVs to states, for various areas of use, ranging from surveillance and tracking down suspects for law enforcement, to border patrol to military applications. For example, they actively lobby for increased funding from e.g. the EU and national governments to expand their research and development programs. To date, EU funding amounts to over € 500 million for funding a plethora of UAV and UAV technology related projects. This has raised serious concerns from civil right activists over the blurring of lines between military and civilian applications of UAV and the role of the UAV industry in proliferation of technologies. As one UAV manufacturer stated:

> *'We don't actually know what the problem is; we just know that the solution is UAVs'.*[9]

1.2 Why are improved controls needed?

Historically, global controls on the export of weapons, weapons systems, and their components have been put in place to prevent unauthorized end users to obtain (certain) military equipment, albeit mainly for national security or geo-political interests. In the last decades, civil society has pleaded successfully to incorporate humanitarian and human rights principles into the decision making process for granting export licenses by states, leading to a number of arms export control regimes and treaties, such as the *EU Common Position and the Arms Trade Treaty* (ATT). The EU Common Position and the ATT are concerned, amongst others, with the need to assess the threat of conflict, the human rights situation and the potential for diversion from the respective country to which arms are exported.

UMS create new possibilities for armed forces, but also for insurgents, terrorist groups and other non-state actors to apply lethal force in combat operations or for attacks on designated targets. Concerns are mounting that UMS are used by non-state actors. Hezbollah, for example, is reported to have used UAVs equipped with explosives to attack Israeli targets in 2006, and has used UAVs to spy on Israeli nuclear facilities, as well as probing Israeli defenses.[10] It is claimed to have a fleet of 200 UAVs at its disposal.[11] Similarly, Iraqi insurgents are reported to have schemed to equip UAVs with chemical weapons.[12] The argument that more and more terrorist groups will aim to use small UAVs for attacks is gaining ground, considering the wide range of opportunities using UAVs. For insurgents or terrorist groups, UAVs, may be employed for wide-scale area attacks, deployed from afar. The generally poor effectiveness of air defense systems in detecting low flying UAVs and the precision capacity of the technology makes them an appealing weapon. The strong psychological effect that use of (armed) UAVs might have, further adds to the appeal for such groups.[13]

At State level, the use of UAVs for targeted killings has raised major concerns over lowering the threshold for using armed violence outside of areas of active hostilities, and likely has created a precedent for repressive states to use this option against political opponents. The US government has used armed UAVs for its targeted killing program, which has faced severe criticism from UN Human Rights rapporteurs and human rights organisations.[14] Iran is developing armed UAVs[15] and is supplying reconnaissance UAVs to Hezbollah and Hamas[16], as well as Sudan and Syria. The Syrian regime has used Iranian UAVs to localize insurgents in densely populated areas, and in surveillance of targets. These subsequent attacks resulted

in the killing of many innocent civilians in the course of the operations.[17] Sudan has deployed Iranian UAVs over Darfur and Kurdufan and has likely used them for target designation of villages for attacks with artillery fire.[18] Despite an arms embargo, Iran is actively seeking UAV technology from UAV producers, which has already led to apparent violations of the US embargo by a Dutch aviation technology trader in 2007.[19] This has alarmed both the US and Dutch government and makes clear that stricter controls are needed.

Furthermore, China is a major upcoming UAV producer[20] and it may be assumed that China has less apprehensions to sell UAV technology to states with a history of human rights abuses, as they are not part of many arms export treaties. As stated by a US Senate report on Chinese technology developments:

> *Surging domestic and international market demand for UAVs, from both military and civilian customers, will continue to buoy growth of the Chinese industry. Chinese defense firms do not face the same export restrictions as top UAV-exporting countries, such as the United States and Israel. As a result, China could become a key UAV proliferator, particularly to developing countries.*[21]

China's aim to explore new markets and build its own UAV industry presumably leads to increased cyber espionage on American defense companies, and the theft of technology is of major security concern to the US government. Several Chinese UAVs show close resemblance to US UAVs, implying they may be based on stolen blueprints, and the recovered wreckage of a crashed US UAV in Iran.[22] This further underlines the need to keep this type of technology under control.[23] Saudi-Arabia is reported to have shown an interest in buying the Chinese Pterodactyl UAV, a design similar to the US Predator.[24]

The blurred lines between military and civilian use are also of concern for proliferation of UAVs. One example of the murky distinction between military and civilian use is the activity of Austria's UAV producer Schiebel, who exported the Camcompter S-100 to China, stating an allegedly civilian conglomerate as the end user. However, the UAV ended up being used by the Chinese Navy on their aircraft carrier.[25] As one author on the Chinese UAV industry in a leading commercial media outlet noted:

> *'China is undoubtedly set to become a major proliferator of UAVs, especially to developing countries with fewer dollars to spend, and who find Western designs too sophisticated or expensive. [...] many Western countries are bound by the MissileTechnology Control Regime and Wassenaar Arrangement, where Beijing is not.'*[26]

Israel, one of the leading UAV exporters, has seen its exports skyrocketing, selling UAVs to over 50 European, Asian and Latin American States.[27] This accounts for over 10% of Israeli arms sales.[28] Major players are Elbit and Israel Aircraft Industries (IAI). Like China, Israel is not part of most international arms control and export control mechanisms, though the US government has strong influence over Israeli export policies.

The UAV industry in the US is pushing Congress to lower the standards applied for exporting a range of UAV systems, arguing that the US would lose a potential market for UAV systems to other states with less strict export controls.[29] Aside from China and Iran, many other states

A pair of militia members fly drones during a test in Shanghai, China, April 21, 2015. China is stepping up research into military drones as its arms industry looks to increase export volumes, hoping to gain traction with cheaper technology and a willingness to sell to countries Western states are reluctant to.

with a growing interest in the development and production of UMS, such as India, Russia and Turkey, are expected to seek an opportunity to ride the UAV gravy train and export their systems to interested buyers across the globe.[30]

More information on proliferation and the increased use of armed drones from a US perspective can be found in the Council of Foreign Relations Report: *Limiting Armed Drone Proliferation*.[31] Concluding that armed drones will see increased interest from states, the authors' recommendations include conducting a survey on trends in unmanned technology; how UMSs will shape future US missions that could run counter to US interest; set up a hearing on the principles and criteria that guide armed and unarmed drone exports and call for a an expert review on US transparency over armed drone policies and their potential effect on emerging proliferators. The US based RAND Corporation also provides analyses on the use and proliferation of long-range UAVs in light of the US national security position and the reshaping of the battlefield by these systems. Although RAND researchers don't see any specific threats emerging from increased proliferation, they note that *'risks to regional stability cannot be dismissed'* and call for more stringent norms on the use of armed UAVs.[32] However, these reports solely focus on the larger type of UAVs, which usually require a considerable amount of financial capacity and technical expertise to acquire and operate. Little attention in the current debate is given to other types of UMS, e.g. smaller systems that are not include in existing arms export control regimes, dual-use systems, and their potential use and capability for transforming armed conflict in asymmetrical settings.

1.3 Non-State Actors and UAVs

Critics of stricter controls argue that the risk that non-state actors and terrorist groups might be acquiring current UAV systems is low, as they are too expensive and complex to be used by such actors. This may very well be the case for larger types of UAVs, but smaller, tactical UAVs can easily be operated by individuals and it requires limited training to turn a small UAV into a precision guided missile, as Hezbollah has demonstrated.[33] The smaller types of UAVs are relatively cheap and some models can easily be bought off the shelf, countering the high-cost threshold argument. Below are some examples of recent use of UAVs by non-state actors:

Hamas

In June 2014, Hamas released footage of an Iranian *Arbabil* 1 a medium sized UAV flying over the Gaza Strip, which appeared to be armed. Before it could inflict any damage it was shot down by a Patriot missile.[34] Although the Hamas missiles were likely fake, the group is able to operate and exploit this new technology, which could have added value for its operations. This recent incident was not the first attempt to use UAVs against Israel. In October 2013, news outlets reported that the Palestinian Authority had arrested a Hamas cell, which was preparing a small UAV with explosives to be used in an attack against an Israeli target.[35] The Israeli Defence Force (IDF) reported that it had previously struck Hamas' UAV capabilities in an airstrike against a UAV on a runway in November 2012.

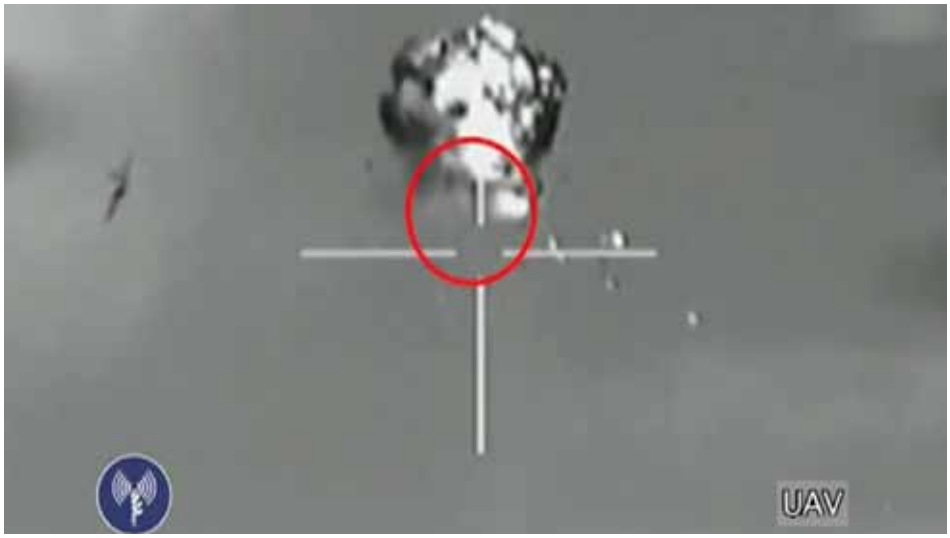
Hezbollah

Hezbollah has operated UAVs over their border areas for a number of years. This includes occasionally flying them over Israeli territory, which seeks to probe Israeli defences (and taunt their military supremacy). In 2006, Hezbollah tried to crash a small UAV with explosives on a military site in a kamikaze UAV attack. This was part of a broader attempt using three small UAVs with explosives for attacks on different targets in Israel.[36] In 2012, Hezbollah flew an Iranian-made UAV over the Mediterranean Sea, before it was shot down by the Israeli Air Force. Estimates suggest that Hezbollah possesses over 200 unarmed UAVs, including medium sized Iranian drones. This has led to serious concerns among Israeli military commanders about the potential for armed attack with UAVs,[37] specifically as existing Israeli air defences seem less capable against smaller UAVs. *'It's very complicated to defend against the drones, because they're so difficult to spot,'* an Israeli military spokesman commented. The US has already started blacklisting companies selling UAV related technology to Lebanon, citing security concerns over Hezbollah's growing UAV capacity.[38]

Islamic State

The first indication of UAV use in Fallujah was in February 2014, when Islamic State in Iraq and Syria (ISIS), as it was then called, used UAV footage for propaganda purposes. Several videos that went online showed that UAVs were used for Intelligence, Surveillance and Reconnaissance(ISR) operations in Iraq and Syria, and it is likely that these UAVs are used for other military operations, strengthening Islamic State's ISR capabilities and target acquisition capacities.[39] The UAVs used seem to be quad-copters, which are fairly easy to obtain (can be bought in any hobby shop) and use. Nonetheless, the use of these UAVs by Islamic State is an interesting development, highlighting a new dynamic in the conflict. It means that states and armed groups such as the Kurdish Peshmerga will need to obtain additional defence systems to detect and shoot down UAVs, adding to the complexity of the conflict in Iraq and Syria.

Video footage released in 2014 by Ezzedeen Al Qassam Brigades, the military wing of Hamas, shows an Iranian Abibil AB1 armed drone flying over Gaza.



An Israeli F-16 shoots down an unidentified UAV over the Negev desert, October 2012. The drone entered Israeli Air Space from the Mediterenian sea, indicating that the orgina is most likely Hezbollah, as report suggested it did not come from Gaza. Footage release by IDF, 2012

A video released by the Islamic State shows drone footage of the battle over the Baiji oil refinery in Iraq. Drones were used to scout enemy positions and artillery guidance and targeting. The drone is most likely a small civilian version imported from Turkey.

1.4 Criticism on use (armed) UMS

Despite these proliferation concerns, other experts arguing mainly from the perspective of the manufacturers, fear that more regulations will hinder innovation and limit economic benefits of UMS sales.[40] Although the expertise and technology involved for operating more complex UMSs requires a certain level of training, the near future will likely see more user-friendly UMS. States with a lead position on sophisticated unmanned technology have an interest in maintaining their position by having strict controls over licenses to end users. Concerns that states with less interest in upholding international human rights and humanitarian law standards may draw on UMS to suppress political opponents or engage in unlawful killings are likely to become more pressing as unmanned technology becomes more easily available. The export of mass surveillance systems to the Middle East and North African region that were used by dictators to monitor, track and kill activists serves as a indication of such dynamics.

Lastly, states, as well as the defense industry, should not be blind to the serious ethical concerns that emerging military technologies bring to 21st century warfare. Ethical objections to deploying means of remote-controlled, or possibly autonomous warfare by unmanned systems are at the core of current discussions amongst civil society, academics and states in a variety of national and international forums. Concerns are raised about the lowered threshold to resort to armed violence, based on minimized risk and lower costs to armed forces.[41] The danger is that unmanned systems become a tempting technological tool, ready to be deployed in situations where other, manned options bear too many military or strategic risks and are more expensive. Furthermore, as reports have shown, the precision and discrimination narrative in the use of armed UAVs is largely a myth, and the diminishing distinction between civilians and combatants in current complex conflict situations in fact increases the potential for civilian casualties.[42] However, the invocation of the military's mantras around precision strike technologies that promises fewer civilian casualties has lead to the misperception that UMS do actually save lives and make UAVs a more ethical choice of weapon. This presumption is heavily contested, since the distinction between who is a combatant and who is not, is extremely challenging to make.[43] Moreover, the notion of 'precision' may have the potential to lead to an increase of targets in densely populated areas, whereas in previous situations, militaries would refrain from attacking in such arenas so as to not incur disproportionate collateral damage and civilian deaths. The overreliance on a technological solution to these profoundly complex combat (or even political) situations has fetishized UAVs specifically and led to a boost in the sales of military robotics. Lastly, the effectiveness of UAV-strikes as a counter-terrorism tool has yet to be proven. Existing data on Pakistan could not establish a link between UAV strikes and a decline in terrorist attacks.[44]

In conclusion, there are many sound arguments that should be included in the discussion on restricting the sales of UAVs, thus preventing their proliferation and potential for abuse and misuse by states and non-state actors. Arguments such as these form a strong base for stricter global controls on the exports of UAVs. ♦

A photo-print of child who lost family members in a drone-strike is laid out next to a house in Pakistan. The print is meant to show US drone-operators who they are targeting, in protest against US drone-strikes and civilian casualties. Photo taken by the artist collective under the name Not A Bug Splat

2. Categories of unmanned military systems

For a better understanding of what UMS are currently used for and what is to be expected in the near future, this section provides a short overview of the different categories of unmanned systems. The majority of current research and development (R&D) projects are test cases of prototypes for showcases to attract funding for further research. Only few of those systems will subsequently be developed for mass production. Well-known examples are the *Dassault* nEURon and the *BAE Sytems* Taranis. UMS that are currently operated by armed forces are fairly conventional, with the main focus on small to medium size systems. There are no universal categorizations for UAVs, making classifications fairly arbitrarily. They are typically categorized by weight, endurance and range, altitude, wing loading capacity and engine types. The US Department of Defense (DoD), for example, applied the following categorization for their UAVs, based on weight, speed and flight levels (see Figure 1.).[45]

The European Union is exploring civilian applications of Remotely Piloted Aircrafts (RPAs)[46] and has applied distinctions based on 'visual line of sight' (VLOS) and 'beyond visual line of sight' (B-VLOS), which refers to the altitude and distance between the remote controller and planes. The latter types of RPAs can still be remote controlled by direct radio contact. Beyond the range where radio contact is possible, satellite communications would be needed, creating Beyond Radio Line of Sight (BRLOS) operations.[47] Others have come up with similar categories.[48] But no clear universal standard categorization is employed to date.

Given this lack of universal standard of classification, the following categories are intended to be helpful for understanding which types of UAVs are currently used or under development.

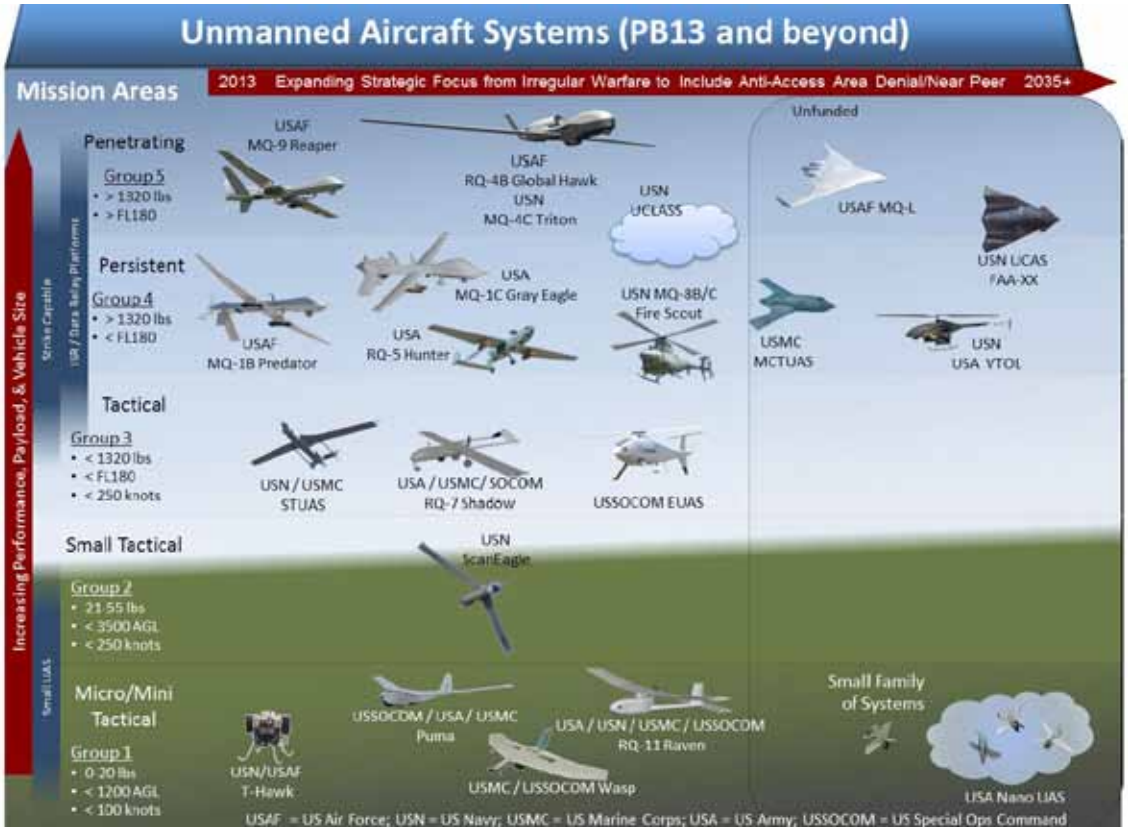


Figure 1. Department of Defense Overview of types of Unmanned Aircraft Systems. Taken from Unmanned Systems Integrated Roadmap FY2013-2038.

2.1 Nano/Micro UAVs

Even though technically speaking, nano UAVs classify as micro (the designation nano UAVs would imply that their size is actually one billionth of a meter), producers choose to call them 'nano', based on the fact that their size is notably smaller than that of mini UAVs. Nano or micro UAVs are a distinctly separate category of UAV determined by their specific properties. Pocketsize, or even smaller UAVs are gaining popularity within armed forces, for their light weight, compact shape and ease in operating them. Recently, Norway's Prox Dynamics developed the PD-100 Black Hornet Nano[49],a 10cm x 2.5cm flying camera that can be used for improved local situational awareness, and has already been deployed by the UK military in Afghanistan. The US-based *AeroVironment*, or *AV Inc.*, which is closely affiliated with the Pentagon's Defense Advanced Research Projects Agency (DARPA), has developed the Nano Hummingbird[50], a lightweight bird-shaped UAV with similar capabilities as the Black Hornet. Although these types of nano UAVs are developed for reconnaissance in urban areas, more lethal types of nano systems are under consideration for development. A well known example is the Air Force Research Laboratory project developing Micro Flying Vehicles (MAVs), which are describes as *'a flight vehicle about two feet in length or less, capable of operating below rooftop level in an urban environment'*.[51] In a demonstration video, swarms of tiny MAVs, the size of large bumblebees, are released from a UAV and sneak into buildings in a coordinated way. Once they have located their target, the MAVs, armed with a tiny explosives, attack and explode. An eerie scenario, all too reminiscent of science fiction, rather than science.

A soldier of The Queen's Royal Lancers holding a BlackHornet, Nano Unmanned Aerial System (UAS) from a compound in Afghanistan during Operation QALB.

2.2 Mini UAVs

The most common type of UAV used in military operations is the mini UAV. They are relatively small, ranging from portable systems to UAVs requiring launching facilities on ships or vehicles. In general, mini UAVs weigh less than 5kg and have a limited flight time operating altitude, although this could change with technological innovations using solar power. Known examples are the *AV Inc.* Raven, Wasp III and ALADIN. In the near future, these types of systems will likely become more integrated into other (un)manned systems as part of a network centric warfare (NCW) approach, where a range of signal intelligence is collected and processed, providing a threat analysis of the battle space and potential attack abilities. Mini UAVs are equipped with sensors, cameras and laser equipment and can be part of Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) operations, as well as electronic warfare. Lethal applications exist for the *AV Inc.* Switch Blade,[52] a tube-size kamikaze UAV; or loitering munitions, with a size of less than two feet, which is basically a loitering remote-controlled grenade. Future applications might see even more lethal capacities with small size munitions or noxious chemicals and increased electronic warfare capabilities.

2.3 Tactical UAVs

Between mini UAVs and larger unmanned systems, there is a broad range of UAVs that are used for tactical purposes. On average, they have a medium range and limited payload, weighing between 100-1500 kg, with an endurance of between 2-24 hours, and a flight altitude

of between 3000-8000 miles. Main usage of such systems is for close range to long range missions, mine detection, communication relay, ISR, Nuclear, Biological and Chemical (NBC) sampling and fire support missions. Present day examples of such systems are the *AAI Corporation* RQ-7B Shadow, *Elbit* Hermes 450b and the *Northrop Grumman* MQ-8 Firebird.

2.4 Medium/High Altitude Long Endurance UAVs (MALE/HALE UAVs)

Medium-size UAVs are best know for their use in military and clandestine operations in Iraq, Yemen, Somalia, Gaza, Afghanistan and Pakistan, where armed Predator and Reaper MALE UAVs are used for fire support operations and attacks, including targeted killings. Larger platforms such as the *Northrop Grumman* Global Hawk HALE are deployed worldwide for ISR and Signal Intelligence (SIGINT) operations. This category of systems is known for its long endurance operations of up to 50 hours (IAI Heron 1) and multiple functionalities, based on the variety of payloads on board.

2.5 Next Generation and Developments

On the other end of the spectrum, high altitude unmanned airships (UAS) are used and being developed for persistent surveillance operations, for example helium balloon type UAVs in Afghanistan that are equipped with sensors and cameras and can stay aloft for days. Current research is also focusing on stratospheric UASs that would be able to stay airborne for years.

The amount of types and applications for UAVs is too broad to summarize comprehensively in this paper, but it is evident that the rapidly developing variety in scales and sizes of various UAVs is clearly posing new challenges in terms of their impact on proliferation and applications in military operations. Conventional current UAVs are fairly slow and vulnerable still, but jet propulsion UAVs, capable of flying faster than the speed of sound, with increased maneuverability and stealth options, will become the future of UAV development, along with swarm attack options, where multiple UAVs coordinate attacks on targets and possess increased autonomy for target selection. Most recent examples of a more highly developed technology are the Northrop Gruman X-47 semi-autonomous UAV the nEUROn, a UAV built by an European consortium of states, and the British *BAE System* Taranis. The current armed UAVs are merely the first generation of aerial UMS and, as with previous revolutionary military technologies, including tanks and airplanes, future generations will likely see major improvements and increased capabilities, making them faster, stealthier, smaller, and increasingly independent, with diminishing human supervision, particularly in complex combat environments.

2.6 Other UMS

In addition to UAVs, there are numerous types of other UMS, such as Unmanned Ground Vehicles (UGVs), Unmanned Underwater Vehicles (UUVs) and Unmanned Surface Vehicles (USFs). The main application for UGVs at present focuses on mines and Improvised Explosive Device clearance (IED). Some weaponised versions of these UGVs were deployed but are still under development, such as *QinetiQs* Talon Swords,[53] which was deployed in Iraq for guarding

compounds. Its successor, the Modular Advanced Armed Robotic System (MAARS) may be deployed on future battlegrounds.[54] There is also interest from emerging industries in Russia and former Soviet States in developing UGVs, such as the Adunok-M produced by the Belarus-based company Display.[55] Most of these systems are relatively unsophisticated and consist of a remotely operated machinegun and a variety of sensors and cameras providing battlefield pictures to the operator. The Israeli Guardium[56] serves as another interesting example for developing potentially armed UGVs. The Guardium is an autonomous UGV used for patrolling. Although not yet armed, the potential for autonomous movements combined with lethal capabilities might attract more interest as it offers a range of operational options, from small UGVs operating in complex urban environments, to larger UGVs for patrolling and offensive operations.

UUVs and USFs are currently mainly used for mine detection, mine laying, SIGINT operations and electronic warfare. Armed USFs such as the Protector[57] are already deployed for patrolling harbors in Israel and Singapore and the Gulf of Aden for anti-piracy missions. UUVs seem to get more traction from various defense research and development departments, most notably in the US and China.[58]

2.7 Dual-Use

Apart from armed forces use, civilian and law enforcement application of UAVs is also increasing. Commercial companies are exploring new markets for UAV use, for example for maintenance of wind energy turbines, inspection of oil pipelines and monitoring farmlands. Law enforcement agencies view UAVs as a useful tool for surveillance and crowd control. They are also used for border protection, fire-fighting and search and rescue operations. Furthermore, the potential for using UAVs and other unmanned systems for humanitarian purposes is gaining more ground amongst civil society organizations operating in developing countries or post-conflict/disaster regions.[59]

As many of these unmanned systems have a dual-use, or even purely commercial character, depending on the technology and payload, the line between military and civilian application will become increasingly blurred and more difficult to discern. Future unmanned systems will likely be smaller in size, and will be easily adaptable for new technologies and payloads. These emerging technologies and their wide range of applications therefore blur the line between civilian and military use of UMS, making it considerably more difficult to apply export restrictions. The increased range of applications and availability of drones and robots in civilian environments will likely motivate states to scale down their export controls to maintain a workable distinction between security risks and commercial interests. This creates ample opportunity for those seeking to obtain dual-use technology.

An important question is to what extent it is possible to weaponize civilian-type robots and drones and how this relates to export control concerns. With existing UAV platforms, the options for terrorist groups or non-state actors would be to either equip them with explosives and turn them into remote controlled flying bombs or deliver biological and chemical agents, while states with more technological capabilities could attach rockets and bombs to larger UAVs, be it of conventional or chemical and biological nature. Other possibilities include the conversion of existing manned platforms or other systems into remote controlled systems. Kits currently available for purchase, such as the DIY drone project,[60] are an apt demonstration of

A female Kurdistan Workers Party (PKK) fighter waits for a drone to land, in Sinjar, March 11, 2015. The drone had flown to check enemy positions near a site which had been hit by two Islamic State car bombs.

the relative ease with which an object can be turned into a remote controlled system. More sophisticated kits for military applications are likely to be available in the very near future, perhaps sooner than expected, considering the rapid pace of technological progress. Aside from installing firing mechanisms – a relatively easy task - developments will likely also focus on using laser target acquisition for increased precision attacks. Ground robots could be armed with machine guns, mines, grenades, and other explosives that can be remotely triggered.

The aforementioned examples represent fairly crude methods for using unmanned systems. However, considering the current level technological progress, many of these technologies will become readily available for interested buyers. As highlighted above, the size of UMS will become smaller, while their battlefield capabilities will increase, especially taking into account swarm technologies. Weaponizing these systems with low or high-grade technologies seems an inevitable evolution in the process, which could be a game changer for non-state actors, terrorists and repressive regimes.[61]

In order to be able to make feasible suggestions for restricting the export and/or use of UMS technologies, a good understanding of current export regulations and mechanisms in place is needed. The following section provides an overview of existing control mechanisms for UAVs and related technologies as a basis for our recommendations for improved export controls on UMS technology. ♦

3. Existing Control Mechanisms for UAVs

The export of weapons, components and related technology are regulated under different export and/or arms control regimes. These regimes are a way to ensure the control of arms, which entails both disarmament and arms limitations. Some were established during the Cold War to prohibit the export of missiles able to carry weapons of mass destruction, others were aimed at restricting the sales of conventional weapons to ensure geopolitical stability or pursue national interests. In addition to arms control treaties, a number of export control agreements emerged, as states agreed to implement export policies on dual-use and missile technology, in order to prevent the proliferation of these types of technologies to unwanted end users. In this section, we will analyse the different treaties in order to assess if and to what extent UMS technology can be controlled by existing regulatory frameworks, and where new regulations and norms should be put in place.

3.1 Arms Control/Trade Treaties

Arms-control treaties are usually legally binding agreements and compliance with treaty specifications is typically verified by the treaty parties or an international organisation. The following part will outline relevant existing control regimes and analyse to what extent they will cover existing and future UMS. For a more in-depth analysis of other arms control treaties and regimes such as the *Biological and Toxin Weapons Convention* and the *Chemical Weapons Convention*, the *Intermedia Range Nuclear Forces Treaty*, the *New Strategic Arms Reduction Treaty* and the *Treaty on Conventional Forces in Europe*, that also have references to relevant unmanned equipment and/or technology, see Jurgen Altmann's analysis *Arms control for uninhabited vehicles: an ethical issue which goes into detail on the wider range of possibilities*.[62]

The *Arms Trade Treaty* (ATT) entered into force in December 2014, and aims to provide the highest possible common standard for regulating or improving the regulation of the international trade in conventional arms and to prevent and eradicate the illicit trade in and diversion of conventional arms.[63] The ATT lays out specific prohibitions when arms, munitions and components cannot be exported, where article 6.3 states that:

> *'A State Party shall not authorize any transfer of conventional arms covered under Article 2 (1) or of items covered under Article 3 or Article 4, if it has knowledge at the time of authorization that the arms or items would be used in the commission of genocide, crimes against humanity, grave breaches of the Geneva Conventions of 1949, attacks directed against civilian objects or civilians protected as such, or other war crimes as defined by international agreements to which it is a Party.'*

In case of an overriding risk that the weapons and/or ammunition exported could be used to violate, among others, International Humanitarian Law (IHL) or International Human Rights Law, or used to facilitate acts of terrorism, the export should not be authorised. The ATT divides conventional arms into seven categories.[64] Article 5 of the ATT deals with its implementation and refers back to the definitions of the UN Register of Conventional Arms. As such, armed UAVs are combat aircrafts or combat helicopters, whereas UGVs can be battle tanks, armoured combat vehicles, or artillery depending on the configuration.[65] As such the trade in armed unmanned vehicles are yet fully covered by the ATT. However, major exporting countries, including the US, Russia, China and Israel, have yet to accede to the treaty. Recommendations to ensure coverage of UMS and strengthen the ATT with regards to existing and upcoming unmanned systems have been put forward during the negotiations which resulted in support for 'future proofing the ATT' to make it possible to update the control list.[66]

3.2 Arms Control Agreements

Canada, the United Kingdom, the United States, France, Germany, Italy and Japan created the *Missile Technology Control Regime (MTCR)* in 1987, to address the risk of proliferation of delivery systems for weapons of mass destruction.[67] So far, 34 countries, mainly Western states, have agreed to restrict exports of missiles and unmanned systems capable of carrying a payload for at least 300 km.[68] The MTCR is the main international agreement controlling the transfer of UAVs. However, because it is an export control agreement and not a treaty, the MTCR is only politically binding. The MTCR establishes guidelines, but the decision of whether or not an export license is approved or denied is left to the individual state.[69] The MTCR uses two categories:

Category 1 contains those items that are considered to be of greatest sensitivity. If an item is included in a system, that system will also be considered as Category I, except when the incorporated item cannot be separated, removed or duplicated.[70] Category I contains, among others: 'Complete unmanned aerial vehicles systems (including cruise missiles, target UAVs and reconnaissance UAVs) capable of delivering at least a 500kg ' payload' to a 'range' of at least 300km'.[71] Because small turbine or internal combustion engines that drive either free or ducted propellers, or small jet engines usually power UAVs, and UAVs tend to fly at speeds of between 360 km/hr to 640 km/hr. the ability to trade off payload and range must be taken into

account when evaluating these systems.[72] There is a 'strong presumption of denial' underpinning Category I – that is, an assumption that MTCR signatory states will not export such systems.[73] Category II comprises items that can be exported after consideration of six distinct criteria relating to the risk of misuse. Here, UAV systems with at least 300km range are included, independent of payload.[74] Countries have greater discretion about exporting Category II systems.[75]

Since 2005, the United States has engaged the MTCR to address multilateral UAV proliferation concerns. To address these concerns the United States has proposed certain significant changes to address how the MTCR controls UAVs, but members have not been able to reach a consensus about these changes. The United States proposed changes to address how the MTCR applies to UAVs, but only one of six proposed changes was accepted. If the other five proposals had been accepted it would have resulted in moving some UAV's that are currently categorized under MTCR Category I to Category II.[76] Between 2005 and 2011 the members have adopted a total of 22 UAV-related technical changes. One such example is that members have adopted controls on turboprop systems used in Category I UAVs and inertial navigation systems in Category II UAV's. Although the MTCR explicitly lists UAVs, only 7 percent of UAV systems are currently subjected to MTCR's strictest controls, due to limits in range and payload.[77]

The *Wassenaar Arrangement* (WA) is an export control agreement for conventional arms and dual-use goods and technologies.[78] The Arrangement comprises 41 members, of which most are Western states, who have agreed to control exports of conventional weapons and sensitive dual-use goods and technologies 'to regions and states with situation/behaviour representing serious concerns to the members', to prevent 'potentially destabilizing accumulations of conventional weapons'. Member States are provided with a range of instructions for making a risk assessment regarding the export of military items. Among others, these risks refer to:

> *'clearly identifiable risks that the weapons might be used to commit or facilitate the violation and suppression of human rights and fundamental freedoms or the laws of armed conflict', diversion to other users, regional stability, UN arms embargos and UN Security Council restrictions.*[79]

To achieve this aim, the WA has set up two lists: the Munitions List and the Dual-Use Goods and Technology list, with the latter covering goods and technologies that have both a military and civilian use. The Munitions List specifically covers military robots and unmanned systems, including UAVs, unmanned underwater robots, UAVs with autonomous flight controls and navigation capability or remotely controlled beyond visual range, as well as equipment and various technologies for these UVs.[80]

The US has proposed three major changes to the *Wassenaar* control list, which members adopted. The first change was adopted in 2005 and added to the control list equipment and components that are specifically designed to convert manned aircrafts into UAVs, as well as equipment specifically designed to control UAVs and guidance and control systems for integration into UAVs, among other items. The second amendment, adopted in 2007, added engines designed to or modified to power a UAV above 50,000 feet to the control lists. The third, adopted in 2008, refined the control policy on navigation, attitude, and guidance and control systems for UAVs.[81] In December 2014, the list was updated and includes references to smaller type UAVs that can fly behind the line of sight with a minimal endurance of 30 minutes.[82]

Under the Wassenaar Munitions List, UAVs are defined under item 10 c), which states the following:

Unmanned aircraft and related equipment, as follows, and specially designed components therefor:

1. 'UAVs', Remotely Piloted Air Vehicles (RPVs), autonomous programmable vehicles and unmanned 'lighter-than-air vehicles';
2. Launchers, recovery equipment and ground support equipment;
3. Equipment designed for command or control;

Aside from the Munitions List, which comprises the UAVs categorization, there is also the Dual Use list, under which UAVs are also listed in item 9, defining them as:

'Unmanned Aerial Vehicles' ('UAVs'), unmanned 'air-ships', related equipment and components, as follows:

9. A. 12. a. 'UAVs' or unmanned 'airships', designed to have controlled flight out of the direct 'natural vision' of the 'operator' and having any of the following:

1. Having all of the following:
a. A maximum 'endurance' greater than or equal to 30 minutes but less than 1 hour; and
b. Designed to take-off and have stable controlled flight in wind gusts equal to or exceeding 46.3 km/h (25 knots); or
2. A maximum 'endurance' of 1 hour or greater;

9. A. 12. b. Related equipment and components, as follows:

1. Not used since 2014
2. Not used since 2014
3. Equipment or components, specially designed to convert a manned 'aircraft' or a manned 'airship' to a 'UAV' or unmanned 'airship', specified by 9.A.12.a.;
4. Air breathing reciprocating or rotary internal combustion type engines, specially designed or modified to propel 'UAVs' or unmanned 'airships', at altitudes above 15,240 meters (50,000 feet).

While the WA applies to the export of some military and dual-use systems used on UAVs, there are a number of limitations identified by the US Governments Accountability Office (GAO) report on UAV export control as not applying *'to other dual-use enabling technologies, according to available analysis.[…] Some of these dual-use technologies are critical to the development of UAV programs in certain countries of concern; however, they are difficult to control because*

they have other commercial applications.'[83] The report does not, however, mention what these technologies are but clearly the dual-use functions hinders effective control. Nonetheless, the concerns laid out grasp the core of the issue, namely that the WA is limited in participation and this proves problematic with the upcoming UAV industry in states that are not a member of the WA, . This could, according to the GAO, potentially *'undermine the regimes' ability to limit UAV proliferation'*. Furthermore, the agreements are non-binding and there are no negative consequences for Member States who violate the agreements.

The difference in interpretation of the WA Guidelines and Principles presents another difficulty, as Member States have different national or regional obligations. Whereas EU Member States are legally bound by the definitions, as the list is part of the EU Common Position, updates on the Dual Use list are often not implemented in other national export control regimes, as some states refer to old version of the list, for example South Africa.[84] A recent example of the problem of interpretation and the political ambiguity around the export control list, including version control issues, is the export of Swedish UAV helicopters to the Chinese Coast Guards,[85] while a similar export licence request from Israel was vetoed by the US earlier on, for fears that China would use the technology for exports to Iran. In short, the standards applied for the interpretation of norms in export requests differ among Member States, and create ambiguity and different outcomes in export licensing. Yet the WA could prove to be a good starting point for seeking improved control mechanism by ensuring broader inclusion of States; start a dialogue with States not (yet) member of the WA to implement the WA lists in their national export control systems and seek to cover all relevant unmanned technologies into both the Munitions List and the Dual-Use list.

The *UN Register of Conventional Arms* (UNRCA) is a voluntary arrangement established on January 1, 1992. It calls upon all Member States to annually provide relevant data on imports and exports of conventional arms, to be included in the Register. Member States are requested to supply data to the Register for seven categories of equipment: battle tanks, armoured combat vehicles, large calibre artillery systems, combat aircraft, attack helicopters, warships and missiles and missile launchers.[87] As mentioned under the ATT section, armed UAVs fall into the category of combat aircraft, but unarmed UMS are not covered, as was also noted by the International Committee of the Red Cross in its analysis of the range of weapons covered under the ATT.[88] Efforts to include dual-use items in the past was, however, met with resistance from certain states, while exclusion of dual-use technology was a reason for other states not to participate.[89] Recently, experts have called on Member States to step up their reporting and increase transparency on the export of armed UAVs, although consensus on the new language for the UNRCA could not be reached.[90] Expanding the categories, to include all types of unmanned military systems, both armed and dual-use under the UNRCA would be an important step toward creating more transparency over the reporting of export of UAVs. This would require extended capacity of States to register what types are being produced and exported, hence also a better control systems. To what extent this is feasible remains to be seen considering the complexity it would involve. Yet, increasing sales and military applications of a wide variety of UAVs would require better control if States want to adhere to international agreements on arms export controls and prevent the export and diversion of these technologies to illegitimate users.

A wrecked military surveillance drone camera that belongs to forces loyal to Syria's President Bashar al-Assad lies in an orchard after rebels claimed to have shot it down May 21, 2014. Picture taken May 21, 2014.

The *EU Common Position on arms exports* is legally binding to all member states and regulates the export of military goods, including limited categories UMS, based on the EU Common Military List and the EU dual-use list, which are basically the same as both WA lists.[91] Eight criteria should guide national licensing policies, including respect for International Humanitarian Law and International Human Rights Law, behaviour of the importing state and its relation to terrorism, and the risk for diversion. The decision to allow or deny the transfer of any military equipment remains at the national discretion of each Member State. Article 6 of the *Common Position* refers specifically to dual-use goods and states that the criteria listed in Article 2 also apply to dual-use goods and technology.[92] This means that exports should not be allowed if there are concerns that the goods and technology will violate the eight criteria of the Common Position.[93]

Some experts highlight the implicit difficulties with the EU system and how the upcoming UAV arms race can be regulated. According to a Portuguese export licensing officer, with extensive experience on UAV exports, the problem is multifaceted, indicating that it *'should be looked at on a case-by-case basis, exploring what configuration the drone has, applying a risk assessment on that and ensuring end-use possibility.'* [94] Users could take advantage of export control difficulties, especially if parts and components can be sold separately and reassembled later. He notes that dual use poses a general problem with aircrafts, and that it is even more difficult to draw a clear line when it comes to UMS. With a simple change of the payload, the configuration of an aircraft can be changed from civilian to military purpose (where military purpose means that it has installed military equipment which is filed under the Munitions List). Can there be guarantees for the actual end-use with dual-use items? If not, Member States are encouraged to apply a stricter risk assessment. However, the licensing

expert notes that there is no repercussion for Member States if they violate the EU CP, making it possible for some States to have lower risk-assessment and softer export controls in order to benefit their UAV industries.

Another key problem is that the EU Common Position criteria can be implemented flexibly and thus to some extent open to interpretation. This has been an ongoing point of criticism from civil society organisations[95] and other experts.[96] Exports to the Middle East and North Africa (MENA) region during the Arab Spring serve as a prime example for these interpretative challenges. Another problematic issue concerning the EU *Common Position* is the different attitude of states under the 'catch-all' clause. This clause permits that items that are not listed in the EU Control lists can still be subject to licensing restrictions or a ban on exports if there is a proliferation risk, though not all Member States apply this clause. The clause applies specifically to dual-use items that can be used for chemical, nuclear or biological weapons, and/or to States that are under an arms embargo, to prevent dual-use items applied for military purposes.[98] However, interpretations of the 'catch all' clause differ between Member States, resulting in one Member State providing an export license where the other refuses it. As a report by the European Commission notes:

> *'Some Member States, industry associations, companies and academia however consider that a certain lack of transparency of decisions, different legal requirements and divergent application of catch all controls across the EU act as a barrier to trade for companies and may in some cases have adverse security effects, especially as a catch-all is only valid in the issuing Member State and therefore proliferators may have access to prohibited items by one or more Member State.'* [99]

The *International Trafficking in Arms Regulations (ITAR)* are a set of US government regulations, which control the export and import of defence-related articles and services comprised on the United States Munitions List. Category VIII (Aircraft and Associated Equipment), includes UAVs, *'which are specifically designed, modified, or equipped for military purposes. Including, but not limited to: gunnery, bombing, rocket or missile launching, electronic and other surveillance, reconnaissance, refuelling, aerial mapping, military liaison, cargo carrying or dropping, personnel dropping, airborne warning and control, and military training'*.[100] Defence contractors put increased pressure on the ITAR, demanding reforms in light of an expanding global market of parts and components, arguing that looser controls result in increased opportunities for the US defence industry.[101] This pressure might lead to less export controls on UMS technology, especially when dual-use technology is considered to be an important economic trade opportunity. Early 2015, the US government updated its regulation for the export of (armed) UAVs, clearly stating that:

> *1. Recipients are to use these systems in accordance with international law, including international humanitarian law and international human rights law, as applicable.*
>
> *2. Armed UASs and strike enabling technologies are to be used in operations involving the use of force only when there is a lawful basis for use of force under international law, such as national self-defense.*
>
> *3. Recipients are not to use UASs to conduct unlawful surveillance or use unlawful force against their domestic populations.*[102]

Table 1
Arms export agreements

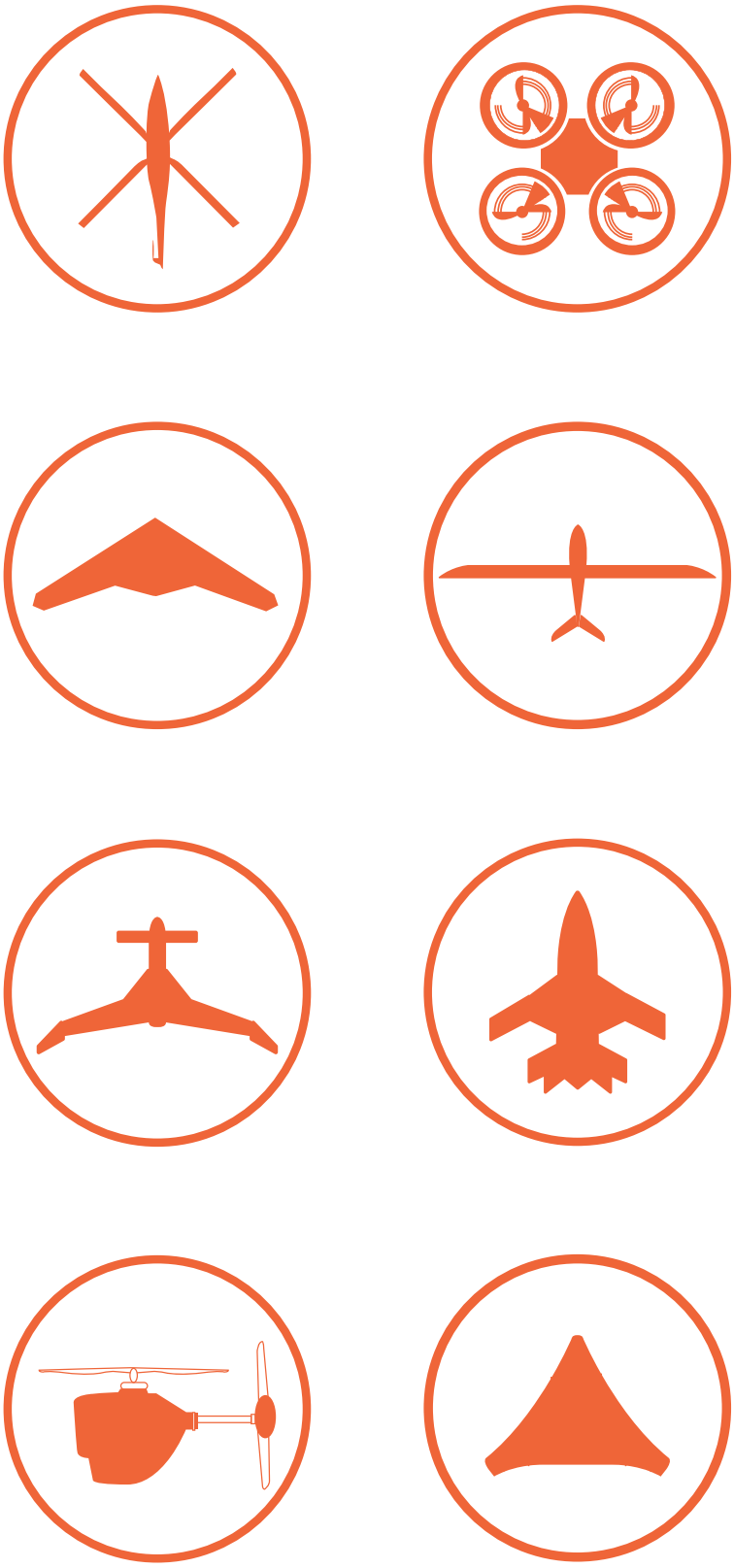
	Unmanned (Combat) Aerial Vehicles		Unmanned (Combat) Ground Vehicles	Unmanned Underwater /Surface Vehicles	
Wassenaar Arrangement	**Munitions List** Military unmanned aircraft and related equip-ment and specially designed components therefor, as defined in item 10C	**Dual Use List** Military or civilian UAVs, unmanned airships, related systems, equipment and components as defined in item 9.A.12(a) and (b)		**Munitions List**	**Dual Use List** 'Unmanned, tethered submersible vehicles designed to operate at depths ≥ 1000m' [104]
Missile Technology Controle Regime	**Cat-1** Capable of delivering ≥ 500 kg pay-load to ≥ 300 km range	**Cat-2** ≥ 300 km range, independent of payload			
ITAR	'Specifically designed, modified, or equipped for military purposes'				
Arms Trade Treaty	'Combats aircrafts or combat helicopters'		'Battle tanks, armoured combat vehicles or artillery, if the criteria are met'	Warships	
EU Common Position	Export of UMS based on WA Munitions and Dual Use List, regulated by 8 criteria		Idem dito	Idem dito	

Concerns have been noted by human rights group that US use of armed drones for targeted killings and its interpretation of IHL and IHRL could set a precedent for others States to use UAVs for similar purposes, if the US interpretation is of guidance.[103]

In sum, the existing arms export controls cover larger, mainly military-designed platforms and a range of technologies associated with the use of these systems. However, the rise of UMS producers, dual-use and hobby UAVs and associated technologies will most likely lower the bar for those actors seeking to assemble, configure, reverse engineer or otherwise utilize unmanned technologies for offensive capabilities. Export control regimes appear to fail to cover systems that are below set limits and ranges in existing regimes, and do not cover a variety of technologies that enable the assemblage of components which could be used to manufacture a complete UMS. Future technologies seem to challenge the existing rules and regulations, providing leeway for those actors seeking to obtain and exportUMS technologies, thereby circumventing export controls agreements.

3.3 National legislation

As unmanned systems are gaining popularity and are increasingly easy available, another proliferation reduction or control measure could potential be improved national control systems to keep oversight. Due to a series of security incidents[105] with UAVs in both the EU and in the US, there is a growing awareness of the potential risks for civilian safety through small hobby UAVs. Aviation specialists have warned about incidents involving air traffic, malfunctioning UAVs that can crash on civilians, while terrorist experts have warned about the use of smaller UAVs for terror attacks. This has resulted in more rules and regulations for civilian air space safety, and discussions about the increased use of UAVs, both in the US and the EU. In March 2015, the US Federal Aviation Association has proposed new rules for the use of smaller type of UAVs[106] and in 2014, the European Commission released a series of studies and ideas for improved regulations.[107] These discussions have also been initiated within individual EU Member States, although aviation security, and transfer and use of dual-use technology would require a regional or even a global approach. Yet, could these discussions forebode increased awareness of the challenges these unmanned technologies poses for both security, privacy and safety? They certainly do highlight the need for improved regulations and pose questions on the speed with which future technologies impact our thinking on safety, security, privacy and warfare. ♦



4. Conclusion

The emergence of armed unmanned systems on the battlefield and for civilian applications have created new challenges for arms control and export controls. More of this new breed of (military) technology clearly can have military advantages on the battlefield and more of these systems will be introduced in air, sea and land operations in the coming years. Accelerated technological developments have led to a booming industry that provides both military, policing and civilian applications for unmanned systems. With a new industry come new challenges. States that are currently exploiting the technological and military advantage of unmanned military systems, and thus have the technological and industrial lead, not only fear losing their technological superiority, but also have concerns over the spread of the technology, including fears that it may end up with adversaries, state or non-state actors or terrorist groups. Other States generally fear for a technological Pandora's Box with a broad range of possibilities for states and non-state actors in possession of these UMS. Likewise, civil society organisations have expressed concerns over the misuse of unmanned systems in and outside the context of armed conflict by current users such as the US, the UK and Israel, and the arming of such systems by repressive regimes and non-state actors.[108] Although the benefit of current and near future UMS will still lie with those who have easy access to advanced technological capabilities (such as satellite systems, using UMS for beyond-line-of-sight operations), small and low-tech UMS could provide a range of possibilities for less-technological equipped states. Examples such as UAV use in Syria, Iran and Sudan underlines this development.

Current export control mechanisms and arms treaties already cover a substantial part of the existing unmanned systems. The MTCR and the Wassenaar Arrangement are seemingly the most important multilateral agreements, due to the number of states that are a party to the treaties and the fact that UAVs are explicitly mentioned. The *Wassenaar Arrangement*

maintains effective export controls for items on the agreed lists, including unmanned vehicles and military robots. However, it refers to UMS as *'specifically designed or modified for military use'*.[109] Although the use of this definition is understandable from an arms exports perspective, with a focus on purely military design, significant amounts of civilian unmanned technology will slip through these standards. Moreover, the potential for military use of civilian UAVs is enormous.

To what extent it is feasible to control this extensive list of technology remains to be seen. It might be highly challenging to overcome the bureaucratic obstacles that will arise with controlling every single item of technology that is part of an UMS setup. The *European Common Position* on arms exports uses the same lists as the Wassenaar Arrangement for controlling the export of military and dual-use systems. The *Arms Trade Treaty* covers armed UAVs that are combat aircrafts or combat helicopters, and UGVs which can be battle tanks, armoured combat vehicles, or artillery, if the criteria are met.[110] But to what extent will new technological developments of UMS that do not fall under existing categories be controlled?

In conclusion, existing regimes for export controls are fairly limited in their effectiveness to deal with new technologies, considering the voluntary and non-binding nature of some of the regimes, and the limited participation of States. Though a large part of the current major producer and export States such as the US and various EU States are part of existing agreements, upcoming UMS produces such as China, Turkey and Russia are not. Technological innovation in the size and type of systems creates new categories that are not necessarily covered by current control regimes, as definitions are ambiguous. In addition, the dual-use nature of many unmanned systems and their increased civilian application creates bureaucratic and other practical obstacles for states to put in place effective controls. This will likely result in alleviated controls on unmanned systems, and an increased likelihood of further proliferation of technology. This results in an export control lacuna, with limited oversight on the export of unmanned systems, including to undesirable end-users.

A core problem is the distinction between the platform (the actual flying, driving or floating mechanism) and the payload. By nature, the platform is merely a vehicle, hence lacking a necessary military application. The payload, be it weapons, radars, sensors etc., defines the use of the system. Acquiring civilian UAVs and turning them into an armed UAV will become less complicated with the growth of expertise and available technological fixes. A growing supply chain focuses on modular components that are independently developed and can be 'plugged and played' on platforms,[111] making them useful dual-use tools. Moreover the influx of available technology has led some to call for less stringent controls. This would lead to a much less controllable market, rather than to greater levels of security in export controls for UMS.

Emerging industries such as in China, Russia, Iran, South Africa, Brazil and India are becoming increasingly important in the global context, and not all states have tight export controls. Taking into consideration that unmanned systems will likely enjoy more traction, arms export controls are needed to ensure stability and restrict the access to conventional weapons. Both manufacturers and states will need to put in place effective and workable proposals to limit the access to critical dual-use technologies through strict global export controls that prohibit the export of unmanned systems to end-users who may use it for human rights violations, oppression or for terrorist purposes. This will undoubtedly require better monitoring mechanisms for end users.

This January 25, 2015 photo appears to show a Chinese made CH-3 drone, owned by Nigeria, which has crash landed upside down. The two AR-1 ATGMs attached to its wing pylons suggest that Nigeria is turning to drone strikes as the bloody war against Boko Haram continues.

Above all, these emerging technologies are already posing challenges regarding their use in and outside the battlefield. Extrajudicial killings, tracking and tracing of political adversaries with these news tools are just the first signs of the changing way warfare is being conducted. Current challenges and undermining of IHL and human rights law with existing UMS paint a bleak picture what the future can be if better oversight, restrictions and accountability mechanisms are not implemented. Profound ethical, legal and tactical questions over the growing use of UMS still require an adequate answer. An answer that strengthens IHL, provide guidelines for military operations, and norms for application of armed violence in and outside regular and irregular conflict grounds. ♦

5. Recommendations

Both on a national and an international level existing control regimes for the export of UMS should be reviewed in order to properly incorporate unmanned systems. Since some of these agreements specifically aim to prevent the illicit trade of arms and each control mechanism believe that the export of UMS technology should be assessed against a set of human rights regulations and humanitarian principles, a number of recommendations can be made. Discussions on existing export control regimes should be initiated within these forums to work towards a broader inclusion of states in existing regimes. Pro-active diplomatic initiatives should be set up that encourages States to become part of the *Wassenaar Agreement* and the *Missile Technology Control Regime* as well as the *Arms Trade Treaty*. With regard to the *Arms Trade Treaty*, in Article 17 (4 c) it is stated that *'the Conference of States Parties shall: (a) Review the implementation of this Treaty, including developments in the field of conventional arms'*.[112] For the future, this could mean that the scope of weapons, or definitions of the existing categories might include all UAVs and related technologies. Based on these considerations, the following recommendations can be made:

- **Work towards standardizing categories of UMS in export control regimes and treaties, in order to provide a better oversight on platforms, payloads and their, dual use applications:** Clear standards would support improved oversight on what is exported and would bolster regulatory arms export agreements and control systems. Collaboration between manufacturers, states and export control regimes is needed to ensure that a set of standardized categories are developed, maintained, updated and incorporated in export control lists. These categories should be used in all relevant arms export and dual use control systems.

- **Increase export controls of UAVs and other unmanned systems of *all* these categories in existing arms export regimes and arms control agreements.** Stricter controls and risk assessment should function as a means to prevent diversion of UMS or UMS ending up in the hands of human rights abusers or finding their way to areas of armed conflicts. States should make an assessment to what extent export of UMS technology, especially those categories not covered by existing export controls, could be used for non-intended use or diverted to non-legitimate end-users, as current policies are inadequate to effectively deal with the pace of technological developments. This would require investment in extra capacity by states on export controls, which seems unavoidable with the growing interest and dual-application of unmanned systems.

- **A core group of States should initiate a global debate in relevant international forums to work towards a broader inclusion of States in existing arms export or arms control regimes:** As over 90 states already posses (armed) UAVs, regulating the import and export of UMS would be a necessary step to curb to proliferation of UAV-technology to prevent UAVS and other unmanned technology to end up with unwanted end-users.. Yet only half of those states are members of relevant export control regimes. Such a core group should take a leadership role in conducting outreach to non-Member States in the need for improved controls and application of existing control lists to ensure increased oversight on export of unmanned technology.

- **Improve transparency on arms and dual-use technology export data and create confidence building measures regarding information sharing on UMS.** The pace with which new unmanned systems and related technologies are developed, utilized and exported is fast, thereby creating more opportunities for misuse or diversion. Transparency building mechanisms will increase oversight on export of UMS and related technology, providing insight in trends and ensuring accountability for sales to unwanted end-users.

- **Strengthen existing and/or set new international norms for the use of UMS in and outside the context of armed conflict.** The last decade has seen an upsurge in the use of UAVs and other UMS by state and non-state actors, which has led to a worldwide debate on the implications of armed violence and remote control warfare. Following the aforementioned recommendations made by the Centre for Preventive Action on armed drone proliferation, an overview of near future developments of UMS, as well as oversight on the use of them by the parliament would be needed, also identifying how the use of UMS could run counter to state interests in counter-terrorism operations. In sum, new challenges posed by UMS due to their unique features will require stricter interpretations of existing norms, or perhaps a new norm. These norms should guide states using (armed) UMS, especially in times of hybrid and complex intra-state conflicts against a wide range of actors. ♦

Endnotes

1 BBC (2002) CIA 'killed al-Qaeda suspects' in Yemen. Accessed at http://news.bbc.co.uk/2/hi/2402479.stm

2 Zwijnenburg, W. (2013) Armed and Dangerous. IKV Pax Christi's position on the use of armed drones.
Accessed at http://www.paxforpeace.nl/media/files/armed-and-dangerous-ipc-position-on-the-use-of-armed-drones-gb-web.pdf

3 PAX is calling for a ban on development, production and use of lethal autonomous weapon systems (LAWs). PAX defines these weapon systems as systems that once activated will select and engage targets on their own without meaningful human control. PAX is co-founder of the International Campaign to Stop Killer Robots see http://www.stopkillerrobots.org. LAWs are outside of the scope of this policy brief.

4 PR Newswire (2012) Teal Group Predicts Worldwide UAV Market Will Total $89 Billion in Its 2012 UAV Market Profile and Forecast. Accessed at:
http://www.prnewswire.com/news-releases/teal-group-predicts-worldwide-uav-market-will-total-89-billion-in-its-2012-uav-market-profile-and-forecast-147008115.html

5 GAO (2012) Non-proliferation: Agencies Could Improve Information Sharing and End-Use Monitoring on Unmanned Aerial Vehicle Exports. Government Accountability Office. Accessed at http://www.gao.gov/assets/600/593131.pdf

6 Department of Defense (2011) Unmanned Systems Integrated Roadmap FY2011-2036
Accessed at http://www.defenseinnovationmarketplace.mil/resources/UnmannedSystemsIntegratedRoadmapFY2011.pdf

7 Popular Mechanics (2009) The Inside Story of the SWORDS Armed Robot 'Pullout' in Iraq: Update
Accessed at http://www.popularmechanics.com/technology/gadgets/4258963

8 Tucker, P. (2014) Every Country Will Have Armed Drones Within Ten Years. Defense One. Accessed at
http://www.defenseone.com/technology/2014/05/every-country-will-have-armed-drones-within-ten-years/83878/

9 Hayes, B. Jones, C. Topfer, E. (2014) Eurodrone Inc. Statewatch and Transnational Institute.
Accessed at http://www.tni.org/sites/www.tni.org/files/download/011453_tni_eurodrones_inc_br_3e.pdf

10 The Independent (2012) Israel points finger at Iran over drone from Lebanon. Accessed at:
http://www.telegraph.co.uk/news/worldnews/middleeast/israel/10023034/Israel-points-finger-at-Iran-over-drone-from-Lebanon.html

11 YNet News (2013) Hezbollah has fleet of 200 Iranian-made UAVs. Accessed at http://www.ynetnews.com/articles/0,7340,L-4457653,00.html

12 BBC (2013) Iraq uncovers al-Qaeda 'chemical weapons plot'. On June 1, 2013. Accessed at http://www.bbc.co.uk/news/world-middle-east-22742201

13 Miasnikov, E. (2005) Threat of Terrorism Using Unmanned Aerial Vehicles. Centre for Arms Control, Energy and Environmental Studie. Moscow Institute of Physics and Technology. Accessed at http://www.armscontrol.ru/uav/UAV-report.pdf

14 United Nations (2013) A/HRC/14/24/Add.6 Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Philip Alston. Accessed at http://www.un.org/ga/search/view_doc.asp?symbol=A/HRC/14/24/Add.6. A complete overview of all report from human rights organisations and UN Special Rapporteurs can be found here: http://www.stimson.org/images/uploads/human_rights_groups_and_un_special_rapporteur_recommendations.pdf

15 The Guardian (2013) Iran's Revolutionary Guards unveil own attack drone.
Accessed at http://www.theguardian.com/world/2013/sep/27/iran-revolutionary-guards-drone

16 Kershner, I. & Lyons, P. (2014) Hamas Publishes Photo of a Drone It Says It Built.
Accessed at http://www.nytimes.com/2014/07/15/world/middleeast/hamas-publishes-photo-of-a-drone-it-says-it-built.html?_r=0

17 CNN (2012) Iranian drones guiding Syrian attacks, rebels say.
Accessed at http://edition.cnn.com/2012/10/31/world/meast/syria-drones/

18 Dorrie, P. (2014) Sudan's Drones Are Dropping Like Flies. Accessed at https://medium.com/war-is-boring/ffa1be165291

19 Wikileaks Cable (2007) Dutch Firm Selling UAV Engines To Iranian Dealer (s)
http://cablegatesearch.net/cable.php?id=09STATE20624&q=demarche%20iran%20netherlands%20uav

20 Easton, I.M. & Hsiao, L.C.R. (2013) The Chinese People's Liberation army's Unmanned Aerial Vehicle Project: Organizational Capacities and Operational Capabilities. Project 2049 Institute.

21 Hsu, K. (2013) China's Military Unmanned Aerial Vehicle Industry. U.S.-China Economic and Security Review Commission.
Accessed at http://origin.www.uscc.gov/sites/default/files/Research/China's%20Military%20UAV%20Industry_14%20June%202013.pdf

22 The Aviationist (2013) New photo shows that China has really copied the U.S. RQ-170 Sentinel stealth drone.
Accessed at http://theaviationist.com/2013/06/02/china-rq170-copy/

23 Wong, E. (2013) Hacking U.S. Secrets, China Pushes for Drones. September 20, 2103, New York Times.

Accessed at http://www.nytimes.com/2013/09/21/world/asia/hacking-us-secrets-china-pushes-for-drones.html?_r=0

24 Want China Times (2014) Saudi Arabia signs deal for China's Pterodactyl drone.

Accessed at http://www.wantchinatimes.com/news-subclass-cnt.aspx?cid=1101&MainCatID=11&id=20140506000088

25 Eder, T. (2012) Schiebel dementiert Verstoß gegen China-Waffenembargo. Der Standard. July 24, 2012.

Accessed at http://derstandard.at/1342947541284/Drohnenhersteller-Schiebel-dementiert-Verstoss-gegen-Waffenembargo

26 Arthur, G. (2014) A Great Leap Forward? Empire Building: China Stamps authority on unmanned technology. Shepard Unmanned Vehicles, Volume 19 Number 1, February/March 2014.

27 Reid, J. (2014) Israeli drone makers fight off export rivals. Financial Times.

Accessed at http://www.ft.com/cms/s/0/2d949c8a-8a6b-11e3-ba54-00144feab7de.html#axzz3136R4mnf

28 Sherwood, H. (2013) Israel is world's largest drone exporter. The Guardian.

Accessed at http://www.theguardian.com/world/2013/may/20/israel-worlds-largest-drone-exporter

29 Hennigan, W.J. (2012) Drone makers urge U.S. to let them sell more overseas. Los Angeles Times.

Accessed at http://articles.latimes.com/2012/jul/01/business/la-fi-drone-foreign-sales-20120701

30 O'Gorman, R. & Abbot, C. (2013) Remote Control War. Unmanned Combat Air Vehicles in China, India, Israel Iran, Russia and Turkey. Open Briefing, September 2013. Accessed at http://www.openbriefing.org/thinktank/publications/remote-control-war/

31 Zenko, M. & Kreps, S. (2014) Limiting Armed Drone Proliferation. Council Special Report No.69. Council of Foreign Relations.

Accessed at http://i.cfr.org/content/publications/attachments/Limiting_Armed_Drone_Proliferation_CSR69.pdf.

32 Davis, L.E., McNerney, M., Chow, J.,Hamilton, T., Harting, S.,Byman, D. (2014) Armed and Dangerous. UAVs and US Security. RAND Corporation.

Accessed at http://www.rand.org/content/dam/rand/pubs/research_reports/RR400/RR449/RAND_RR449.pdf

33 Global Post (2012) China unveils new drones aimed at buyers in developing countries.

Accessed at : http://www.globalpost.com/dispatch/news/regions/asia-pacific/china/121114/china-unveils-new-drones-developing-economies

34 The Aviationist (2014) Hamas flying an Iranian-made Armed Drone over Gaza . Accessed at http://theaviationist.com/2014/07/14/ababil-over-israel/

35 Isscacharchoff, A. (2013) PA forces thwart Hamas attack drone plot in West Bank. The Times of Israel.

Accessed at http://www.timesofisrael.com/pa-forces-uncover-hamas-attack-drone-plot/

36 Dreazen, Y. (2014) The Next Arab-Israeli War Will Be Fought with Drones.

Accessed at http://www.newrepublic.com/article/117087/next-arab-israeli-war-will-be-fought-drones

37 Kais, R. (2013) Hezbollah has fleet of 200 Iranian-made UAVs.

Accessed at http://www.ynetnews.com/articles/0,7340,L-4457653,00.html

38 AFP (2014) U.S. blacklists Hezbollah agents buying drone components.

Accessed at http://news.yahoo.com/us-blacklists-hezbollah-agents-buying-drone-components-174143886.html

39 Cenciotti, D. (2014) Islamic State Has Drones. Nobody panic. Accessed at

https://medium.com/war-is-boring/islamic-state-has-drones-7827987c1755

40 United Press International (2013) Israel's UAV makers face export curbs.

Accessed at http://www.upi.com/Business_News/Security-Industry/2013/05/31/Israels-UAV-makers-face-export-curbs/UPI-26481370018476/; McClafferty, E. & Slack, R.(2012) Export Control Reform: Opportunities and Risk for the UAV Industry. Accessed at

http://www.kelleydrye.com/publications/articles/1626/_res/id=Files/index=0/Export_Control_Reform_-_Opportunities_and_Risks_for_the_UAV_Industry.pdf

41 Stimson Centre (2014) Recommendations and Report of The Task Force on US Drone Policy.

Accessed at http://www.stimson.org/images/uploads/research-pdfs/task_force_report_FINAL_WEB_062414.pdf

42 International Human Rights and Conflict Resolution Clinic Stanford Law School, and Global Justice Clinic NYU School of Law. Living Under Drones - Death, Injury, and Trauma to Civilians from US Drone Practices in Pakistan, September 2012.

http://livingunderdrones.org/wp-content/uploads/2012/10/Stanford-NYU-LIVING-UNDER-DRONES.pdf.

43 Kreps, S. & Kaag, J. (2012) The Use of Unmanned Aerial Vehicles in Contemporary Conflict: A Legal and Ethical Analysis.

Accessed at SSRN: http://ssrn.com/abstract=2023202 or http://dx.doi.org/10.2139/ssrn.2023202

44 Walsh, G.I. (2014) The Effectiveness of Drone Strikes in Counterinsurgency and Counterterrorism Campaigns

US Army Strategic Studies Institute. Accessed at http://www.strategicstudiesinstitute.army.mil/pubs/display.cfm?pubID=1167

45 Department of Defense (2011) Unmanned Systems Integrated Roadmap FY2011-2036

Accessed at http://www.defenseinnovationmarketplace.mil/resources/UnmannedSystemsIntegratedRoadmapFY2011.pdf

46 The term Remotely Piloted Aircrafts (RPA) is often also used for UAVs, or drones, mainly in the EU.

47 EU RPAS (2013) Roadmap for the integration of civil Remotely-Piloted Aircraft Systems into the European Aviation System, Final report from the European RPAS Steering Group. Annex 2

48 See for example: Bento, Mario de Fatima (2008) Unmanned Aerial Systems. An Overview. Inside GNSS Working Papers. Accessed at http://www.insidegnss.com/auto/janfeb08-wp.pdf; RAND Corporation (2014) Armed and Dangerous? UAVs and US Security.
Accessed at http://www.rand.org/content/dam/rand/pubs/research_reports/RR400/RR449/RAND_RR449.pdf

49 Proxy Dynamics (2013) PD 100 Personal Reconnaissance System. Access at http://www.proxdynamics.com/products/pd_100_prs

50 AV Environment (2013) . Nano Hummingbird. Accessed at http://www.avinc.com/nano

51 US Air Force (2010) Micro Air Vehicle Integration a& Application Research Institute.
Accessed at http://www.wpafb.af.mil/library/factsheets/factsheet.asp?id=17006

52 AeroVironment. Switchblade. Accessed at http://www.avinc.com/uas/adc/switchblade/

53 Foster Miller Talon. Accessed at http://en.wikipedia.org/wiki/Foster-Miller_TALON

54 Magnusion, S. (2013) Future of Armed Ground Robots in Combat Still Debated.
Accessed at: http://www.nationaldefensemagazine.org/blog/Lists/Posts/Post.aspx?ID=1236

55 Army Recognition (2012) : Adunok-M remote-controlled observation and weapon station robot
Accessed at http://www.armyrecognition.com/belarus_army_military_wheeled_armoured_vehicles_uk/adunok-m_unmanned_ground_vehicle_remote_controlled_weapon_observation_station_robot_data_sheet_uk.html

56 Israeli Aerospace Industries: Guardium - Autonomous Security Vehicle.
Accessed at http://www.iai.co.il/17483-31663-en/Business_Areas_Military_Land_UGV.aspx

57 Rafael Advanced Military Systems (2013) Protector: Unmanned Naval Patrol Vehicle.
Accessed at http://www.rafael.co.il/Marketing/288-1037-en/Marketing.aspx

58 Lin, J. & Singer, P.W. (2014) Not A Shark, But A Robot: Chinese University Tests Long-Range Unmanned Mini Sub. Accessed at http://www.popsci.com/blog-network/eastern-arsenal/not-shark-robot-chinese-university-tests-long-range-unmanned-mini-sub?dom=PSC&loc=recent&lnk=1&con=not-a-shark-but-a-robot-chinese-university-tests-long-range-unmanned-mini-sub; Mujamdar, D. (2014) CNO Greenert Bullish on Unmanned Underwater Vehicles.
Accessed at http://news.usni.org/2014/10/23/cno-greenert-bullish-unmanned-underwater-vehicles

59 Chow, Jack.C (2012) Predators for Peace. Drones have revolutionized war. Why not let them deliver aid? In: Foreign Policy, April 27, 2012.
Accessed at http://www.foreignpolicy.com/articles/2012/04/27/predators_for_peace.

60 See for example the Do-it-Yourself Drone Kit website http://jaspervanloenen.com/diy/ & Do-it-Yourself Drones website at http://diydrones.com/

61 Hatzigeorgopoulos, M (2012) European Perspectives on Unmanned Aerial Vehicles. European Security Review 63, December 2012. ISIS Europe.

62 Altmann, J. (2013) Arms control for uninhabited vehicles: an ethical issue. Ethics and Information Technology, June 2013, Volume 15, Issue 2.
Open access at http://link.springer.com/article/10.1007%2Fs10676-013-9314-5

63 Arms Trade Treaty (ATT), article 1. UN A/CONF.217/2013/L.3 at http://www.un.org/disarmament/ATT/docs/ATT_text_(As_adopted_by_the_GA)-E.pdf

64 Ibid

65 Ibid

66 Bolton, M. & Zwijnenburg, W. (2012) Futureproofing Is Never Complete: Ensuring the Arms Trade Treaty Keeps Pace with New Weapons Technology. ICRAC Working Paper #1. Accessed at http://icrac.net/wp-content/uploads/2013/10/Futureproofing-ICRAC-Working-Paper-3-2.pdf

67 Missile Technology Control Regime. Acccessed at http://www.mtcr.info/english/index.html

68 Altmann, J, 'Arms control for uninhabited vehicles: an ethnical issue' (2013), pg 7; http://en.wikipedia.org/wiki/Missile_Technology_Control_Regime

69 Ibid

70 Missile Technology Control Regime (MTCR) Annex Handbook – 2010, pg 18

71 Ibid, pg 30.

72 Ibid

73 Altman, J. (2013), pg 7.

74 Ibid

75 Cole, C. (2012) Mapping drone proliferation: big business vs. the MTCR.
Accessed at http://dronewars.net/2012/09/18/mapping-drone-proliferation-big-business-vs-the-mtcr/

76 GAO (2012) Non-proliferation: Agencies could improvie information sharing and end-use monitoring on unmanned aerial vehicle exports. GAO-12-536.pg 20
Accessed at http://www.gao.gov/products/GAO-12-536

77 Ibid

78 The Wassenaar arrangement on export controls for conventional arms and dual-use goods and technologies, 19 december 1995

79 Wassenaar Arrangement (2011) Guidelines & Procedures, including the Initial Elements.

Accessed at http://www.wassenaar.org/guidelines/docs/Guidelines%20and%20procedures%20including%20the%20Initial%20Elements.pdf

80 Altman, J. (2013). pg 7.

81 GAO (2012)Non-proliferation: Agencies could improve information sharing and end-use monitoring on unmanned aerial vehicle exports' GAO-12-536, Jul 30, 2012, pg 21

82 STR Trade Report (2015) Dual-Use Export Control Changes Agreed by Wassenaar Arrangement Members. Accessed at http://www.strtrade.com/news-publications-dual-use-export-controls-Wassenaar-010615.html?utm_source=15-0106+Tuesday&utm_campaign=14-092+Daily+Bugle&utm_medium=email

83 GAO (2012)Non-proliferation: Agencies could improve information sharing and end-use monitoring on unmanned aerial vehicle exports' GAO-12-536, Jul 30, 2012, pg 21

84 Vermeer, A. (2013) A Guide to the Wassenaar Arrangement. Privacy International.

Accessed at https://www.privacyinternational.org/blog/a-guide-to-the-wassenaar-arrangement

85 Want China Times (2014) Swedish firm sells UAVs to Chinese coast guard.

Accessed at http://www.wantchinatimes.com/news-subclass-cnt.aspx?id=20140420000107&cid=1101

86 Israel Defence (2014) Sweden sells UAVs to China. Accessed at http://www.israeldefense.com/?CategoryID=472&ArticleID=2789

87 UN Register of Conventional Arms. Accessed at http://www.un.org/disarmament/convarms/Register/

88 Wood, A. (2010) The UN Register as a basis for the ATT? Background paper: Scope.

Accessed at http://www.icrc.org/eng/assets/files/2012/att-boston-symposium-scope-background-paper.pdf

89 UNODA (2009) Assessing the United Nations Register of Conventional Arms. UNODA Occasional Papers

No. 16, April 2009. Accessed at http://www.un.org/disarmament/HomePage/ODAPublications/OccasionalPapers/PDF/OP16.pdf

90 Jefferson Morley (2013) UN experts call for drone reporting.

Accessed at http://www.armscontrol.org/act/%252F2013_09/UN-Experts-Call-for-Drone-Reporting%20

91 Mark Bromley (2012) The review of the EU common position on arms export: prospects for strengthened controls. SIPRI. EU non-proliferation consortium no. 7, January 2012, pg 4. Accessed at http://www.sipri.org/research/disarmament/eu-consortium/publications/publications/non-proliferation-paper-7

92 As specified in Annex I to regulation (EC) No 1334/2000

93 EU Council (2008) Council common position 2008/944/CFSP of 8 December 2008 defining common rules governing control of exports of military technology and equipment. Accessed at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:335:0099:0103:EN:PDF

94 Interview with arms export licensing officer. Portugese Ministry of Foreign Affairs. September 2014.

95 Saferworld (2013) Arms transfer controls in Europe. Accessed at http://www.saferworld.org.uk/what/arms-transfer-controls-in-europe-

96 Grebe, J. (2013) Harmonized EU Arms Exports Policies in Times of Austerity? Adherence to the Criteria of the EU Common Position on Arms Exports. Bonn International Centre for Conversion.Accessed at http://www.bicc.de/press/press-releases/press/news/harmonized-eu-arms-exports-policies-in-times-of-austerity-369/

97 Vranckx, A. Slijper, F. Isbister,R.(2011) Lessons from MENA. Appraising EU transfers of military and security equipment to the Middle East and North Africa . Accessed at http://www.psw.ugent.be/crg/publications/bb2withhyperlinks.pdf

98 Bauer, S. (2013) WMD-Related Dual-Use Trade Control Offences in the European Union: Penalties and Prosecutions. EU Non-Proliferation Consortium. Non-Proliferation Papers. Nr. 30, July 2013. Accessed at http://www.sipri.org/research/disarmament/eu-consortium/publications/nonproliferation-paper-30

99 EU Commission (2013) Strategic export controls: ensuring security and competitiveness in a changing world - A report on the public consultation launched under the Green Paper COM(2011) 393. Accessed at http://trade.ec.europa.eu/doclib/docs/2013/february/tradoc_150459.pdf

100 United States Munitions List, category VIII. Accessed at http://www.pmddtc.state.gov/regulations_laws/documents/official_itar/2013/ITAR_Part_121.pdf

101 Laird, Robin (2013) US Needs 21st Century Arms Export System; Embrace Allies.

Accessed at http://breakingdefense.com/2013/09/09/us-needs-21st-century-arms-export-system-embrace-allies/

102 US State Department (2015) The DDTC announces new requirements for the permanent export of unmanned aerial systems. Accessed at https://www.pmddtc.state.gov/documents/UAS_NoticeRevised.pdf

103 Open Society Foundations (2015) The Human Cost of Secret US Drone Strikes in Yemen.

Accessed at http://www.opensocietyfoundations.org/voices/human-cost-secret-us-drone-strikes-yemen

104 Wassenaar Agreement (2013), Article 8.A.1.(c) and (d).

105 See for example: BBC (2015) Paris drones: New wave of alerts. Accessed at http://www.bbc.com/news/world-europe-31725302; Washington Post (2015) Drone incident at White House highlights long-studied, still-unsolved security gap. Accessed at http://www.washingtonpost.com/politics/drone-incident-at-white-house-highlights-long-studied-still-unsolved-security-gap/2015/01/26/ed2e7f9e-a594-11e4-a7c2-03d37af98440_story.html

106 FAA (2015) Regulations will facilitate integration of small UAS into U.S. aviation system.

Accesed at http://www.faa.gov/news/press_releases/news_story.cfm?newsId=18295

107 EU Commission (2015) Remotely Piloted Aircraft Systems (RPAS) http://ec.europa.eu/growth/sectors/aeronautics/rpas/index_en.htm

108 The Guardian (2013) Reprieve files for judicial review over export of British drone parts to US.

Accessed at http://www.theguardian.com/world/2013/aug/14/drones-reprieve-export-judicial-review-us; Oudes & Zwijnenburg (2011) Does Unmanned make

Unacceptable. Exploring the Debate on using Drones and Robots in Warfare .

Accessed at http://www.ikvpaxchristi.nl/media/files/does-u-make-ulowspreads_0.pdf

109 Altmann, J. (2013) Arms control for uninhabited vehicles: an ethnical issue (2013), pg 7

110 Arms Trade Treaty (ATT), Article 5. UN A/CONF.217/2013/L.3

Accessed at at http://www.un.org/disarmament/ATT/docs/ATT_text_(As_adopted_by_the_GA)-E.pdf

111 Gilli, A. (2013) Drones for Europe. Brief Issue 29, European Union Institute for Security Studies.

Accessed at http://www.iss.europa.eu/publications/detail/article/drones-for-europe/

112 A/CONF.217/2013/L.3 Article 17.4a

Godebaldkwartier 74
3511 DZ Utrecht
The Netherlands

www.paxforpeace.nl
info@paxforpeace.nl
+31 (0)30 233 33 46

P.O. Box 19318
3501 DH Utrecht
The Netherlands