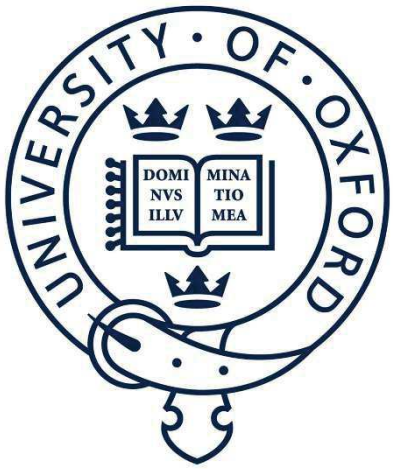
The Unmanned Revolution

How Drones are revolutionising Warfare



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Abstract

Are drones revolutionary? Reading about military unmanned aerial vehicles (UAVs), or 'drones', one could be led to believe that drones are a revolutionary technology, set to fundamentally change warfare. Their fast proliferation, the association with Science Fiction, combined with the secrecy that surrounds drone use has led many to conclude that the 'Unmanned Revolution' is upon us.

This thesis studies the Unmanned Revolution. It develops a framework based on the concept of the 'Revolution in Military Affairs' and applies it to the study of three countries' drone uses and integration into their armed forces. It furthermore explores the role that the designation as revolutionary has played for the integration and use of UAVs in the United States, Germany, and the United Kingdom.

It shows that drones have proven their worth in military operations and compares the three countries' experiences. This thesis' detailed assessment of how the different countries have adopted drones and what implication this adoption has had, makes it a work of reference, in particular with regard to the German and British case studies.

Assessing five types of changes – operational, doctrinal, strategic, organisational, and social and societal – this thesis argues that the most fundamental, and possibly revolutionary, change caused by military drones is social, namely, the fundamentally changed experience of war by combatants. In addition, it highlights country-specific changes.

It concludes that the designation of drones as revolutionary has had an important impact in one country, Germany, although in the opposite way than initially expected. Namely, the intense debate around UAVs has hindered drone procurement and doctrinal thinking. In the other two countries, the Unmanned Revolution narrative was less prevalent and hence less influential.

As drones are proliferating globally, I hope my thesis can be of use to policy-makers, military decision-makers as well as researchers worldwide.

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Foreword

One of the inspirations of this thesis was a book I found browsing in one of my favourite London vintage bookstores: Nels A. Parson Jr.'s *Missiles and the Revolution in Warfare*. Parson was a soldier in the US Army whose division broke through the Siegfried Line not far from my German hometown during the Second World War. When the war ended, Parson got involved in *Operation Paperclip* that brought dozens of German rocket scientists to the United States, including Wernher von Braun. Inspired by their research, Parson went on to study mechanical engineering and formed the section "Combat Developments", at Continental Army Command in Virginia. He published *Missiles and the Revolution in Warfare* – with a foreword by von Braun – in 1962, with the aim of analysing missiles' "revolutionary impact on military operations".

Parson was not the first to study the impact of a new military technology on warfare, nor will he be the last, yet I feel close to his work. Parson tried to come to terms with a military technology that was developing in front of his eyes, uncertain of where the journey was leading. He was driven by the conviction that technological developments could "creat[e] a revolution in warfare".[1] For years I have been fascinated by the idea of the 'Revolution in Military Affairs' (RMA), the belief that a novel technology can, in the right circumstances, cause fundamental change in warfare.[2] As an engineer, Parson was convinced that his readers needed to understand the functioning and capabilities of missiles and therefore included many technical details and sketches. While I do not have Parson' engineering background, I share his conviction that, to make informed predictions about a technology's

[1] Nels A Parson, *Missiles and the Revolution in Warfare* (Cambridge: Harvard University Press, 1962).p.5.
[2] See for instance Ulrike Franke, "A Tale of Stumbling Blocks and Road Bumps: Germany's (non-) Revolution in Military Affairs," *Comparative Strategy* 31, no. 4 (2012).

impact on warfare, one needs to understand said technology – which is why some space in this thesis is dedicated to the discussion of drone's technical capabilities.

Because of when it was written, Parson's work was more speculative than mine. Whereas I can rely on years of drone use in different battlefields and by different actors, Parson could, thankfully, only speculate on how a war that included ICBMs with nuclear warheads would unfold. Still, he provided fascinating insights into how missile technology could change warfare and military organisation, from the British government's decision to make missiles the UK's sole nuclear deterrent, to chilling speculations about the use of tactical nuclear missiles in warfare. Parson's work is a prime example of the benefits of focusing on a new military technology that is considered revolutionary to study changes in warfare. While some of his predictions – such as the imminence of planetary space travel or moon bases – were overly optimistic, overall, he provided a useful analysis of the lasting impact missile technology would have on warfare, strategy, politics, and society. I can only hope my thesis will stand the test of time equally well.

A moving target

Every student faces the challenge that as she writes her thesis, gaps in the literature are closing. I realised that this would be particularly problematic for my research when I started working on drone warfare in 2013. Interest in the topic was rising, and a growing number of academics, journalists, NGOs, and government officials were tackling different aspects of the topic.

I was still surprised by the speed of the revelations on drone use. The growing public interest, and the use of drones against Daesh, an enemy that everyone could agree was evil, made the US and the UK governments more open about their drone use than they initially

were. More information also became available through Freedom of Information Requests, leaks, and investigative journalism. Keeping up with the academic research on the topic was a continuous challenge. At the same time, over the course of the research for this thesis, the view of drones as revolutionary developed further. Where originally there had been many, largely uncritical claims about the Unmanned Revolution, today there are more sceptical views that question the enthusiastic (or warning) first assessments.[3]

Often, the newly available information helped my research. Sometimes however, it made my findings obsolete, or downgraded what I at the time judged to be spectacular insights into general knowledge. I hope the reader nevertheless finds the following enlightening.

[3] Arthur Holland Michel and Dan Gettinger, "The Drone Revolution Revisited," *Centrer for the Study of the Drone* (2016).

I. Introduction

This chapter discusses the motivation for the research and the research question. It introduces the framework, which will be addressed in more detail in chapter III, and details the methodology, including a discussion of the sources used. It presents the research's relevance and limits, and ends with an overview of the thesis structure.

1. Drones are taking off

No military technology has attracted as much public attention in recent years as unmanned aerial vehicles (UAVs) or 'drones'. Joe Chapa notes: "Philosophers, theologians, strategists, historians, psychologists, playwrights, film directors, poets, musicians, and anthropologists have, each according to the norms of his or her own discipline, engaged in important (and sometimes unimportant) questions about [them]".[1] In the media and politics, drones are a hotly debated topic.[2] In popular culture, from Hollywood movies to video games, drones are omnipresent.[3] Social Science scholarship was initially slow to take

[1] Joe Chapa, "Drone Ethics and the Civil Military Gap," *War on the Rocks*, 28 June 2017.

[2] Within the span of one arbitrarily chosen week in September 2013, the *New York Times* reported on Chinese efforts to hack into US drone maker systems, the *Washington Post* wrote about the temporary closure of a US drone base in Djibouti, the British *Independent* covered a court case aimed at making publicly available data on UK armed drone use, and the Swiss *NZZ* discussed the planned use of drones by the Zurich Police. In the order mentioned: Edward Wong, "Hacking U.S. Secrets, China Pushes for Drones," *New York Times*, 20 September 2013. Craig and Miller Whitlock, Greg, "U.S. moves drone fleet from Camp Lemonnier to ease Djibouti's safety concerns," *Washington Post*, 25 September 2013. Kunal Dutta, "Court case aims to force MoD's hand with Freedom of Information requests on drones," *Independent*, 22 September 2013. Jörg Krummenacher, "Im Fokus fliegender Kameras," *NZZ*, 24 September 2013.

[3] The movies "Good Kill" (2014) and "Eye in the Sky" (2016) both focus on drone operations. The plot of the award-winning TV-series *Homeland* revolves around a missile attack carried out by a US-drone in Pakistan. In the video game *Call of Duty, Black Ops 2* a terrorist succeeds in hacking US drones and uses them to target US cities. Drone also feature in *Ghost Recon – Future Soldier* (Ubisoft 2012), *Frontlines – Fuel of War* (THQ-Kaos Studios 2008)*, Arma 2* (Bohemian Interactive 2009), *Battlefield 3* (EA/DICE 2011), *Medal of War – Warfighter* (EA/Dangerclose 2012). All examples by gamesandpolitics "G'n'P, *Drohnen in Videospielen* (Youtube, 2013).

on the various questions posed by the growing use of unmanned systems,[4] but the body of literature is now growing at exponential rates (see 'the literature', chapter II).

Drones are not only talked about, they are used globally. As of 2017, over 90 countries worldwide have some type of military UAV in their arsenals, with most states having procured new systems within the last five years.[5] The US Air Force already trains more UAV pilots than fighter pilots and is facing a pilot shortage as UAVs are being procured faster than pilots can be trained. Modern UAVs have been used in military operations by over a dozen countries, from Pakistan to Italy, Nigeria to Russia.

The prominence of drones has given rise to the narrative that drones are revolutionising warfare. This "Unmanned Revolution" narrative can be found in academic and military writing, politics, and the media debate. Peter W. Singer, author of *Wired for War* (2009), one of the most influential books on drones to this day, is a prominent advocate of the idea. He is regularly quoted with statements such as, "it is of the scale of the introduction of gunpowder, of the introduction of the steam engine, of the introduction of the atomic bomb, of the computer – it's that level of a game-changer for war".[6] Other authors and journalists use terms such as disruptive,[7] transformative,[8] game-changing,[9] or

[4] Matthew Crosston notes that when putting together a special drone issue for the *Journal of Strategic Studies* in 2013/14: "it was actually somewhat surprising to this editorial team, given how easy it was to find discussions about drones amongst pundits and politicians, to not find as developed or organised an audience amongst serious scholars and practitioners". Matthew Crosston, "Future Challenges in Drone Geopolitics," *Journal of Strategic Security* 7, no. 4 (2014).
[5] See 'Global UAV proliferation' in Chapter II.
[6] Henry Bernhard, "Tiefenblick, Zukunft der Kriege (1/3), Auf dem Weg zur unbemannten Luftwaffe," *WDR5*, 18 September 2013.
[7] Henna Hopia, *Dawn of the Drones: Europe's Security Response to the Cyber Age* (Wilfried Martens Centre for European Studies, 2015).
[8] Lev Grossman, "Drone home," *Time*, 11 February 2013.
[9] Shawn Brimley, Ben FitzGerald, and Kelley Sayler, "Game changers," *Disruptive technology and US defense strategy. Washington, DC: Center for a New American Security* (2013).

revolutionary[10] to describe military drones. The view is present among drone supporters and anti-drone activists alike; manufacturer Lockheed Martin claims that "unmanned systems are changing modern warfare",[11] while anti-drone activist Brian Terrell speaks of a "paradigm shift that can be compared to what happened when an atomic bomb was first used to destroy the city of Hiroshima in Japan."[12]

Even more interesting from a strategic studies viewpoint is the re-emergence of the concept of the "Revolution in Military Affairs" (RMA).[13] For Adam Stulberg, it is already "conventional wisdom" that the world stands "at the dawning of the unmanned aerial vehicle revolution in military affairs".[14] Most remarkably, a 2011 report written by the British Ministry of Defence's think-tank states: "Unmanned aircraft now hold a central role in modern warfare and there is a real possibility that, after many false starts and broken promises, a technological tipping point is approaching that *may well deliver a genuine revolution in military affairs*".[15]

But the claims about drones' revolutionary nature are strikingly ambiguous. First, there is no agreement as to *why* UAVs are revolutionary. As pointed out by Colin Gray: "Revolutionary change in warfare is a concept that typically trips off the tongue or out of

[10] "The drone revolution. Breaking down the videos," *NBC news* 2016.
[11] Lockheed Martin, *Unmanned Systems* ([cited); available from http://www.lockheedmartin.com/us/what-we-do/aerospace-defense/unmanned-systems.html.
[12] Quoted in John Dear, "A peace movement victory in court," *Common Dreams*, 18 September 2010.
[13] For instance: James DeShaw Rae, *Analyzing the Drone Debates: Targeted Killings, Remote Warfare, and Military Technology* (Palgrave Macmillan, 2014). p.4. Noel Sharkey, "America's mindless killer robots must be stopped," *Guardian*, 3 December 2012. Andrew Sniderman and Mark Hanis, "Drones for Human Rights," *New York Times* 2012. Crosston, "Future Challenges in Drone Geopolitics." p.i. Daniel Sukman, "Lethal Autonomous Systems and the Future of Warfare," *ISN* (2016).
[14] Adam N Stulberg, "Managing the unmanned revolution in the US Air Force," *Orbis* 51, no. 2 (2007). p.251.
[15] "The UK Approach to Unmanned Aircraft Systems, Joint Doctrine Note 2/11," ed. Concepts and Doctrine Centre The Development, UK Ministry of Defence (2011). p.iii. Emphasis added.

the computer with scant felt need by its employer for detailed explanation".[16] With regard to drones, a wide range of assertions are put forward. Drones are revolutionary, it has been proposed, because

- of drone strikes' accuracy,
- they keep soldiers out of harm's way,
- of their ability to 'lift the fog of war',
- they offer new capabilities to non-state actors,
- they make war easier and more likely,
- they are cheap and efficient,
- they allow states to act alone,
- they offer panoptic surveillance, and more.[17]

Secondly, it remains unclear *for whom* drones are revolutionary: all militaries that use drones, specific militaries which use drones in a certain way, or non-state users?

2. Research questions

My research aims to answer two questions. First, what impact has the introduction of military UAVs had so far? Second, what role did the designation, or non-designation of drones as revolutionary play?

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[16] Colin S Gray, *Recognizing and understanding revolutionary change in warfare: The sovereignty of context* (DIANE Publishing, 2006). p.4.

[17] Examples of these claims in order of the list: Alan W. Dowd, "Drone Wars: Risks and Warnings," *Parameters* Winter/Spring (2013). Tim Hsia and Jared Sperli, "How Cyberwarfare and Drones have Revolutionized Warfare," *New York Times*, 17 June 2013. Chris Abbott et al., "Hostile Drones: The Hostile Use of Drones by Non-state Actors against British Targets," ed. Remote Control (London: 2016). Uwe Kerkow, "Die Roboter-Revolution auf dem Schlachtfeld," *Neues Deutschland*, 28 September 2010. Ian Shields and James Spencer, "An Unmanned Future for Naval Aviation: UAV Carriers," *RUSI Journal* 156, no. 6 (2011). Jamie Shea, " Precision Strike Capabilities: Political and Strategic Consequences," in *Precision Strike Warfare and International Intervention*, ed. Mike Aaronson, et al. (2015). p.xvii. Stulberg, "Managing the unmanned revolution in the US Air Force, Priya Satia, "Drones: a history from the British Middle East," *Humanity: An International Journal of Human Rights, Humanitarianism, and Development* 5, no. 1 (2014).

The first question aims at gathering empirical data on changes caused by drones, which is still lacking (see 'the literature', chapter II). The rationale for the second question is born out of the conviction (detailed in chapter III) that the designation of a technology as revolutionary has impact on that technology independently of whether the technology is in fact changing warfare. I show that the perception and designation of drones as revolutionary has had important impacts on the technology's introduction, in at least one country, Germany, albeit in the opposite way from that I initially expected.

Against the backdrop of the claims of an Unmanned Revolution, I study three countries that have used military drones in recent military operations. To answer the two questions, I trace how military drones are perceived by elites and the public, and uncover changes in operations, doctrine and strategy, and military organisation, and reveal the societal implications of military drone use. My research was motivated by three goals: (1) to help fill some glaring gaps in the drone literature; (2) to provide useful insights into contemporary drone use that benefit military and political decision-makers, (3) to contribute to the RMA literature by conceptualising the study of an RMA and adding the element of the role the elite and public plays in bringing such a revolution about.

3. Methodology

3.1. Comparative case studies organised along the RMA framework

The research for this thesis consists of three case studies that I compare using Alexander George's method of structured, focused comparison. A small-n qualitative case study is the most appropriate research method as it is more conducive to detailed insights. The methodological choice is furthermore motivated by the belief that, from a policy

perspective, case studies have proven to be particularly useful.[18] The choice of small-n studies also imposes itself because of the limited number of available cases (see case selection below).

My research is driven by a fascination with the idea of Revolutions in Military Affairs in general, and with the Unmanned Revolution in particular. But although the RMA has been tremendously influential and retains relevance, it is also an essentially contested concept.[19] In the same way that it cannot conclusively be decided whether a painting is a work of art, the decision of whether a new military technology is revolutionary remains a judgment call. Hence, rather than attempting to answer the question whether drones are causing an RMA, I develop a conceptual framework to study the Unmanned Revolution based on the RMA concept and the RMA literature. This framework divides the study of drones (or other technologies) into five sub-elements: operational change, doctrinal change, strategic change, organisational change, and social and societal change. I orient the empirical research along this construct, which allows for a structured, focused comparison in which the same questions are asked for each case "to guide and standardize data collection, thereby making systematic comparison and cumulation of the findings of the cases possible."[20] Accordingly, the three case studies all follow the same structure.

[18] This belief is supported by a 2014 survey of national security decision-makers in which contemporary case studies were identified as the second most useful methodological tool employed by social scientists. Michael C. Desch and Paul C. Avey, "What Do Policymakers Want From Us? Results of a Survey of Current and Former Senior National Security Decision-makers," *International Studies Quarterly* 58, no. 4 (2014).
[19] John N Gray, "On the Contestability of Social and Political Concepts," *Political Theory* 5, no. 3 (1977). p.344.
[20] Alexander George and Andrew Bennett, *Case studies and theory development in the social sciences* (Cambridge: MIT Press, 2005). p.67.

The RMA is a useful framework to study the Unmanned Revolution for two reasons. First, the aforementioned cited reasons for drones' revolutionary impact are considerably wider than those solely pertaining to military operations, suggesting that there are other elements that require attention when trying to assess drones' impact. As shown in detail in chapter III, the RMA concept provides this wider framework, as operational change is just one of several RMA criteria. For the same reason, the RMA is a helpful framework to study the introduction of any new military technology. Studying a new military technology through the RMA framework – hence, as a larger whole, including doctrinal, strategic, organisational, and social changes – allows a much better prediction as to their impact on warfare and international relations than a mere focus on operations.

Secondly, it is possible, by using the RMA concept as a framework, to identify the changes caused by the introduction of drones that are most revolutionary. While the question whether drones are indeed revolutionary is not one that social sciences scholarship can answer,[21] I can still offer empirical support to make the argument that drones are revolutionising warfare in some respects – although nothing can prevent the reader from coming to the opposite conclusion.

3.1.1. Case selection

I study countries that have introduced drones into their military arsenal. For a country to be considered as a case in this thesis, it needed to fulfil two criteria. First, it had to have used UAVs in a military operation, as any statement on the revolutionary impact of UAVs

[21] The question of whether the introduction of drones has caused a Revolution in Military Affairs is not acceptable for empirical Social Sciences research because a) it is a yes/no question that rarely, if ever works in social science research (see John Gerring, *Social Science Methodology: A Critical Framework* (Cambridge University Press, 2001). p.237), and b) as shown in chapter III, the RMA is an essentially contested concept. The only way to arrive at an answer would be for me to define the RMA and then answer the question, meaning that the RMA could be whatever I wanted it to be and the Unmanned Revolution would be an RMA (or not) simply because I decided for it to be.

needs to be grounded in a study of their actual use. Military operations can act as a catalyst for change, and push a military to really integrate a new technology. Secondly, information on the country's drone operations, doctrine, and more needed to be available. When I began my research, there was only a limited number of cases that fulfilled the first criterion. The data availability criterion excluded more cases. Of the remaining cases, the following three were selected: (1) the US's adoption of military drones and use in Pakistan 2004 – January 2017, (2) Germany's adoption of UAVs and use in Afghanistan 2003 – 2014, and (3) the UK's adoption and use of UAVs in Afghanistan 2007 – 2014.

The cases were chosen as they allow to best assess the claims about the Unmanned Revolution. The three countries are leaders in drone use, meaning that they use a reasonable number[22] and range of UAVs. Between them, the three armed forces used the complete range of currently available military UAV types, from nano-UAVs to HALE UAVs. This, in addition to the fact that two are European drone users, also helps to close some of the most glaring gaps in the drone literature, namely, the lack of studies of unarmed drones and drone use in official military operations, and the lack of non-US studies.

3.1.2. Case 1. The US's adoption of drones and use in Pakistan 2004-2017

The US's adoption of drones and their use in Pakistan imposes itself as a case study in any work on drones. Together with Israel, the US can claim to have invented modern drones (see 'the history', chapter II). Today, the US is the world's most important user of UAVs

[22] As Colin Gray notes "the tactical effectiveness of weaponised technology depends not only on its technical military performance as a weapon, but also on the quantity in which it is procured". (*Perspectives on Strategy,* Oxford University Press: 2013, p.171.) For any technology to have a distinct impact on military operations, it needs to be available in a certain number and experience is needed for best practices to develop. On the basis of this criterion, countries with limited UAV-use or those which only recently started to use the technology were excluded.

and leader in UAV research and development: of the estimated 70bn USD that the global military UAV market is worth in 2017-2021, the US accounts for 30bn.[23] It has used armed UAVs on a large scale, in conventional military operations and outside official warzones. Of these theatres, Pakistan has come "to symbolize the front line in the US covert drone war".[24] It is the prime example of the use of armed UAVs outside a designated war zone – the type of drone use most heatedly discussed and which has had a crucial impact on the debates in other countries.[25] The timeframe for this study is June 2004 (first US drone strike in Pakistan on 17 June 2004) to January 2017 (end of the Obama administration).[26]

3.1.3. Case 2. Germany's adoption of drones and use in northern Afghanistan 2003-2014

"Germany has a strong track record in the use of UAVs and is looking to acquire the full spectrum of UAV capabilities, more so than any other European country," a European Commission study noted in 2007.[27] Allegedly the initiator of the "first battle of the robots" in 1944,[28] Germany has a long history of UAV use. Modern UAVs were first deployed by the Bundeswehr in the 1970s. It currently has seven different surveillance and reconnaissance drones in its arsenal, five of which were used in Afghanistan. Unmanned systems were the only air-borne ISR systems used by the German forces throughout most of the Afghanistan mission. The timeframe for the study is 2003 (the beginning of German

[23] Noah Poponak et al., "Drones. Flying into the Mainstream," ed. Goldman Sachs Group (2016). p.50.
[24] Christopher Woods, *Sudden Justice. America's secret drone wars* (Oxford University Press, 2015). p.93.
[25] As the focus of this study is the Pakistan operation, the rest of the case study also focuses on US Air Force experiences, and changes associated with the Pakistan operation, rather than with all drone types.
[26] For the US case, there is not an obvious end date as for the other two cases. As the Pakistan operations are still ongoing, the end of the Obama administration in January 2017 has been chosen as end date, though not all available data reaches until 2017.
[27] Frost & Sullivan, "Study analysing the current activities in the field of UAV," in *European Commission*, ed. Enterprise and Industry Directorate-General European Commission (2007). p.15.
[28] Christopher Coker, *Warrior geeks: How 21st-century technology is changing the way we fight and think about war* (London: Hurst, 2013). p.18.

UAV use in Afghanistan) to December 2014 (the end of the ISAF mission and with it the German combat operations in Afghanistan).[29]

3.1.4. Case 3. The UK's adoption of drones and use in Helmand, Afghanistan 2007-2014

The UK's Armed Services have had UAVs in service continuously since 1961. The UK is the only European country to have armed UAVs, and one of only a few countries worldwide to have employed armed UAVs in combat. Over the last decade, the UK has deployed its UAVs to several theatres, including Iraq and Syria. I have chosen to study the operation in Afghanistan, mainly in Helmand, because it was the largest British operation and saw the most intensive British UAV use. In total, the UK used six different UAV types in Afghanistan, ranging from the smallest military UAV in service worldwide (the Black Hornet) to the notorious Reaper. Because of the jointness and close coordination of US and British operations in Afghanistan, the study of British UAV use in Afghanistan also gives insights into conventional US UAV operations. The timeframe for the British case study is 2007 (beginning of UK UAV use in Afghanistan) to 2014 (end of ISAF mission).

3.2. Looking for the Unmanned Revolution

3.2.1. Sources

This study is mainly based on primary sources – interviews, doctrinal and strategic writings, and other written contributions by actors directly involved. The latter category includes literary accounts written by soldiers returning from the battlefield (see below). Given the topicality of the subject, this thesis relies more than usual on news reporting as it provided the most up-to-date information on recent developments. Secondary sources, such as books, journal articles, and articles in the trade press have been used to provide

[29] The non-combat mission "Resolute Support" was launched in January 2015 to which Germany is contributing troops with the aim of providing training and assistance to the Afghan security forces.

technical data and information on historical drone development and allowed for cross-checking of some of the information gathered in the interviews.

3.2.2. Studying doctrine and strategy

Studying military doctrine is challenging as there is no agreement on how to define doctrine, and "[s]cholars and military practitioners approach doctrine largely on the intuitive level".[30] NATO defines doctrine as the "[f]undamental principles by which the military forces guide their actions in support of objectives. It is authoritative but requires judgement in application".[31] Where to find these "fundamental principles" and who has the authority to write them is however open for debate. Walter Kretchik argues doctrine is defined by two characteristics, approval by a government authority and mandatory use.[32] Martin van Creveld argues doctrine is written by military professionals.[33] This points to official, written documents, but Bjerga and Haaland note: "Apart from the fact that the concept of doctrine itself means *that which is taught* (from the Latin *doctrina* meaning *teaching* or *instruction*), there is no single answer as to what doctrine is. On the contrary, quite different documents have been labelled doctrines."[34]

To examine doctrinal change caused by the introduction of drones, I have therefore studied official doctrinal and strategic documents; however, where applicable, I also include other documents, as well as observations and information drawn from interviews that may not be codified in a document (yet), but which point to emerging doctrine. In doing this I follow Barry Posen, who, in his seminal study of interwar doctrine in France,

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[30] Albert Palazzo, *Moltke to Bin Laden* (Land Warfare Studies Centre, 2008). p.6.
[31] NATO, "AAP-06 Edition 2012 Version 2 NATO Glossary of Terms and Definitions," (2012). p.2-D-9.
[32] John A. Bonin, "Review of U.S. Army Doctrine: From the American Revolution to the War on Terror, By Walter E. Kretchik," *Parameters* 43, no. 2 (2013).
[33] Martin Van Creveld, *The Age of Airpower* (New York: PublicAffairs 2011). p.236.
[34] Kjell Bjerga and Torunn Haaland, "Development of Military Doctrine: The Particularly Case of Small States," *Journal of Strategic Studies* 33, no. 4 (2010). p.507.

Britain and Germany, analyses *what is being done*, rather than (solely) what has been written. "Military doctrines are hard to hide", he noted, and primarily relied on secondary literature, only supplementing it with primary source material "when such material was useful to elaborate a certain point or fill in gaps".[35]

Casting the net wider is also important because doctrinal writing has changed in recent years. Høiback notes that official doctrinal documents are increasingly written for a public audience rather than for soldiers; today military doctrine is sold in bookshops.[36] The growing belief that doctrine needs to be "flexible" and "adaptable", to allow the military to deal with inevitable battlefield surprises,[37] also means that doctrine is becoming increasingly transient. The fast development of drones may also outpace the thinking on them, as US President Obama admitted in 2016: "in the first couple of years of my presidency, the architecture – legal architecture, administrative architecture, command structures – around how [drones] were utilized was under-developed relative to how fast the technology was moving".[38]

Furthermore, a narrow definition may work well for one country, but it is unlikely to yield equally good results for other countries. For instance, German doctrinal has been slow since the creation of the Bundeswehr in 1955 to the point of "doctrinal stagnation".[39] Accordingly, documents and sources other than the official doctrines need to be included.

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[35] Barry Posen, *The Sources of Military Doctrine. France, Britain, and Germany between the World Wars* (Ithaca and London: Cornell University Press, 1984).

[36] Høiback refers to the US Army/ Marine Corps Counterinsurgency Field Manual which was published in 2007 by the University of Chicago Press. Cf. Harald Høiback, "What is Doctrine?," *Journal of Strategic Studies* 34, no. 6 (2011). p.896.

[37] Meir Finkel, *On flexibility: Recovery from technological and doctrinal surprise on the battlefield* (Palo Alto: Stanford University Press, 2011).

[38] Julian Hattem, "Obama outlines hopes for legacy on drone strikes," *The Hill*, 7 April 2016.

[39] Tom Dyson, "Managing Convergence. German Military Doctrine and Capabilities in the 21st century," *Defence Studies* 11, no. 2 (2011).p.10.

In the UK, Høiback notes, "many have seen the multifariousness of war as the main argument against doctrine," and have opted for a "doctrine of no doctrine" approach.[40] A more inclusive approach is thus sensible when studying and comparing different countries' doctrinal thinking.

While on a theoretical level, the distinction between doctrinal and strategic change is sensible (see chapter III), in the case studies I have studied doctrinal and strategic change alongside each other. For one, in the real world, the distinction is difficult to hold up with doctrinal documents veering into strategy and vice-versa. More importantly, the distinction becomes hollow when studying countries that approach doctrinal and strategic thinking differently. While the US, and to some extent the UK publish strategic-level documents, Germany's strategic documents are less strategic in nature.[41]

3.2.3. Studying soldiers' accounts

To get a fuller picture of drone usage and to study what impact the introduction of the technology has had on soldiers' battlefield experiences (an element of social change), I study soldiers' first-hand accounts, including literary renderings (*Heimkehrerliteratur,* 'homecoming literature' in German).[42] As argued by John Keegan: "allowing the combatants to speak for themselves, is not merely a permissible but, when and where possible, an essential ingredient of battle narrative and battle analysis".[43] Still, soldiers' writings need to be approached with caution. A soldier may be tempted to embellish the

[40] Høiback, "What is Doctrine?." p.890.
[41] On this, see Olivier De France and Nick Witney, "Europe's strategic cacophony," *ECFR Policy Brief, European Council on Foreign Relations (ECFR)* (2013). p.4.
[42] Heimkehrerliteratur was originally defined as the German fiction published after WWII by returning soldiers. Germany is currently experiencing a second wave of *Heimkehrerliteratur* through literary accounts written by soldiers returning from Afghanistan. For an overview (and passionate critique) of this literature, see Florian Kessler, "Krieg in Banalien," *ZEIT*, 17 September 2013.
[43] John Keegan, *The face of battle: a study of Agincourt, Waterloo and the Somme* (Pimlico, 2004 (1976)). p.32

reality, make the story more interesting, or make herself look better. Also, soldiers may have interests that need to be considered, which may make them more or less welcoming of a new technology. As David Hambling notes, "asking current military people about air-to-air drones is a bit like asking cavalry officers about tanks in 1910."[44] Yet, if approached with caution, soldiers' writings can give crucial insights into the reality of combat and the combatants' experiences.

3.2.4. Studying public and elite perceptions

To find out what view political decision-makers and the public hold of UAVs, I study media coverage and elite discourse. Elite discourse, media coverage, and public opinion are highly interlinked and interdependent, particularly in liberal democracies. Marjan Malešič points out that public opinion is shaped by elite political discourse and media coverage.[45] Adam Berinsky similarly finds that public opinion about war is shaped by patterns of elite conflict and their reporting in the media, a phenomenon that he has termed "elite cue theory".[46] This interaction, however, is not unidirectional: "the media do not create public opinion at will, but in some measure reflect the views of readers, listeners, viewers, and political actors".[47] Hence, public opinion and elite views are in constant interaction, with the media playing the role of intermediary.

The national media coverage is thus used as a proxy for public opinion, supplemented by relevant studies. The elite debate is researched by studying official documents, such as

[44] David Hambling in email 24 June 2017.
[45] "Elite political discourse and media coverage are assumed to be two decisive factors for shaping public opinion" Marjan Malešič, Gerhard Kümmel, and Mathias Bonneau, *Security and the Military between Reality and Perception* (Nomos, 2011). p.17.
[46] Adam J Berinsky, "Assuming the costs of war: Events, elites, and American public support for military conflict," *Journal of Politics* 69, no. 4 (2007).
[47] Hugh Smith, "What costs will democracies bear? A review of popular theories of casualty aversion," *Armed forces & society* 31, no. 4 (2005). p.499.

parliamentary questions and speeches, and interviews with politicians, military decision makers, and activists.

4. Contribution and relevance

My research has both academic and practical aspirations. Specifically, I believe that my work is relevant for policy makers and the defence community. With drones proliferating all over the world, it is of immediate importance to understand what, if any, changes the introduction of these systems cause. Armed forces around the world are deciding which UAV systems to buy and are looking for best practices on how to use them. The three militaries studied in this thesis acquired their UAVs predominantly through urgent operational requirement processes and are now faced with the question of where they fit in and how to further develop their unmanned assets. Now is an appropriate time to step back and evaluate. The narrow focus of the drone literature is particularly problematic in this regard. As detailed in chapter II, the literature is primarily focused on:

(1) The use of *armed UAVs,*

(2) for targeted killings,

(3) outside of official war zones,

(4) by the US military or its intelligence services,

(5) with the pilot being located far away from the battlefield, (mainly in the US).

Any generalisations about drone use and its consequences are based solely on the particular circumstances of armed UAV use in current US operations in Pakistan, Yemen,

and Somalia. If politicians believe that the only utility of armed drones is targeted killing,[48] this dangerously skews drone policies, doctrines, and procurement.

The case studies help to fill these gaps. First, the German and British case studies give ample evidence as to how *unarmed* UAVs are being used in military operations, which are piloted from within the battlefield. Secondly, two of the cases are *conventional military operations*, in which drones are used by armed forces, and are not the only asset but are used in concert with other weapon systems. Third, two of the cases concern drone use by *actors other than the United States*. In this regard, the German case study in particular breaks new ground as the first comprehensive analysis of German military drone use. I hope for my thesis to become a work of reference on German (and British) drone use. Last, this thesis adds to the *strategic studies literature*, which is weak in its coverage of drones.

The findings of this thesis can help advance doctrinal writing and thinking on drones – which is crucially important as inadequate doctrines for new technologies have been behind many strategic errors in the past.[49] In World War II, France had more, and higher quality, tanks than Germany, but while the latter devised new doctrines, France did not and was unable to confront the German advance.[50] The US in WWII failed to develop the right doctrine for the tank destroyer, making it one of the most famous failed innovations

[48] As for instance argued by the chairman of the Bundestag defence committee. Hans-Peter Bartels, "'Drohnen sind nicht die Spitze der Technik'. Interview mit Hans-Peter Bartels (SPD)," *IP Internationale Politik*, 29 July 2014.

[49] As noted by Lucas Kello, "The meaning of the Cyber Revolution: perils to theory and statecraft," *International Security* 38, no. 2 (2013). p. 14.

[50] On this see for instance James Corum, *The roots of Blitzkrieg: Hans von Seeckt and German military reform* (University Press of Kansas, 1992). Others have cast doubt on the narrative of a Blitzkrieg RMA and a Blitzkrieg doctrine: see Rolf Hobson, "Blitzkrieg, the Revolution in Military Affairs and Defense Intellectuals," *Journal of Strategic Studies* 33, no. 4 (2010). And JP Harris, "Debate the Myth of Blitzkrieg," *War in History* 2, no. 3 (1995).

in US military history.[51] Studying drones and drone doctrine is hence crucial, not least in order to find out what reforms not to implement, as Jeremy Shapiro points out: "no nation or military can afford the disruptions and upheavals caused by excessively frequent reorganizations. False revolutions also impose a severe cost in terms of wasted effort, chaotic disruption of routine, and inappropriate innovations".[52]

Third, independently of drones, it is important to find a way to study ongoing technological change. Military historians have done important work on past changes, but military technology is set to change ever faster, meaning that conflicts in this century will be fought with weapons that have not yet been invented. I show that the RMA prism is a useful concept to apply to ongoing military change, meaning that it can in the future equally well be applied to another rising military technology. The concept of revolutionary change has demonstrated an exceptional longevity. Colin Gray notes: "Revolutionary change in warfare is a notion that cannot be dismissed with a yawn."[53] With regard to the RMA literature, the original contribution of this thesis consists in acknowledging and studying the elite's and public's view of a new technology in bringing about revolutionary changes.

5. Limits of the research

At least one particularly interesting case had to be excluded during case selection; Israel, a country with a long history of modern drone use and the second-most advanced drone user after the US. Data on Israeli drone use remains scarce as Israel is keeping its drone

[51] Christopher Gabel, *Seek, Strike and Destroy: US Army Tank Destroyer Doctrine in World War II*, vol. 12 (DIANE Publishing, 1985). Also see Thomas Ricks, "Rules of innovation (10): Don't build your doctrine on incorrect lessons drawn from poorly researched and designed exercises," *Foreign Policy* (2016).
[52] Jeremy Shapiro, "Information and War: is it a Revolution?," in *Strategic Appraisal: The Changing Role of Information in Warfare*, ed. Zalmay Khalilzad and John White (RAND, 1999). p.115.
[53] Gray, *Recognizing and understanding revolutionary change in warfare: The sovereignty of context*. p.2

operations secret.[54] In addition, there is a growing number of cases that deserve further attention. I chose the cases for the availability of their data and my linguistic abilities, but further research into other countries is warranted.

It is also not ideal that both the German and the British employ UAVs in the Afghan theatre. It would have been preferable if the three countries operated in different military operations and geographic areas, to have a representation of different circumstances with regard both to operation type and to geography and climate. This concern is somewhat attenuated by the fact that the German and British engagements in Afghanistan were quite different in nature, scope, and scale. They took place in different parts of Afghanistan and under different circumstances. As a British Army officer put it somewhat undiplomatically in his Afghanistan memoirs: "You could not compare what 7000 Brits in Helmand were doing, with the Germans, loafing up in Herat, who weren't even allowed out at night."[55] Also, this unintended focus may in fact give Afghanistan the attention it deserves. It was in Afghanistan that the first drone strike in combat took place, in the opening nights of the air war,[56] and for the last decade, Afghanistan has been the epicentre of drone use, "the most heavily drone-bombed country in the world".[57] Chris Woods furthermore makes the argument that, "[i]t was above Afghanistan and Iraq where

[54] See Tamir Libel and Emily Boulter, "Unmanned Aerial Vehicles in the Israel Defense Forces," *RUSI Journal* 160, no. 2 (2015). p.68.
[55] Patrick Hennessey, *The Junior Officers' Reading Club: Killing Time and Fighting Wars* (Penguin UK, 2009). (Audiobook hour 7:27).
[56] Jason Fields and Matthew Gault, *Months before 9/11, he had Bin Laden in his sights, but no trigger to pull* (2016).
[57] Alice K. Ross, Jack Serle, and Tom Wills, "Drones in Afganistan. A Scoping Story," *Open Briefing, Remote Control Project* (2014).

the US Air Force and its British allies learned how best to use this revolutionary weapons system".[58]

One final caveat needs to be addressed. History is full of examples of false prophets on allegedly revolutionary developments. Assessing ongoing changes is notoriously difficult for contemporaries. This thesis can only reflect the situation at a specific point in time. Drone technology is changing as new systems are being developed, and technological breakthroughs such as autonomy, are expected. Most importantly, drones are breaking into the civilian realm, with potential military implications which will influence the public and elite view of drones. This means that this thesis cannot – and does not pretend to be – a final assessment of military drone use.

6. Thesis structure

The thesis is structured into seven chapters. This chapter (I) has given the context for the research and outlined the research question and methodology. Chapter II gives an overview of the workings and development of military UAVs. I have chosen to split the literature review in two parts; in chapter II, I provide an overview of the state of the drone literature which serves to identify the gaps in the literature that this thesis aims to fill. Chapter III provides the framework for the study of the Unmanned Revolution, developing the matrix to study the Unmanned Revolution. In this chapter, I take another look at the existing literature on drones, discussing what the literature says about the areas defined in this chapter. Chapters IV to VI form the heart of the thesis, the case studies of the US, Germany, and the UK. The case studies follow in their structure the framework established in the third chapter and represent an in-depth study of how drones have been adopted

[58] Woods, *Sudden Justice. America's secret drone wars*. p.xv.

and used in the three countries. Given the large body of literature on the US, the US case represents the least original research of this thesis. I have nevertheless chosen to discuss it first as the US's drone use has been highly influential on the other two cases. Chapter VII presents the combined findings from the case study, addresses the implications of those findings for the international balance of power and international relations more broadly, and offers a view ahead.

II. Unmanned Aerial Vehicles

"[The drone] is a heavy object, full of undiagnosed complications" – Adam Rothstein, 2015[59]

This chapter provides an overview of drone technology, its constituent parts, classification and nomenclature, and identifies the most important milestones in drone development. It reviews the literature on drones, identifying the most important gaps that this thesis aims to help fill.

There is no universally accepted definition of an unmanned system, as official documents have struggled to keep up with its technological development. Often, a 'you-know-it-when-you-see-it' approach is adopted, which is acceptable for most research but problematic for arms control and drone proliferation studies. In fact, some arms control experts consider drones revolutionary precisely because they defy existing definitions of weapon systems.[60] This chapter presents the most often used definition and categorisations.

1. The technology

An unmanned aerial system (UAS) has four components. First, the *air vehicle* that carries the *payload*. Second, the *support systems* such as ground control station, launching apparatus, recovery systems, etc. Third, the *infrastructure*, which may include satellites, air bases, relay stations, etc. Fourth, *the pilot(s)* and/or *operator(s)* that programme the

[59] Adam Rothstein, *Drone* (NY/London: Bloomsbury, 2015). p.ix.
[60] As noted by David Hambling at UNIDIR meeting (15 November 2016, own notes).

flight path, remotely pilot the vehicle, analyse the collected data, and operate the payload.

1.1. The vehicle

The air vehicle is the most visible element of a drone system. For this thesis, a 'drone' or 'UAV' will be defined as:

> An airborne vehicle which does not carry a human operator, and may be piloted remotely, follow a pre-programmed flight path, fly autonomously, or a combination of all three. It is designed to be recoverable and carries a lethal or non-lethal payload. Non-recoverable vehicles and projectiles such as ballistic vehicles, cruise missiles, and artillery projectiles are not considered UAVs.[61]

This definition consists of five elements:

UAVs are *airborne.* Although the term 'drone' is sometimes used for all UA types, and the number of ground-based (UGV) or underwater systems (UVV) is growing, in this thesis 'drone' refers exclusively to airborne systems.

UAVs *do not carry a human operator*. This does however not necessarily exclude the presence of humans onboard. As of 2017, no military drone system transports troops, yet there are several civilian developments that carry humans ('drone taxis').[62] These, and any future unmanned military troop transports, qualify as UAVs as long as the passengers do not pilot the vehicle.

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[61] I have used this definition previously in Ulrike Franke, "The global diffusion of Unmanned Aerial Vehicles (UAVs), or drones," in *Precision Strike Warfare and International Intervention: Strategic, Ethico-Legal and Decisional Implications*, ed. Mike Aaronson, et al. (Routledge, 2014)., from which the following is partly adapted.

[62] Sophie Morlin-Yrob, "Driverless Flying Taxi Service Set to Launch in Dubai," *CNN*, 17 March 2017.

UAVs are *piloted remotely, follow a pre-programmed flight path, fly autonomously, or a combination of all three.* This pays tribute to the increasing technical complexity of UAVs. Initially, UAVs were either piloted remotely throughout the entirety of the flight, or followed a pre-programed flight path that could not be modified after take-off. Most modern UAVs combine different steering mechanisms, including automatized or even autonomous capabilities.[63]

UAVs are *designed to be recoverable*: this distinguishes UAVs from missiles. Missiles and drones developed alongside each other and share common roots. But missiles are expendable one-way weapons. Not included in the definition therefore are "kamikaze drones" – unmanned systems that monitor an area, and destroy a target by crashing into it such as the Chinese CH-901 or the Israeli Harpy, that are better described as loitering munitions.

UAVs *carry a lethal or non-lethal payload.* UAVs are carrier systems that transport payloads, which can include weapons such as missiles or bombs. (See more on payloads below).

The elements not included in the definition are equally important:

UAV design: UAVs do not need to accommodate a pilot and her life-support systems, and do not need to limit G-forces, meaning that the only restrictions for UAV design are aerodynamical. Historically, UAVs were fixed-wing systems, similar to model aeroplanes or jets, or helicopter-like vertical-take-off systems. As the technology developed, more

[63] The definition of autonomy is even more problematic than of drones. See the discussion at the UN's Convention on Certain Conventional Weapons: Chris Jenks and Chris Ford, "The International Discussion continues: 2016 CCW Experts Meeting on Lethal Autonomous Weapons," *Just Security* (2016).

innovative designs appeared. Today's military drones range from flying wing designs, to vertical-take-off systems with four, six or more rotors, while civilian developments are even more extravagant. Drone design (and technology) is still in an early stage. In this regard, today's situation is comparable with the beginning of manned flight.[64] New drone designs are being devised; it remains to be seen whether one design will come out on top.

Size/weight: Equally, there is no size restriction for UAVs. As of 2017, the smallest military UAV fits in the palm of a hand, while the biggest has a wingspan larger than that of most commercial airliners. Take-off weight or maximum payload weight varies from grams to tons.

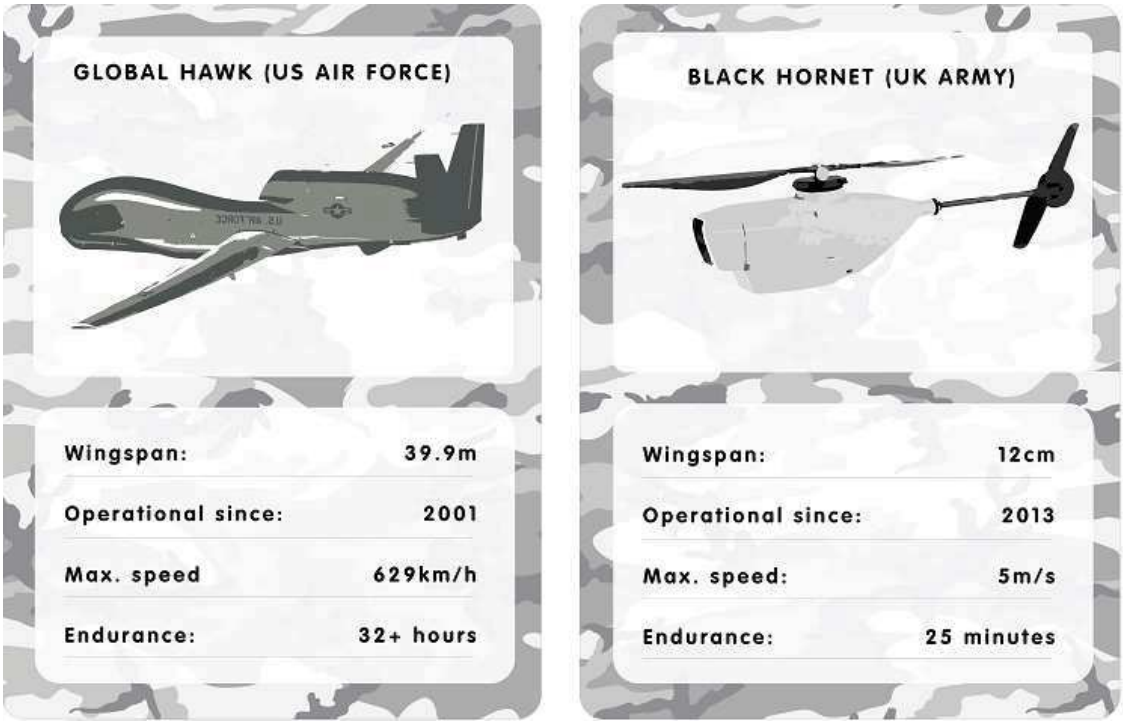

Illustration II.1. The smallest and biggest UAV currently in use
Source: Ulrike Franke, "A European approach to military drones and artificial intelligence"[65]

[64] I have made this argument in more detail in Ulrike Franke, "Looking Back to the Future: The Beginnings of Drones and Manned Aerial Warfare," *Strategy Bridge*, no. December (2017).
[65] Ulrike Franke, "A European approach to military drones and artificial intelligence," in *New European Security Initiative*, ed. Ulrike Franke and Manuel Lafont Rapnouil (London: ECFR, 2017).p.19.

1.2. The payload

UAVs' raison d'être is carrying payloads – "the platform, that's just a taxi".[66] Military UAVs' payloads can be roughly divided into four types:

Payload	Example	Occurrence
Equipment for drone's orientation & communication	GPS, radio, Bluetooth, transponders etc.	All UAV types
Sensing equipment (passive payload)	Imagery sensors such as daylight and infrared cameras (still-picture and video), Synthetic-aperture radar (SAR) for 3-D imagery. Signals Intelligence (SIGINT) or COMINT (Communications Intelligence) equipment, such as spectral sensors, voice interception.	Imagery sensors are the most common payload; most UAVs at a minimum carry a still-picture or video camera. The Northrop Grumman GlobalHawk carries the most sophisticated SIGINT and imagery equipment to date. See Illustration II.2. below.
Effectors (active payload)	Jamming and hacking devices; lethal weapons such as missiles and bombs; non-lethal weapons such as nets, marker dye.	The Predator can carry two Hellfire missiles; its larger cousin Reaper carries a mix of missiles and bombs. The Chinese CH-4 carries a laser-guided, supersonic missile or a 100-lb satellite-guided bomb. Non-lethal payloads are used mainly by law enforcement agencies.
Cargo	Drones can be used to transport supply or personnel.	A rare payload as of 2017. The US Marines have used an unmanned K-MAX, an external cargo load helicopter, in Afghanistan.[67]

[66] Chris Pocock, "With the UK sorted, Thales touts Watchkeeper prospects in France," *AIOnline* (2015).
[67] "Unmanned K-Max Heading for Afghanistan," *Air International* (2011).

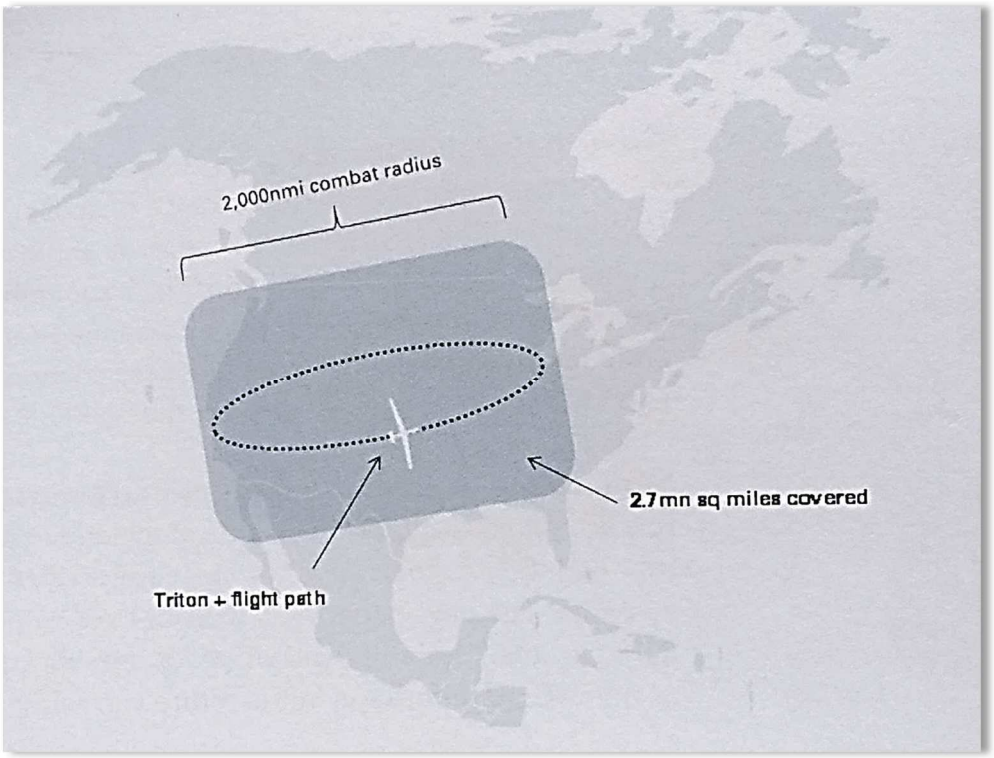

Illustration II.2. Area covered in one Triton (GlobalHawk variant) mission
Source: Noah Poponak et al., "Drones. Flying into the Mainstream," ed. Goldman Sachs Group (2016). p.56.

1.2.1. Armed UAVs

As of 2017, most military drones are unarmed. Armed systems carry air-to-ground missiles such as the Hellfire missile (with a 9kg warhead); US and Chinese systems also carry larger bombs (up to 250kg).

The term UCAV (‘unmanned combat aerial vehicle’) is sometimes used to describe UAVs with “offensive and defensive capabilities on a par with current manned systems that

allow them to operate in contested airspace when necessary".[68] This refers to drones designed for air-to-air combat. As of 2017, no such drone system exists but tests are being carried out to arm drones with air-to-air missiles.[69]

1.3. The support system

In addition to the vehicle, a UAS further comprises:

1. The *ground control station* (GCS). GCSs vary from hand-held controllers to containers with several work stations. Some drones have additional terminals that give troops access to drone feeds.
2. *Launching equipment*. Vertical-take-off systems (VTOL) or hand-launched systems can start without any equipment. Smaller fixed-wing systems are launched by a ramp, or with the help of a bungee catapult. Larger fixed-wing drones start from runways – the 6m long Hermes 450 for instance requires a 1.2km runway.
3. *Recovery systems*. Only few drones can land anywhere without support. Most systems require a runway or other equipment such as parachutes or nets.
4. *Replacement parts & additional payloads*. Some systems are built in a way that makes them break upon impact (ALADIN, Raven), which means replacement parts need to be on hand. Smaller drones often have additional payloads that can be exchanged when needed.

1.4. The infrastructure

Smaller systems that provide close reconnaissance usually only require a line-of-sight radio-link to the control station. Line-of-sight systems have the advantage that they do not

[68] "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume II Written evidence," ed. House of Commons Defence Committee (2014).
[69] Jennings Brown, "US Air Force is building drones for Air-to-Air Combat," *Vocativ*, 13 July 2016.

require an extensive infrastructure, and, as their signal is not routed through satellites, do not experience a time lag – which, for satellite operations, can be up to several seconds. More sophisticated systems however, particularly those equipped to do 'remote-split operations', require a more extensive infrastructure. Remote-split operations are operations in which the drone is launched near the theatre of operation, but the main operator controls the drone from afar, taking over when the drone is in the air. Remote-split operations over satellite connections provide almost unlimited reach.

Remote-split operations require an architecture consisting of:

1) *Satellites* & *fibre optic cables* (or *relay drones*): satellites are needed to bridge the gap between the operator and a drone on the other side of the globe. As of 2017, only a handful of states have military satellites, but relay drones may be used as quasi-satellites to stretch line-of-sight links.
2) *Air bases*: Other than the base where the operators are stationed, remote-split operations require airbases and GCS closer to the area of operation, from where the drones can be launched and landed. As of 2017, only the US has an extensive network of such airbases, with ten bases in Africa alone. China is working to extent its network.[70]

[70] Brad Lendon and Steve George, "China sends troops to Djibouti, establishes first Overseas Military Base," *CNN*, 13 July 2017.

3) *Personnel on the ground*: Other than the drone operators at home, additional personnel are required on the airbases to carry out take-offs and landings which are done through line-of-sight links. As of 2017, only few countries do remote-split operations, among them China, the US, and the UK.

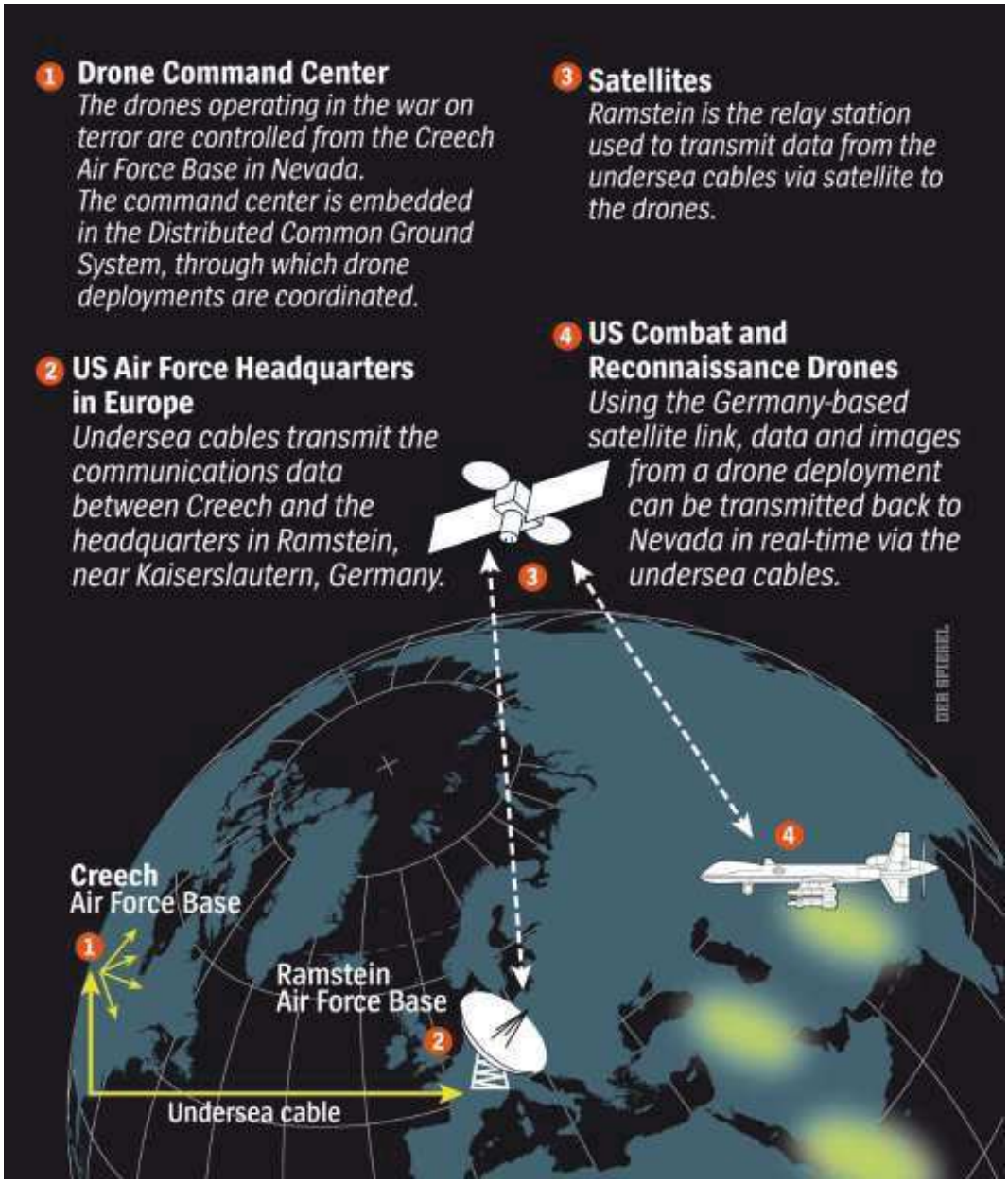

Illustration II.3. Example of US remote-split operations

Source: *Spiegel* 2015[71]

[71] n/a, "Grüne fordern Ermittlungen des Generalbundesanwalts," *Spiegel*, 19 April 2015.

1.5. The pilot(s) and operator(s)

UAV operations comprise three main tasks; the piloting of the aircraft, the operating of the payload, and the analysis of the collected data. For smaller drone systems, one person often does all three tasks.[72] Most systems have a minimum of two operators: one pilot in charge of the vehicle and payload, and one data analyst. Yet, this number can grow fast; a Reaper Combat Air Patrol (CAP) – a team that by rotating up to four drones and personnel provides non-stop coverage – requires 171 personnel,[73] while a GlobalHawk requires 300.[74]

1.6. Classification

There is no definitive UAV classification. In the US, different military services even use different classification systems.[75] Drones could be categorised by many criteria; from an engineering point of view, different engines – electric drones versus fuel burning drones, or fixed-wing versus vertical take-off – may be most important. From an arms control angle, the range and payload are most crucial.

Mostly, however, UAVs are classified by the characteristics of the air vehicle, usually by a combination of size, weight, and range, as shown in Illustration II.4. But categories remain unclear and overlap – and are expected to do so increasingly: small drones, that might be

[72] UAV manufacturers and militaries around the world are interested in ways to control several UAV from one control station and by one pilot. The US military is experimenting with swarm technology, but for the moment, military UAVs are controlled by at least one pilot.
[73] Winslow Wheeler, "The MQ-9's cost and Performances," *Time*, 28 February 2012.
[74] David Cloud, "Civilian contractors playing key roles in U.S. drone operations," *Los Angeles Times*, 29 December 2011.
[75] Mike Fowler, "The Strategy of Drone Warfare," *Journal of Strategic Security* 7, no. 4 (2014). p.116.

expected to operate only in lower airspace and have short ranges, have already demonstrated transatlantic reach.[76]

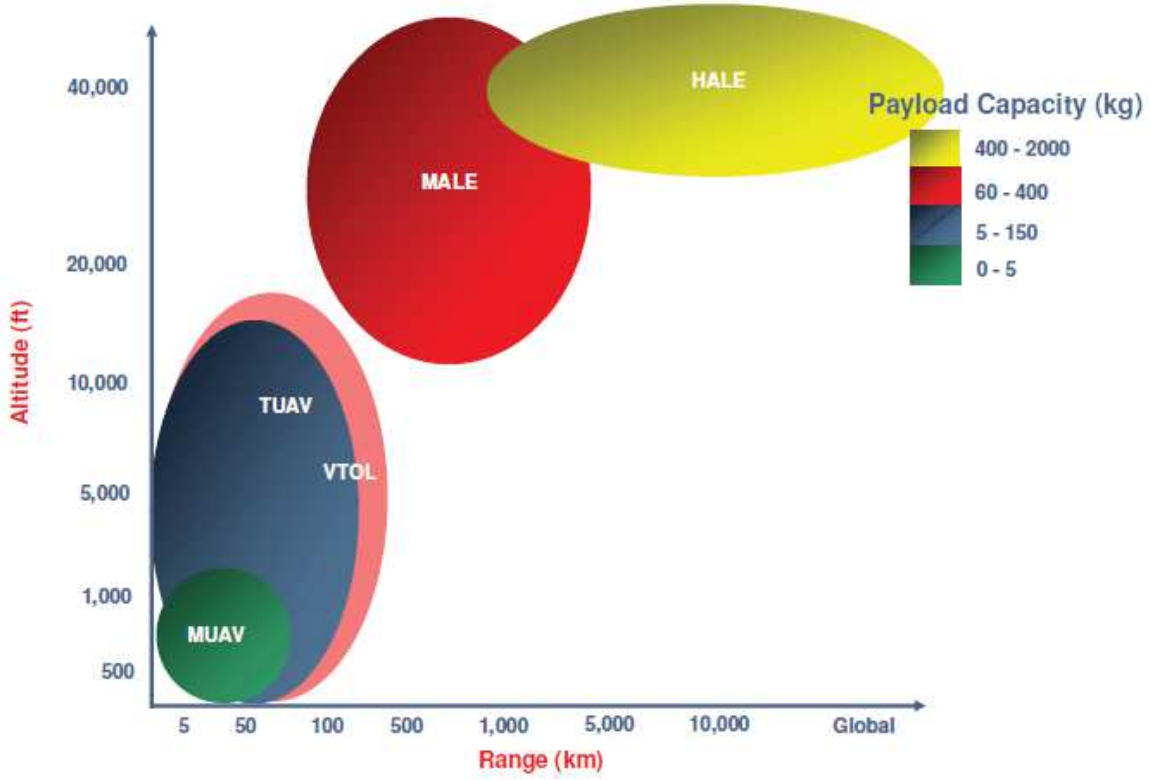

Illustration II.4. Drone classification by range/ operating altitude
Source: Frost & Sullivan (2007), p.6.[77]

This lack of clear categories poses problems beyond arms control. From a military point of view, it makes little sense to combine systems as different as the Black Hornet, the Predator, and the GlobalHawk under one heading. Modern drones range from systems the size of a sparrow to the size of commercial airliners, and are used for entirely different

[76] "The UK Approach to Unmanned Aircraft Systems, Joint Doctrine Note 2/11." p.2.4.
[77] Frost & Sullivan, "Study analysing the current activities in the field of UAV." p.6.

tasks. It is this ambivalence of the term drone, among others, that has allowed claims about the Unmanned Revolution to go unchecked, as it allows anyone to interpret it in multiple ways.

1.7. What's in a name?

The following names are used to describe unmanned aircraft:

Drone,

UAV/S - Unmanned/Uninhabited/Unpiloted Aerial Vehicle/System,

RPV/S & *RPAS* - Remotely Piloted Vehicles/System / Remotely Piloted Aircraft System.

Historically, these terms refer to different systems, with 'UAV' serving as umbrella term that includes *pre-programmed* 'drones' and *remotely piloted* 'RPVs'.[78] It is however rare that authors employ these terms to indicate technological differences – instead, the terms employed indicate the author's view of UAVs and the target audience.[79]

'Drone' is the most widely-used term. This name probably stems from the 1930s pilotless version of the British Fairey Queen fighter, the 'Queen Bee', or from the bee-like black stripes the first target drones used to be marked with. Alternatively, the name may simply be derived from the buzzing sound UAVs (used to) make, a theory supported by the fact

[78] NATO, "AAP-06(2008) Version 2 NATO Glossary of Terms and Definitions," (2008). p.2-U-2, 2-R-7. In 2011, NATO updated its Glossary, by deleting the entry for (but not the term) RPV, and replacing UAV with 'Unmanned Aircraft System (UAS)': "A system whose components include the unmanned aircraft, the supporting network and all equipment and personnel necessary to control the unmanned aircraft" NATO, "AAP-06 Edition 2012 Version 2 NATO Glossary of Terms and Definitions." The drone entry remains the same.

[79] I have made a similar argument in Franke, "The global diffusion of Unmanned Aerial Vehicles (UAVs), or drones."

that in the Pakistani tribal areas drones are called 'machays' (wasps) or 'bhungana' (the one that produces a bee-like sound).[80]

Favoured by anti-UAV activists, 'drone' is unpopular with UAV manufacturers and the military (though opposition is fading). The concern is that drone sounds too menacing and removes the pilot from the equation. The NSA considers the term 'drone strike' "propaganda", as it "connote[s] mindless automatons with no capability for independent thought".[81] UAV manufacturers and the military prefer the term 'Remotely Piloted Vehicle' as it emphasises the 'man-in-the-loop'. "The term 'unmanned'", the British MoD argues, "can cause confusion or uncertainty over the actual level of human control and has led to safety, ethical and legal concerns being raised, particularly with regard to the employment of weapons and flight in non-segregated airspace."[82] The term 'remotely piloted vehicle' emerged in the 1970s and was originally chosen "to sweeten the bitterness of the idea" that pilots would be edged out of critical missions.[83] 'UAV' is arguably the most neutral and accurate term to describe modern drones. For better readability and to avoid repetitions, in this thesis both 'drone' and 'UAV' are used.

2. The history

"Drones are not new" - New York Times, 1946[84]

[80]Brian Glyn Williams, *Predators: the CIA's drone war on al Qaeda* (Potomac Books, 2013). p.1. And Pir Zubair Shah, "My Drone War " *Foreign Policy* (2012).
[81] Glenn Greenwald, "UK detention of Reprieve activist consistent with NSA's view of drone opponents as 'threats' and 'adversaries'," *The Guardian* 25 September 2013.
[82] Quoted in "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume 1," ed. House of Commons Defence Committee (2014). p.13.
[83] A RAND study, quoted in "The Strange History Of The Word 'Drone'," *Aviation Week & Space Technology* (2016).
[84] Hanson Baldwin, "The 'Drone': Portent of Push-Button War," *New York Times*, 25 August 1946.

The meteoric rise drones have experienced in the last decade has created the impression of novelty. But while the stars aligned for drones at the turn of the millennium, the precursors to modern drones have been around for a century. The idea of building flying vehicles even predates the dream of manned aviation. What kind of purposes UAVs could be used for was, however, for a long time limited by technological progress, while today's limitations are predominantly legal, ethical, or organisational rather than technical. Drone development has been a stop-and-go affair, with periods of stagnation, due to technological problems and loss of interest and knowledge, alternating with moments of intense research.

2.1. Early beginnings

Some trace the roots of UAV technology back to Chinese plans for using kites to bombard well defended cities over 1000 years ago.[85] Others cite the Austrian attack on Venice with balloons equipped with explosives on 22 August 1849,[86] or the Northern Union's use of balloons armed with incendiary devices during the American Civil War.[87] But the real starting point for the precursors of today's systems was the early 20th century, when militaries began working on drones as guided bombs or for targeting practice.

2.1.1. Guided bombs

Today, UAVs and missiles are distinct, but their history is intertwined, as Newcome's 'family tree of unmanned aircraft' (Illustration II.5.) illustrates. The earliest example of their common roots is the Kettering Bug (Kettering Aerial Torpedo). Developed in 1917 by

[85] Michael Trautermann, "Unmanned Aerial Vehicles, Katalysator für die Transformation," *Europäische Sicherheit Online* (2006).
[86] Russel Naughton, *Remote Piloted Aerial Vehicles: An Antholog* (2003 [cited 1 January 2017]); available from http://www.ctie.monash.edu.au/hargrave/rpav_home.html#Beginnings.
[87] Jim Garamone, "From the U.S. Civil War to Afghanistan: a short history of UAVs," *American Forces Press Service* (2002).

the US Army, the Kettering Bug was a 4m long unmanned biplane with a wingspan of 4,5m, armed with an 80kg warhead. The Bug could not be remotely piloted; instead, after a predetermined length of time, the engine shot off and the Bug plunged to earth, detonating on impact.[88] Fewer than 50 Kettering Bugs were built before the end of WWI and it never saw combat.[89]

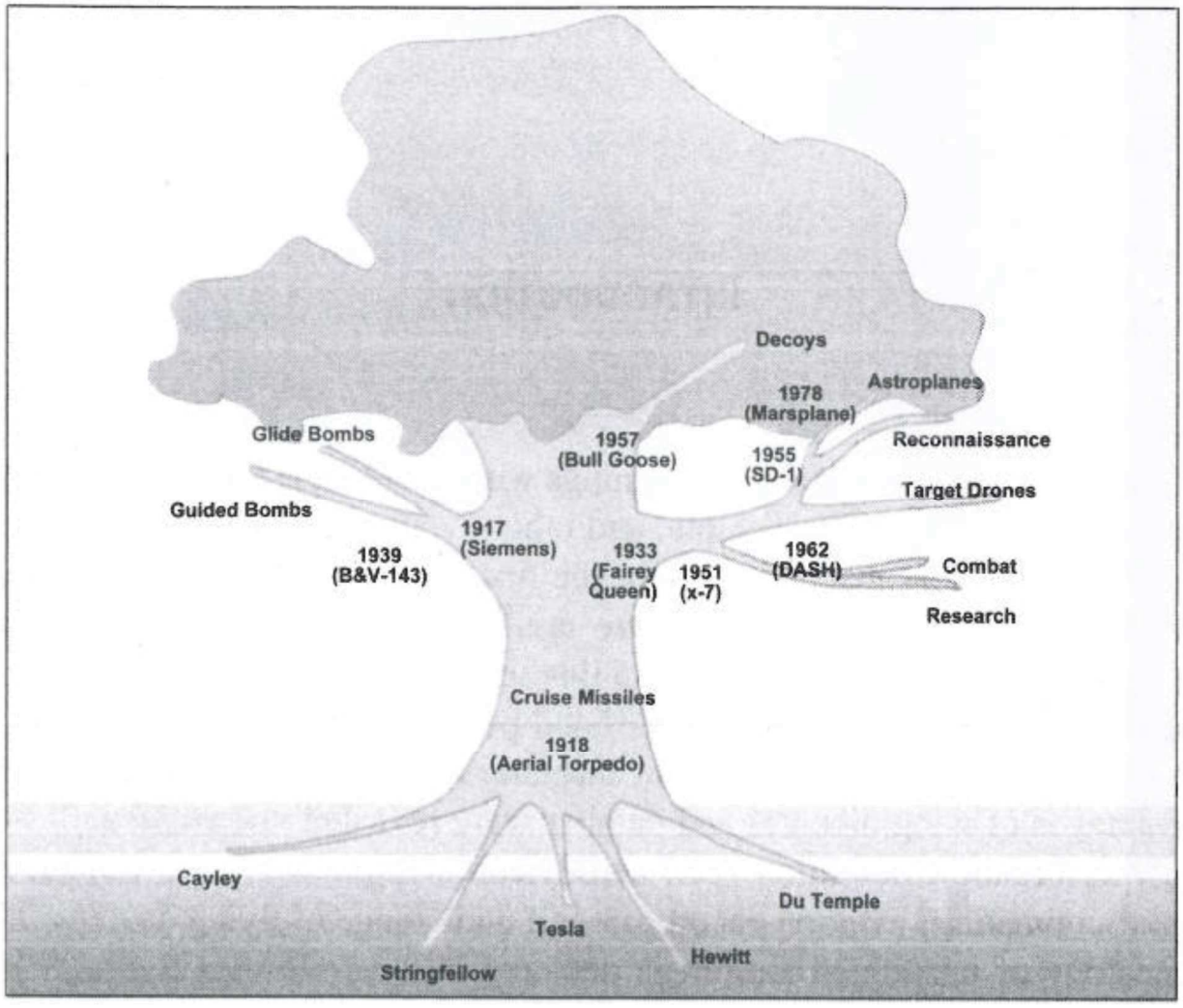

Illustration II.5. "A family tree of unmanned aircraft"
Source: Newcome (2004).[90]

[88] " Kettering Aerial Torpedo "Bug" ", *National Museum of the US Air Force* (2014).
[89] Ibid.
[90] Laurence Newcome, *Unmanned aviation: a brief history of unmanned aerial vehicles* (Barnsley: Pen & Sword Aviation, 2004). p.2.

British manufacturers in the interwar years prepared to fight German Zeppelins and worked on turning aircrafts into flying bombs. The Larynx ('Long Range Gun with Lynx engine') was developed in 1925. The flying bomb existed in different versions and could reach speeds of over 300km/h.[91] Because of technical difficulties and interrupted funding, the project never reached mass production, but prototypes were developed and tested, including in the Iraqi desert in 1928.[92]

Another example of the link between drones and missiles are the German *Vergeltungswaffen* V1 and V2. Famously used in the 1944/45 offensive on Britain, V1 and V2 are considered the first cruise and ballistic missiles. Their roots lay in an eventually abandoned prototype of a reusable UAV that could carry a one-ton bomb and would be controlled via a piloted version of the same aircraft.[93]

On the other side of the Atlantic, the US Navy experimented with refitted B-24 bombers, which pilots had to start and parachute out of when in the air. The aircraft was guided through radio-control by another plane. Seventeen such aircraft were used against submarine pens on Helgoland, Germany, though none of them hit their target.[94] This system proved unreliable, with a high number of planes prematurely crashing or detonating, killing in one incident John F. Kennedy's older brother Joseph, a pilot.[95] The Navy also used the Interstate TDR, armed with a torpedo or 900kg bomb. It was optionally

[91] Kenneth Werrell, "Evolution of the cruise missile," *Air University* (1985). p.18.
[92] Katharine Kindervater, "The emergence of lethal surveillance: Watching and killing in the history of drone technology," *Security Dialogue* 47, no. 3 (2016). p.226.
[93] Steve Zaloga, *Unmanned aerial vehicles: robotic air warfare 1917-2007*, *New vanguard* (Oxford: Osprey, 2008). p.7.
[94] Baldwin, "The 'Drone': Portent of Push-Button War."
[95] John Sifton, "A Brief History of Drones," *The Nation* (2012).

manned (for test flights) and, in this configuration, could be landed.[96] TDRs flew their first combat mission in September 1944 against a Japanese merchant ship and were used in several missions against Japanese targets.[97]

2.1.2. Target drones

Target drones were the second precursor of modern UAVs. "The first mass-produced unmanned plane in history",[98] was the 7cm wingspan PR-4 Radioplane, nicknamed 'Dennymite'. The US Army bought nearly 15 000 of these drones and used them for target training by from 1940 onwards.

In the UK, manufacturer de Havilland modified a trainer aircraft for gunnery practice, thus creating the 'Queen Bee', whose name allegedly inspired the term 'drone'.

2.2. Cold War and Vietnam War – US drone development

In Europe, UAV development slowed down after WWII. The US military during the 1950s and '60s pushed ahead, conceptualised drones as ISR tools, and developing the first real surveillance drone, the first armed and the first vertical take-off drones.

Illustration II.6. The world's first surveillance drone, the USD-1

The AN/USD-l or SD-1 (based on the Dennymite) was the world's first real surveillance UAV. It carried still picture and optional TV cameras and was used by the US Army for aerial surveillance and target

[96] Cf. "Interstate BQ-4/TDR" in Andreas Parsch, "Directory of US Military Rockets and Missiles. Appendix 1. Early Missiles and Drones."
[97] Lawrence Spinetta, "The Rise of Unmanned Aircraft," *Aviation History Magazine* (2010).
[98] Peter W Singer, "Drones don't die," *Military History* 28, no. 2 (2011).

acquisition.[99] Serial production started in 1959 and produced 1500 drones, some of which remained in service until 1971.[100] However, as the drone's films had to be recovered and developed after landing, drones' utility for surveillance during combat operations was limited.

In the 1950s, the US also developed the first recoverable armed UAV and first operational vertical take-off system, the Gyrodyne QH-50 DASH. The DASH was a 6x3m UAV which could take-off from smaller ships, including during weather that would keep manned systems on deck. It became operational with the Navy in 1962. Secretary of Defense McNamara approved budgeting for enough QH-50 aircraft to provide two DASHs for each of the Navy's 240 FRAM destroyers,[101] but persisting unreliability and high loss rates led to the end of the programme in 1970.[102] Today, the DASH is all but forgotten.[103]

Illustration II.7. The first armed UAV, the Gyrodyne QH-50 DASH (US Navy)

On 1 May 1960s, an American U2 reconnaissance aircraft was shot down over the USSR and its pilot, Francis Gary Powers, captured. The event caused great embarrassment to the US and became a defining moment of UAV development: "We believe that for some

[99] Zaloga, *Unmanned aerial vehicles: robotic air warfare 1917-2007*. p.10.
[100] Western Museum of Flight, *Northrop Radioplane RP-71 Falconer, SD-l* (2010 [cited); available from http://www.wmof.com/rp71falconer.html.
[101] Samuel Evans, S., "The Incredible Story of the QH-50 DASH," *VERTIFLITE* (2011). For extensive information on the DASH, see http://www.gyrodynehelicopters.com/
[102] Until 2006, some DASHs were still in use for target training. The German company Dornier and the Israeli Aircraft Industries (IAI) acquired a low number of DASHs for research purposes
[103] Not only is the Predator usually considered the first armed UAV, in 2014 the US Navy proudly announced that "Truman will be the first aircraft carrier in naval aviation history to host test operations for an unmanned aircraft". Cited in David Hambling, *Swarm Troopers* (Archangel Ink, 2015). p.22.

missions the cockpit must be taken out of the airplane, put on the ground, and let the pilot fly the vehicle from there", a manufacturer noted.[104] 'Red Wagon', a programme to develop remotely piloted vehicles was started only weeks after the incident.[105] The outcome were among others, Ryan Model 147A Firefly and Model 147 Lightning Bug, two drones which could be used for photographic surveillance missions and later, real-time video. The Lightning Bug was air-launched from a mother ship, flew pre-programmed (but sometimes remotely controlled) and was recovered using a parachute. It pulled turns in excess of 6Gs – unmatchable by a piloted aircraft.[106] The Air Force's Strategic Reconnaissance Wing flew more than 3000 Lighting Bug sorties over China, North Vietnam, Laos, and Cambodia between August 1964 and April 1975.[107] Low-flying Lightning Bugs were used for battle damage assessment and surveillance of Vietnamese prisoner of war camps.[108] The drones were even credited with the loss of several Vietnamese fighters – either because they collided with the aircrafts and made them crash or because missiles fired to shoot the drones down missed and hit other Vietnamese fighters instead.[109] In the following years, tentative steps were taken to use UAVs for air-to-air combat, but eventually abandoned.[110]

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[104] A Ryan official quoted in William Wagner, *Lightening Bugs and other Reconnaissance Drones* (Fallbrook CA.: Aero Publishers, 1982). p.13.
[105] Jon Lake, "The unmanned future. Great white hope or impossible dream?," *Combat Aircraft Monthly* (2012). p.60.
[106] Rothstein, *Drone*. p.28.
[107] Lake, "The unmanned future. Great white hope or impossible dream?." p.60.
[108] Christopher A. Jones, "Unmanned Aerial Vehicles (UAVS). An Assessment of historical operations and future possibilities," *Air Command and Staff College* (1997). p.9. Also see Zaloga, *Unmanned aerial vehicles: robotic air warfare 1917-2007*. p.12. For an interesting account of a US prisoner of war in a Vietnamese camp and his experience with drone surveillance, see Wagner, *Lightening Bugs and other Reconnaissance Drones*. p.204-206.
[109] Zaloga, *Unmanned aerial vehicles: robotic air warfare 1917-2007*. p.14.
[110] Lake, "The unmanned future. Great white hope or impossible dream?." p.61.

US drone development came to a halt after the end of the Vietnam War as the decision was taken to fund manned aircraft projects instead. This, combined with relative secrecy about past successes,[111] resulted in drones sinking into oblivion. In the early '80s, the only operational US drones left were target drones. A 1981 report by the General Accounting Office criticised the Pentagon's "apathy" and "unawareness" regarding UAVs.[112]

2.3. UAVs in the Soviet Union

The USSR developed several powerful unmanned systems. The *TBR-1* system, a surveillance drone based on a target drone, was the first Soviet surveillance UAV and entered service in 1962.[113] It was comparatively big (more than 8m long, with a wing span of 7.5m), and carried a film camera. Its endurance however was limited to around one hour. The TBR-1 remained in service until the early 1980s and was based in Latvia, Belarus, and Ukraine. [114]

In 1944, Tupolev Tu-123 Jastreb entered service.[115] It had an impressive size (27m long, 5m high, 8m wingspan) and housed electronic intelligence systems and cameras. During landing, the nose section containing the camera and other data storage devices would parachute out while the main portion of the airframe crashed, meaning the system was only partly recoverable. Tu-123 was one of the fastest drones ever, operating at Mach 2.5 (c.3000km/h). The USSR had three squadrons stationed in Ukraine, Belarus, and Latvia,

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[111] "DoD's Use of Remotely Piloted Vehicle Technology Offers opportunities for Saving Lives and Dollars," (Washington DC: General Accounting Office, 1981).
[112] Ibid.
[113] Zaloga, *Unmanned aerial vehicles: robotic air warfare 1917-2007*. p.17. also see "Tupolev Tu-143 and Tu-243 Reis (Russian Federation), Unmanned aerial vehicles", Jane's, at http://articles.janes.com/articles/Janes-Unmanned-Aerial-Vehicles-and-Targets/Tupolev-Tu-143-and-Tu-243-Reis-Russian-Federation.html.
[114] Ibid. p.17.
[115] Information on Tu-123, Tu-143 and Tu-141 are taken from ibid. p.17/18. and Bill Gunston, "Tu-123," in *Tupolev Aircraft since 1922* (1995)./ Bill Gunston, "Tu-141, 143," in *Tupolev Aircraft since 1922* (1995).

each equipped with a dozen drones.[116] The high operational costs caused by the regular loss of airframes eventually led to the system's retirement in the early 1980s.

Other systems included the 8m long, 2,2m wing span Tu-143 Reis, and its scaled-up version Tu-141 Strizh, which was in service from 1977. With cruising altitudes of only 100-1000m and 13 minutes endurance, it was developed for repeated use by front-line troops, similar to today's tactical UAVs. Its minimum radar cross-section made it difficult to detect. The Tu-143 was equipped alternatively with an optical camera or radiation survey instruments.[117]

2.4. A UAV milestone: Lebanon 1982

More than any other event, the 1982 Lebanon War was a milestone in global UAV development and laid the foundation of Israeli leadership in drones. While the US had temporarily lost interest in drones after the end of the Vietnam War, and European countries had not yet realised their potential, Israel began to increase investment, buying several US UAV types to refine and rework the technology. In 1971, Israel established its first UAV Squadron near Tel Aviv, initially operating US Firebees, and later Israeli productions.[118] Israeli manufacturers, particularly Israeli Aerospace Industries (IAI), developed various drone types, such as Scout, a 4m long, 5m wing span drone, and the Mastiff (produced by Tadiran), a slightly smaller drone with a 7-hour endurance.

[116] Zaloga, *Unmanned aerial vehicles: robotic air warfare 1917-2007*. p.17.
[117] Gunston, "Tu-141, 143."
[118] "40 years of Israeli UAV operations," *Air International*, November 2011. Also see "Secret Memos show Pakistan Endorsed US Drone Strikes," *BBC*, 24 October.

Israel had already successfully deployed drones as decoys in the Yom Kippur War in 1973,[119] but it was during the war in Lebanon nine years later that the Israeli forces used drones to the biggest effect. During the combat operations, the IDF used drones to localise Syrian surface-to-air missiles (SAM) batteries, which were then destroyed by missiles. Scout and Mastiff UAVs furthermore provided real-time surveillance and were used for damage assessment and for accompanying ground troops.[120]

The Israeli successes in Lebanon revived interest in drones, particularly in the US. The Navy purchased the Mastiff system, and in an US-Israeli joint venture developed the RQ-Pioneer.[121] Within ten years, the US armed forces fielded an array of UAVs in the Gulf War.

2.5. Drones in the 1990s

Operation Desert Storm saw at least one UAV airborne at all times.[122] US Navy, Marine Corps and Army deployed 30 Pioneer and Pointer UAVs and flew over 500 sorties, a total of 1641 flying hours.[123] Drones were used for surveillance and reconnaissance and – as by Israel before – as decoy drones for SAMs.[124] France and the UK used (foreign-built) drones. The Gulf War demonstrated to US decision-makers the usefulness of drones – and

[119] Bill Yenne, *Attack of the drones : a history of unmanned aerial combat* (St Paul, Minn.: Zenith Press, 2004). p.29.
[120] David Rodman, "Unmanned Aerial vehicles in the service of the Israeli Air Force," *Gloria Centre, IDC Herzliya* (2010).
[121] Lake, "The unmanned future. Great white hope or impossible dream?." Also see Spinetta, "The Rise of Unmanned Aircraft."
[122] Lake, "The unmanned future. Great white hope or impossible dream?."
[123] Ibid. According to Zaloga, the Army used 40 Pioneer of which 7 were lost. Cf. Zaloga, *Unmanned aerial vehicles: robotic air warfare 1917-2007*. p.28.
[124] Zaloga, *Unmanned aerial vehicles: robotic air warfare 1917-2007*. p.28.

their scarcity: “If [the Iraqis] start shooting them down, we don’t have ready replacements in the pipeline, unfortunately,” a commander noted at the time.[125]

Drone research and development increased in response, leading to the development of the RQ-1 General Atomics Predator. The history of the now iconic Predator has been traced in many publications.[126] It saw its first operational use in the Balkans where it provided surveillance and reconnaissance from March 1996 in Operation Joint Endeavor as part of NATO’s IFOR and SFOR forces. Predator’s airframe is a low-tech affair: “you started the engine the way you would a modern outboard boat motor – by pushing a button located in the ground panel on the outside of the plane. Earlier models had used a pull cord. You killed the engine by running in front of one of the wings”, an early Predator pilot recalled.[127] The Predator flew like a glider, having large wings compared to its fuselage size, which enabled long endurance but made it sensitive to wind – a problem with regard to later satellite operations: “Any radical movement chanced losing the satellite link and therefore all control of the airplane”.[128]

In NATO’s 1999 Operation Allied Force in Kosovo, Germany, France, the US, and the UK deployed drones. UAVs were crucial in ensuring reconnaissance and intelligence coverage during the conflict. US unmanned capabilities were rivalling and overtaking Israeli systems; US Predator and Hunter logged 2000 flight hours during the Kosovo operation.[129] Without

[125] "Limited Number of UAVs would be concern in ground war ", *Aerospace Daily* 157, no. 31 (1991).
[126] Most notably Richard Whittle, *Predator: the secret origins of the drone revolution* (Henry Holt and Co., 2014). Thomas Erhard, "Air Force UAVs: The Secret History," in *Mitchell Institute for Airpower Studies* (Arlington VA: 2010).
[127] Matt Martin and Charles Sasser, *Predator, The remote-control air war over Iraq and Afghanistan: A Pilot's Story* (Minneapolis: Zenith Press, 2010). p.18.
[128] Ibid. p.24.
[129] Anthony H. Cordesman, "The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo," (2000). p.321.

satellite links, the pilots operated out of Hungary and later Albania.[130] In Kosovo, the Predator was for the first time fitted with laser designators to help target designation.

The Kosovo conflict saw the first deployment of the British Phoenix, and the French Army deployed the French-built Crécerelle, a 2m long surveillance drone equipped with optical and infrared cameras with a 50km range and 5 hours endurance.[131] One system proved particularly valuable, the CL-289, a pre-programmed Canadian-European ISR system that flew 500 sorties, deployed by France and Germany.[132] The films from their cameras needed to be recovered for processing and evaluation, but the infrared line camera provided near-real-time images. 70 - 90% of the images used by the coalition forces were taken by CL-289, that proved more weather-resistant than the Predator. In several instances, CL-289 was the only reconnaissance provider.[133] NATO lost 27 UAVs during the operation, 21 of them in combat,[134] shot down, for instance, by soldiers with machine guns, aiming at the drones from open helicopter doors.[135]

Following Kosovo, US Deputy Assistant Secretary of Defense for CISR and Space Systems, Robert Nutwell, concluded that no future operations involving advanced forces would occur without drones.[136] General John Jumper, Commander of the US Air Forces in

[130] "UAV Annual Report FY 1997," ed. Office of the Under-Secretary of Defense (Washington DC: DTC Review, 1997). p.5. Mark Mazzetti, *The Way of the Knife* (New York: Penguin, 2013). p.91.
[131] "Rapport d'information sur le coût de la participation de la France aux opérations menées en vue du règlement de la crise au Kosovo," ed. Assemblée Nationale (Paris: 1999).
[132] Richard Arning and Marc Ebersoldt, "CL-289, Bewährtes System im stetigen Wandel," in *DGLR Workshop „UAV-/ UCAV-/ MAV-Aktivitäten in Deutschland"* (Bremen: 2004).
[133] Ibid.
[134] US: 8 Hunter, 3 Predator, 4 Pioneer; UK: 2 Phoenix; Germany: 5 CL-289; France: 2 CL-289, 3 Crecerelle. Estimates by Tim Ripley: Tim Ripley, "UAVs over Kosovo - did the Earth move?" *Defence Systems Daily* (1999).
[135] Ibid.
[136] "Kosovo War makes UAVs part of all 'future combat'," *Jane's Defence Weekly* (1999).

Europe, on the other hand was particularly impressed with the possibility of using drones for targeting[137] – and shortly after advocated arming the Predator.

2.6. The turn of the millennium – Drones take off

At the turn of the millennium, the stars aligned for drones. The experiences in Lebanon, the Gulf War and Kosovo created goodwill, and several relevant technologies made important advances. Contrary to other military innovations such as the nuclear bomb, UAVs' advent did not depend on the invention of one specific technology, but rather on the maturation and combination of several. The most important advances were smaller and lighter sensors, including cameras, smaller data storage and better data links, and the invention and diffusion of GPS technology – the same technologies that made smartphones possible allowed drones to develop. A 2000 report concluded that "UAVs have made greater strides over the past 18 months, in terms of their widespread acceptance by the user community, than in their entire previous history".[138]

Miniaturisation had a particularly important impact as it allowed for previously impossible systems. A few decades earlier, the US DoD had invested over 1bn USD into a comparatively small drone for the Army (to be portable by four soldiers), but the small airframe could not accommodate the necessary payload leading to the project's cancellation.[139]

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[137] "Statement of General John Jumper, Commander, United States Air Forces in Europe," *United States Congress* (1999).

[138] "Pilotless progress report - UAVs have made exceptional strides recently," *International Defense Review* (2000).

[139] David Brown, "Medusa's Mirror: Stepping Forward to Look back. Future UAV Design Implications from the 21st Century Battlefield," *DTIC Review* (1997).

These favourable technological developments notwithstanding, in the end, it was the Wars on Terror that created the necessary urgency in the US and beyond. When the US War on Terror began, the US was scrambling for its drones. The Air Force only had 13 Predators and four GlobalHawks, leading to Deputy Secretary of Defense Wolfowitz telling NATO allies that from now on US drones were at a premium in the Balkan.[140]

2.7. Arming the Predator

Contrary to popular belief, the Predator was not armed in response to 9/11 but a few months before. It had become obvious that the same capabilities that made drones good surveillance tools also made them well suited to a strike role. RAF bomber and reconnaissance pilot Brookes noted in 2000: "It now seems perverse to use expensive strike aircrafts (each costing around 50 million USD) to deliver precision munitions when UAVs could do the whole job".[141] The rationale for arming the Predator was manifold, a combination of cost, casualty aversion, technology enthusiasm stemming from the IT-RMA, and more. Often quoted is a September 2000 incident when a Predator pilot identified Osama bin Laden in 2000 but had no means of attacking him.[142]

The Predator was fitted with two laser-guided 105-pound Hellfire missiles in February 2001. As the Predator was a light aircraft, there were concerns as to whether the aircraft's weak wings could carry the missile (already one of the lightest) and would survive the blowback. Once armed, the system's designation changed from RQ-1 (R for

[140] Michael Gordon and Eric Schmitt, "A Nation challenged: The Strategy," *New York Times*, 29 September 2001.
[141] Andrew Brookes, "The prospects for Unmanned Aerial Vehicles," *IFS Info* 6/2000 (2000). p.6.
[142] The Pilot's account: Scott Swanson, "War Is No Video Game – Not Even Remotely," *Breaking Defense* 18 November 2014.

reconnaissance, Q for unmanned aircraft) to MQ-1B (M for multirole). In November 2001, the US launched its first armed drone strike in Afghanistan.

Whether the Predator deserves the attention it has received is an ongoing debate. Some considered it one of "the most overrated weapons of war".[143] Deserved or not, the Predator has become the image of drone warfare and the War on Terror. Even a children's book exists.[144] The US military stopped procurement of the Predator in 2010, substituting it with its larger cousin, the Reaper, the first drone system specifically built as a hunter-killer, which can carry a combination of several Hellfire missiles and laser guided bombs. Reapers are some of the largest and most powerful military drones – while weighing only a sixth of an F-35.

Israel armed its drones around the same time, possibly even before the US, but attracted much less attention doing so.[145] The Israeli military is particularly secretive about their drone use and, given language barriers and Israel's less exposed geopolitical role, there is much less research on Israeli drone use.[146] According to reports, Israel has used armed UAVs multiple times, against Hamas militants in Gaza and the West Bank in 2004, against Hezbollah in Lebanon in 2006, during Operation Cast Lead in Gaza in 2008/09, and Operation Pillar of Defence in Gaza in 2012.[147] As of 2017, a growing number of states is

[143] Robert Farley, "The Most Overrated Weapons of War," in *War is boring* (20 January 2017). https://warisboring.com/the-most-overrated-weapons-of-war/
[144] Jack David, *Predator Drones*, ed. Torque (Bellwether Media, 2008).
[145] Cf. Ralph Sanders, "UAVs, An Israeli Military Innovation," *Joint Forces Quarterly* (2002). p.117.
[146] Good articles on Israeli drone use: Philippe Gros, "Les drones armés israéliens: capacités, bilan de leur emploi et perspectives," (FRS, 2013), Uri Sadot, "A Perspective on Israel," in *Proliferated Drones* (Washington DC: Center for a New American Security, 2016).
[147] Ben Emmerson, "Report of the Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism," ed. UN General Assembly (2013).

able to build armed drones, most importantly China, which has become the most important exporter of armed drones.

2.8. Civilian and commercial drones

For decades, the development of unmanned aerial vehicles (UAV) has been an exclusively military affair. In the last half-decade, however, civilian drones have developed exponentially. As of 2017, drones are used in journalism, to inspect pipelines and crops, to scare away poachers, to bring the internet to remote areas, and more. Drones are "flying into the mainstream", a Goldman Sachs report notes, which sees a 20.6bn USD global market opportunity for commercial drone sales.[148] Thousands of commercial drone users (particularly delivery services) are waiting in the wings for some final technical details to be resolved (most notably sense-and-avoid technology) and for the implementation of legal regulations allowing drones to share airspace with manned aircraft.

The emergence of civilian drone systems is doubly relevant for the military. First, investment from the world's richest companies[149] means that technical breakthroughs are now more likely to come from the civilian than the military realm. The effect is reinforced by the fact that civilian systems can be on the market much faster than military ones which go through several stages of acquisition and budget controls. Accordingly, civilian drones are already entering the military market; the German Navy and US Army use Chinese commercial DIJ Phantom drones,[150] the Dutch Navy uses the Chinese Yuneec Typhoon.[151] As cheap personal drones flood the market, soldiers may soon bring their own systems onto the battlefield, in the same way that Special Forces bring their own armour:

[148] Poponak et al., "Drones. Flying into the Mainstream." p.11.
[149] Alphabet, Facebook, and Amazon are all investing in drone capabilities.
[150] Media reports confirmed by email by Deutsche Marine, 8 August 2017. In August 2017, the US Army grounded all DJI drones because of "cyber vulnerabilities".
[151] "Marine Controleert Vluchtelingenbootjees Met Drone," *Ministerie van Defensie* (2016).

"These days soldiers are less likely to be awestruck at the gadgetry they are issued than shocked by how clunky it is compared to the sleek lightweight devices they have at home."[152]

At the same time, the availability of sophisticated drones raises concerns. Non-state actors are already strapping grenades on drones, creating flying IEDs (see VII. Conclusion). Thanks to this development, anti-drone technology has become an important growth area.

Secondly, the recreational and commercial use of drones is likely to influence the image of military drones.[153] The most common association with the term drone is a Predator-like "killer drone", but tomorrow's associations may be more positive. This again illustrates the problem of using one term to describe systems as different as an Amazon delivery drone and a SIGINT surveillance drone. Sabine Selchow notes: "[…] like a magnet [the term drone] bids all sorts of meanings from different (including military and civil) debates and carries them from one (UAV-related) debate to another."[154] While this may initially lead to more positive drone connotations, this can quickly change when a civilian drone causes a high-casualty event (such as when colliding with an aircraft).

2.9. Global UAV proliferation

UAVs have proliferated dramatically over the last decade, at a pace superior to other military technologies. UAVs are being manufactured, bought, and sold around the world, with global spending on military UAVs over 2016-2021 estimated to reach 51bn USD.[155]

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[152] Hambling, *Swarm Troopers*. p.3.
[153] I have made this argument in Ulrike Franke, "Civilian Drones: Fixing an Image Problem?," *ISN* 2015.
[154] Sabine Selchow, "The Drones of Others: An Insight into the Imagination of UAVs in Germany," *Behemoth–A Journal on Civilisation* 8, no. 2 (2015). p.67.
[155] Poponak et al., "Drones. Flying into the Mainstream." p.65.

In 2000, *The Military Balance* listed only 17 countries holding military UAVs. The numbers of UAVs in the military arsenals of these countries were mostly single-digit, with the notable exception of the US and Israel. No Latin American country had UAVs, nor did any Sub-Saharan African state besides South Africa. By 2008, UAVs were spread over all continents.[156] In 2013, I found 56 known holders of military UAVs and a further 22 suspected holders,[157] while a 2014 study estimated that 90 countries had military drones of some kind.[158]

Because of the pace of development, and as some countries claim drone capabilities they do not have[159] while others have an interest in hiding theirs, and because of the availability of military-grade commercial systems, it has become impossible to trace drone proliferation with accuracy, but it can be assumed that most countries today have unmanned capabilities. There are, however, great differences regarding the sophistication and size of the respective countries' unmanned arsenals. The most recent and reliable study estimates that 27 states have "advanced" drones: UAVs that can remain in the air for at least twenty hours, operate at an altitude of at least 5000m, and have a maximum take-off weight of at least 600kg.[160] At least 11 countries have armed drones,[161] and many more are pursuing their acquisition. Some claim that by 2024 every country will have armed drones.[162]

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[156] *Military Balance 2008*, International Institute for Strategic Studies. (Institute for Strategic Studies, London, 2008)

[157] Franke, "The global diffusion of Unmanned Aerial Vehicles (UAVs), or drones."

[158] Michael Horowitz and Matthew Fuhrmann, "Droning on: Explaining the Proliferation of Unmanned Aerial Vehicles," *International organization* 71, no. 2 (2017).

[159] See for instance Bill Ray, "Iran Photoshop Fail: 'New Drone' actually Japanese University Bird," *Register*, 28 November 2012.

[160] Horowitz and Fuhrmann, "Droning on: Explaining the Proliferation of Unmanned Aerial Vehicles."p.402.

[161] This number is based on my own research of countries that have operational armed drones, integrated into their armed forces. Horowitz and Fuhrmann speak of nearly thirty countries with "armed drone programs", suggesting that this number is set to grow rapidly.

[162] Patrick Tucker, "Every Country Will Have Armed Drones Within 10 Years," *DefenseOne*, 6 May 2014.

3. The literature

The following section traces the development of the literature on drone warfare over the last two decades and provides a comprehensive review of the debate. This review identifies five strands of academic drone literature, and shows that, despite their different foci, the strands exhibit similar gaps as most attention is being paid to a very specific type of drone use – the US's use of armed UAVs outside official battlefields. This contributes to the ambiguity of the claims about drones' revolutionising potential.

3.1. Early writing on drones: technology and Science Fiction

In the 1990s and early 2000s, there was little non-academic and virtually no academic writing on UAVs outside of physics or engineering, even though over a dozen states already employed military UAVs. First among those to pick up the topic were authors interested in military technology and technology more broadly. Bill Yenne, Marc Grozel, Tim Ripley, William Wagner, and Laurence Newcome discussed UAVs from a military-technological viewpoint, much in the same way that their colleagues would write about manned aircraft.[163] Specialised military technology outlets – from *Jane's* publications to *Flight Global, Air&Space Europe,* and *Wehrtechnik* and *Europäische Sicherheit* outside the English-speaking world – further reported on unmanned developments.[164]

[163] Cf. Yenne, *Attack of the drones : a history of unmanned aerial combat*. Wagner, *Lightening Bugs and other Reconnaissance Drones*. Newcome, *Unmanned aviation: a brief history of unmanned aerial vehicles*. Zaloga, *Unmanned aerial vehicles: robotic air warfare 1917-2007*. Bill Gunston, *An illustrated guide to spy planes and electronic warfare aircraft* (London: Salamander Books, 1983). Marc Grozel and Geneviève Moulard, *Drones, Mystérieux Robots Volants*, *Renseignement Histoire & Géopolitique Documents* (Lavauzelle, 2008).

[164] "Current and Future UAV Military Users and Applications," *Air & Space Europe* 1, no. 5/6 (1999). Jessica Drake, "UAV programs learn lessons from new equipment," *Aerospace Daily* (1999). Bill Sweetman,

Then, journalists of popular tech-publications such as *Wired* became interested. Their reporting shows a fascination with the technology and with a future in which "the kill chain will be in the hands of geeky teenagers"[165] (who arguably constitute *Wired*'s main readership). Yet, even though UAVs were increasingly used by armed forces around the world, their existence was reported on only by niche experts.

The public debate was jump-started by Peter W. Singer's *Wired for War,* published in January 2009. No other author can claim to have influenced the drone debate to the same extent as Singer. He starts his book with the question "Why a book on robots and war?" and gives the answer himself: "Because robots are frakin' cool."[166] This sets the tone for a book filled with robot stories and references to popular culture and science fiction. *Wired for War* was clearly aimed at a generalist rather than academic audience – Singer's book tour included a stop on the *Daily Show* – but it provided a well-researched *tour d'horizon* of the use of robotics in warfare. Singer's main message: "we are in the midst of something important, maybe even a revolution in warfare and technology that will literally transform human history". He considers the introduction of robotic weaponry "the most important weapons development since the atomic bomb".[167]

Singer's book coincided with the rise of US drone use in Pakistan which makes it difficult to disentangle the influence the book had from the generally growing media attention at

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"Endurance above all for UAVs," *Jane's International Defense Review* (2003). "Drohnen in Deutschland," *Wehrtechnik* 1990.

[165] Noah Shachtman, "Attack of the Drones," *Wired*, June 2005. Also see Phil Patton, "Robots with the right stuff," *Wired*, 1 March 1996.

[166] Peter W. Singer, *Wired for War. The Robotics Revolution and Conflict in the 21st Century* (New York: Penguin Press, 2009). p.1.

[167] Ibid. pp.11,10.

that time. Regardless, Singer succeeded in placing himself as the foremost expert on UAVs for the decade to come, including in the non-English literature.[168]

3.2. The rise of anti-drone activism

From 2009 onwards, the body of literature began to grow exponentially. The renewed interest in drones inspired historical work on UAVs' beginnings,[169] and authors such as Gareth Jennings, Nick Turse, Noah Shachtman, and David Axe covered the latest developments for military-technology or technology-focused media outlets. With more information on the use of drones for targeted killings becoming public, activist groups formed to protest this type of drone use, and their writing soon dominated the market. One of the most important books in this context is *Drone Warfare* by Medea Benjamin. Benjamin, co-founder of the women grassroots organisation Code Pink, is known for her interruption of US President Obama's National Defense speech in May 2013 when she demanded that he "take the drones out of the hands of the CIA".[170] *Drone Warfare* was published in 2012 and became an influential pamphlet against US drone policy.[171] Notwithstanding its fundamental critique of drones, *Drone Warfare* offered an overview of UAV use at a time when literature on the subject was scarce, and quickly became a work of reference.

On the other side of the Atlantic, British robotics professor and activist Noel Sharkey began writing on military UAV use as early as 2007, when he became concerned with the

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[168] Peter W. Singer, "La guerre connectée: les implications de la révolution robotique," *Politique étrangère*, no. Automne (2013). Peter W. Singer, "Die Zukunft ist schon da," *Internationale Politik* Mai/Juni (2013).
[169] Spinetta, "The Rise of Unmanned Aircraft." Michael I. Draper, *Sitting ducks & peeping toms* (Staplefield: Air-Britain Ltd., 2011). Sifton, "A Brief History of Drones."
[170] John Glaser, "Code Pink's Medea Benjamin Interrupts Obama Speech " *Anti-war.com*, 23 May 2013.
[171] Medea Benjamin, *Drone Warfare. Killing by remote control* (London, New York: Verso Books, 2012).p.124. For a detailed review see Ulrike Franke, "Drones, Drone Strikes, and US Policy: The Politics of Unmanned Aerial Vehicles," *Parameters* 44, no. 1 (2014).

growing autonomy of UAVs.[172] Other individuals and organisations in the UK (Chris Cole, *Drone Wars UK*), the US (*No Drones Network*), Germany (Peter Strutynski, *Drohnenkampagne*), France (Aymeric Elluin), and other countries began to entertain websites, organise protests, and publish on these issues. Increasingly, international organisations such as *Amnesty International* and *Human Rights Watch*, and legal activists, such as *Reprieve*, became engaged in the debate.[173] Most anti-drone groups joined together in April 2013 under the aegis of the *International Campaign to Stop Killer Robots* whilst continuing their individual work.

A different strand of literature, situated between activism and academic research, appeared with the work of the New America Foundation, the Long War Journal, and the Bureau of Investigative Journalism (*BIJ*), organisations that in 2009/10 began studying the number of (civilian) casualties caused by drones. This research has helped push the debate on political accountability and has laid the basis for much academic work.

By the time the public interest in drones was awoken in the early 2010s, the literature was dominated by activists' and journalists' accounts. An interested reader came to hear about drones either as fascinating Science Fiction robots (Singer, tech-media) or evil killing machines (Benjamin, Sharkey, activist literature). The writing was focused exclusively on armed drones. These beginnings have influenced the drone debate ever since.

[172] Noel Sharkey, "Robot wars are a reality," *Guardian*, 18 August 2007, Noel Sharkey, "March of the killer robots," *Telegraph*, 15 June 2009.
[173] "Losing Humanity, The case against killer robots," (Human Rights Watch, 2012). "'Will I be next?' US drone strikes in Pakistan," *Amnesty International* (2013). *Drone strikes*, (2016 [cited 17 April 2016]); available from http://www.reprieve.org.uk/topic/drones/.

3.3. The Social Sciences literature on drones

The Social Sciences, specifically International Relations and Politics, were surprisingly slow to take on the topic. At the *International Studies Association's* (ISA) Annual Convention 2009, not a single paper on any aspect of drone use was presented.[174] The numbers rose slowly in 2010 (1 paper), 2011 (6) and 2012 (8). Only then did more attention begin to be paid to the political impact of increasing drone use. In 2013 the number of ISA papers had risen to 22, the highest number of papers presented was in 2014 with 44. Since then, interest has somewhat subsided.[175]

At first glance, the topics discussed by the academic community appear diverse. At least five strands can be identified: law, ethics, politics, critical literature, and the autonomy debate.[176] But although these strands appear wide-ranging, the literature's focus is narrow. In fact, the following review shows that the academic literature focuses almost exclusively on:

(1) The use of *armed UAVs,*

(2) for targeted killings,

(3) outside of official war zones,

(4) by the US military or its intelligence services,

(5) with the pilot being located far away from the battlefield, (mainly in the US).

[174] I use conference papers rather than actual publications because of the time lag between a paper's submission and publication. ISA is the most renowned conference in the field of International Relations.
[175] ISA 2015: 41 papers, ISA 2016: 20.
[176] For this review, a broad definition of social sciences has been chosen which includes works by legal scholars, philosophers and Politics/IR scholars. This overview is partly adapted from Ulrike Franke, "Drone Warfare," *Oxford University Press Bibliography* (2017).

3.3.1. Law

Scholars working on legal questions pertaining to drone use are primarily interested in the legality of 'drone strikes', specifically targeted killings.[177] Mary Ellen O'Connell studied US drone attacks in Pakistan and found them illegal under international law. "Killing without warning is only tolerated during the hostilities of an armed conflict", she argued, and there is "no armed conflict on the territory of Pakistan because there was no intense armed fighting between organized armed groups". O'Connell argues that, because of alleged high casualty rates, the use of drones violates the war-fighting principles of distinction, necessity, proportionality, and humanity.[178] French scholar Jean-Baptiste Jeangène Vilmer considered drones to be more discriminate than other weapon systems. Distinguishing between the technology (remotely controlled armed drones) and the tactic (targeted assassinations), he considered armed drones not illegal per se but raised legal concerns regarding the specifics of the tactic and even more about the increasing automation of drones, specifically the automation of firing decisions.[179]

Three UN 'Special Rapporteurs' have been tasked to work on drone use and international law. Philip Alston singled out the US drone programme, describing it as "a vaguely defined license to kill". He recommended disclosing the procedures of how individuals are chosen

[177] More legal literature: Peter Rudolf and Christian Schaller, "Targeted Killing: zur völkerrechtlichen, ethischen und strategischen Problematik gezielter Tötens in der Terrorismus- und Aufstandsbekämpfung," *SWP Studie* (2012). Jeanne Mirer, "US Policy of Targeted Killing with Drones: Illegal at any Speed," in *Drones and Targeted Killing. Legal, Moral, and Geopolitical Issues*, ed. Marjorie Cohn (2015). William C. Banks, "Regulating Drones: Are Targeted Killings by Drones Outside Traditional Battlefields Legal?," in *Drone Wars*, ed. Peter L. Bergen and Daniel Rothenberg (Cambridge: Cambridge University Press 2015). Kevin Jon Heller, "One hell of a killing machine. Signature Strikes and International Law," *Journal of International Criminal Justice* 11, no. 1 (2013). Robert Frau, *Drohnen und das Recht: Völker- und verfassungsrechtliche Fragen automatisierter und autonomer Kriegführung* (Mohr Siebeck, 2014).

[178] Mary Ellen O'Connell, "Unlawful Killing with Combat Drones. A Case Study of Pakistan, 2004-2009," *Notre Dame Law School, Legal Studies Research Paper No. 09-43* (2009). p.1,24. Also see Mary Ellen O'Connell, "Seductive drones: Learning from a decade of lethal operations," *JL Inf. & Sci.* 21 (2011).

[179] Jean-Baptiste Jeangène Vilmer, "Légalité et légitimité des drones armés," *Politique étrangère* (2013). p.129-130.

as targets and suggested international agreements on rules regarding this process.[180] His successor Christof Heyns focused on the legality of armed drone use, specifically outside official warzones, and recommended states to capture rather than kill whenever feasible.[181] Ben Emmerson, in his 2013 report (to which I contributed as a member of Emmerson's research team), studied civilian casualties caused by Israeli, British, and American drone operations.[182] Emmerson believed that drones, if used in strict compliance with the principles of international humanitarian law, can reduce the risk of civilian casualties in armed conflict by "significantly improving the situational awareness of military commanders". In cases in which civilians appear to have been killed, "the State responsible is under an obligation to conduct a prompt, independent and impartial fact-finding inquiry and to provide a detailed public explanation."[183]

As of early 2017, the mainstream view is leaning towards finding the US drone programme illegal (with notable outliers such as Heritage Foundation's Steven Groves, and Charles Dunlap),[184] but few argue that the technology itself is illegal.

3.3.2. Ethics

The ethics debate consists of works by philosophers, political theorists, and legal scholars, and is split into two strands; the first is concerned with the ethics of killing "by remote

[180] Philip Alston, "Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Philip Alston. Study of targeted killings," (2010). p.27-29.
[181] Christof Heyns, "Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions ", ed. UN General Assembly (2013). p.23.
[182] Emmerson, "Report of the Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism." p.22.
[183] Ibid. p.23/24.
[184] Steven Groves, "Drone Strikes: The legality of US targeting Terrorists abroad," *Heritage Foundation* (2013). Charles Dunlap Jr., "Does Lawfare need an Apologia," *Case Western Reserve Journal of International Law* 43 (2010).

control",[185] the second with autonomous systems. Again, the focus is firmly on armed drones piloted remotely in order to kill. In fact, as noted by Waddington, although many people appear to make an ethical argument against drones, drones have become the focal point of criticism of the targeted killing doctrine.[186] Stephanie Carvin puts it bluntly; when discussing the ethical issues surrounding drones, "the weapon itself is seldom the true issue at hand."[187]

French philosopher Grégoire Chamayou finds (armed) drones immoral, an "*objet violent non-identifié*" that deprives the enemy of its opponent.[188] One paper that deserves special mention is Bradley Strawser's "Moral Predators: The Duty to Employ Uninhabited Aerial Vehicles". Strawser made his name by going against the mainstream view, namely, by arguing that "there is an ethical obligation to use UAVs. Indeed, [...] there is no need for special ethical concern for this weapons system as opposed to any other more standard weapon technology."[189] Herfried Münkler adopts a similar pro-drone position, arguing that they rebalance war after the widespread use of IEDs has given militants an

[185] Ethics literature: Matthew W. Hallgarth, "Just War Theory and Remote Military Technology: A Primer," in *Killing by Remote Control*, ed. Bradley Jay Strawser (Oxford: Oxford University Press, 2013). George R. Lucas Jr, "Engineering, Ethics, and Industry: The moral Challenges of Lethal Autonomy," in *Killing by Remote Control*, ed. Bradley Jay Strawser (Oxford: Oxford University Press, 2013). Stephen Kershnar, "Autonomous Weapons pose no Moral Problem," in *Killing by Remote Control*, ed. Bradley Jay Strawser (Oxford: Oxford University Press, 2013). Bernhard Koch, "Es ist an uns. Zur sozialethischen Abwägung bei bewaffneten Drohnen und ihren normativen Implikationen," in *Das Zeitalter der Einsatzarmee* ed. Fabian Forster, Sascha Vugrin, and Leonard Wessendorff (Berlin: Berliner Wissenschaftsverlag, 2014). "Drone Warfare, Are strikes by unmanned aircraft ethical?," *CQ Researchers* 20, no. 28 (2010).

[186] Conway Waddington, "Drones: degrading moral thresholds for the use of force and the calculations of proportionality," in *Precision Strike Warfare and International Intervention*, ed. Mike Aaronson, et al. (Routledge, 2014).

[187] Stephanie Carvin, "Getting Drones wrong," *International Joural of Human Rights* 19, no. 2 (2015). p.127.

[188] Grégoire Chamayou, *Théorie du drone* (La Fabrique editions, 2013). p.26.

[189] Bradley Jay Strawser, "Moral Predators: The Duty to Employ Uninhabited Aerial Vehicles," *Journal of Military Ethics* 9, no. 4 (2010).

asymmetrical advantage.[190] More recently, authors have begun to argue that drones can also be a "humanitarian technology"[191] that should be used in UN peacekeeping.[192]

The ethical dimension plays an important role in current debates, as activists are mainly motivated by ethical concerns.

3.3.3. Politics

The majority of the politics literature focused specifically and solely on the US. This literature is divided into two strands. The first is turned inward, interested mostly in the role that different federal agencies play in drone warfare;[193] the second strand is turned outward, studying the impact of US drone use in the targeted countries and on the broader drone debate. The first strand will be discussed in the US case study. The outward-looking strand is concerned in particular with the effectiveness and international implications of drone warfare. A particularly contentious issue is the number of casualties, and civilian casualties in particular, and how casualties affect the effectiveness of drone warfare.[194]

The literature that goes beyond domestic US issues looks at questions pertaining to drone proliferation and geopolitics. The field of drone proliferation studies is growing in parallel with the global number of drones. Studies look into what makes drones attractive, such as

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[190] Herfried Münkler, *Der Wandel des Krieges* (Velbrück Wissenschaft Weilerswist, 2006).
[191] Kenneth Anderson, "Written Testimony Submitted to subcommittee on National security and Foreign Affairs: rise of the Drones - Unmanned Systems and the Future of War," ed. Subcommittee on National Security and Foreign Affairs (2010).
[192] Caroline Kennedy and James Rogers, "Virtuous Drones," *International Journal of Human Rights* 19, no. 2 (2015). David Whetham, "Drones to Protect," *International Joural of Human Rights* 19, no. 1 (2015).
[193] Christopher Fuller, "The Eagle Comes Home to Roost: The Historical Origins of the CIA's Lethal Drone Program," *Intelligence and National Security* 30, no. 6 (2015). Naureen Shah, "A Move Within the Shadows," in *Drone Wars*, ed. Peter L. Bergen and Daniel Rothenberg (Cambridge University Press, 2014).
[194] Michael Boyle, "The costs and consequences of drone warfare," *International Affairs* 89, no. 1 (2013). Williams, *Predators: the CIA's drone war on al Qaeda*

their appeal for democratic states.[195] I have argued elsewhere that drones are proliferating at current rates because militaries around the world have seen them as prestigious must-haves.[196] As some worry about a global UAV arms race,[197] the research also focuses on what proliferation means for international politics and whether it can or should be limited.[198] Kelley Sayler believes that "[p]reventing the proliferation of armed drones is impossible", a conviction shared by many.[199] At the other end of the spectrum, Andrea and Mauro Gilli argue that a global diffusion of (advanced) drones is unlikely given the necessary know-how and financial means.[200] But not only the proliferation of high-end drones would be problematic, Sayler argues. The diffusion of off-the-shelf hobbyist drones is also a security concern as these systems hold significant disruptive potential.[201]

The impact of drone proliferation on international relations is hotly disputed. Authors have expressed worry that the US has set precedents that other countries may follow once they have the same means. Michael Boyd goes further, saying that the US drone campaigns are "corrod[ing] the stability and legitimacy of local governments [while] creat[ing] new recruits for Islamist networks aiming to overthrow these governments".[202] Others warn of conflict escalation because of drones. Brimley, Fitzgerald, and Ratner fear that drones may entice actors to take greater risks and that the deployment of drones

[195] Horowitz and Fuhrmann, "Droning on: Explaining the Proliferation of Unmanned Aerial Vehicles."
[196] Franke, "The global diffusion of Unmanned Aerial Vehicles (UAVs), or drones."
[197] Michael J Boyle, "The Race for Drones," *Orbis* 59, no. 1 (2015).
[198] Micah Zenko and Sarah Kreps, "Limiting armed drone proliferation," *Center for Preventive Action. Council* (2014). And Frank Sauer and Niklas Schörnig, "Killer drones: The 'silver bullet' of democratic warfare?," *Security Dialogue* 43, no. 4 (2012).
[199] Kelley Sayler, "A World of Proliferated Drones: A Technology Primer," *Centrer for a New American Security* (2015). pp.31,32. Also see Tucker, "Every Country Will Have Armed Drones Within 10 Years."
[200] Andrea Gilli and Mauro Gilli, "The Diffusion of Drone Warfare? Industrial, Organizational, and Infrastructural Constraints," *Security Studies* 25, no. 1 (2016). Also see Shashank Joshi and Aaron Stein, "Emerging Drone Nations," *Survival* 55, no. 5 (2013).
[201] Sayler, "A World of Proliferated Drones: A Technology Primer." p.29.
[202] Boyle, "The costs and consequences of drone warfare."

could lead military conflict to spiral out of control.[203]. Finally, Horowitz, Kreps, and Fuhrmann analyse the likely consequences of current-generation drone proliferation in six contexts: counterterrorism, interstate conflict, crisis onset and deterrence, coercive diplomacy, domestic control and repression, and terrorism. The authors argue that drones have minimal impact on interstate relations and are unlikely to provoke international crises or incite regional instability.[204]

3.3.4. Critical literature

Slowly, the focus of the literature has begun to move on from classic topics in international relations to the role of the drone pilot in drone warfare.

The interest in those who control the drone is comparatively recent, dating to around the second decade of the 21st century. Media coverage initially dominated the field, with interviews with drone pilots and portrayals of the 'cubicle warrior'.[205] Anti-drone activists argued that drone pilots are too distant from their work, and hence adopt a "PlayStation mentality", reducing victims to pixels on the screen.[206] Academic works followed, such as by Robert Sparrow, Christian Enemark, and Peter Lee.[207] They study whether classic

[203] Shawn Brimley, Ben Fitzgerald, and Ely Ratner, "The Drone War Comes to Asia," *Foreign Policy* (2013).
[204] Michael C Horowitz, Sarah E Kreps, and Matthew Fuhrmann, "Separating Fact from Fiction in the Debate over Drone Proliferation," *International Security* 41, no. 2 (2016).
[205] "Interview with a Drone Pilot: 'It Is Not a Video Game'," *Spiegel*, 12 March 2010. Abigail Fielding Smith and Jack Serie, "'It's very odd' – a former UK drone operator speaks," *Bureau of Investigative Journalism*, 3 October 2014. David Wood, "Drone Strikes: A Candid, Chilling Conversation With Top U.S. Drone Pilot," *Huffington Post*, 15 May 2013. Huffington Post, "PTSD And Drones: Emotional Costs Far Away From The Battlefield " (2012). David Axe, "How to Prevent Drone Pilot PTSD: Blame the 'Bot," *Danger Room Wired* (2012). "Remote-control warriors suffer war stress," *Slate*, 11 August 2008. Rob Blackhurst, "The air force men who fly drones in Afghanistan by remote control," *Telegraph*, 24 September 2012. Elisabeth Bumiller, "A Day Job Waiting for a Kill Shot a World Away," *New York Times*, 29 July 2012. "A rare insight into a day at work for a pilot of a drone," *BBC News* 2013. Aaron Sankin, "The loneliness of the long-distance drone pilot," *The Kernel*, 1 February 2015.
[206] Chris Cole, Mary Dobbing, and Amy Hailwood, "Convenient Killing, Armed Drones and the 'Playstation' Mentality," ed. The Fellowship of Reconciliation (2010).
[207] This literature includes but goes beyond psychological works. Drone pilot literature: Ian Graham Ronald Shaw, "Playing War," *Social & Cultural Geography* 11, no. 8 (2010). F.S. Naiden, "Heroes and Drones " *Wilson*

warrior virtues of courage, loyalty, and mercy can be displayed by drone pilots. The psychological consequences of piloting drones such as burnout, stress, and post-traumatic stress disorder is being studied by psychologists, most notably US Air Force Psychologist Wayne Chappelle.[208]

Concerns about the negative impact on soldiers of controlling drones remotely has led some to argue for measures to mitigate the negative effects. Scott Fitzsimmons and Karina Sangh went as far as to suggest deploying operators with troops on overseas combat tours. This would shield drone operators from "the stress-aggravating effects of having to frequently transition between a war fighter and civilian mentality". Furthermore, to reduce drone operators' exposure to the "stress-inducing traumatic imagery associated with conducting airstrikes against human targets", the authors proposed to visually hide the human victims from the operators who carry out the strikes, for example with graphical overlays.[209] Again, these proposals solely pertained to remote-split operations of armed drones.

3.3.5. Autonomy

The fastest-growing strand of the drone literature focuses on autonomous systems, as some argue that "[remotely piloted] drones are yesterday's news".[210] Roboticist Ronald Arkin considers the eventual deployment of systems with ever increasing autonomy as "inevitable",[211] and argues that adherence to the laws of war can be programmed into

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Quarterly Autumn (2013). Wayne L Chappelle et al., "Symptoms of psychological distress and post-traumatic stress disorder in United States Air Force "drone" operators," *Military medicine* 179, no. 8S (2014).

[208] Wayne Chappelle et al., "An analysis of post-traumatic stress symptoms in United States Air Force drone operators," *Journal of anxiety disorders* 28, no. 5 (2014).

[209] Scott Fitzsimmons and Karina Sangha, "Killing in high definition," *Technology* 12 (2010).

[210] Denise Garcia, "The Case against Killer Robots," *Foreign Affairs* (2014).

[211] Ronald C Arkin, "Governing lethal behavior: Embedding ethics in a hybrid deliberative/reactive robot architecture," *Georgia Institute of Technology, Technical Report* (2007).

robots and should be pursued vigorously. How to define autonomous systems, and to what extent existing unmanned systems are already autonomous, are key debates in this field. As few modern systems, if any, are truly autonomous, and as this thesis is concerned only with currently existing systems, I will not go further into the details of the autonomy literature.[212]

3.4. Standard narrative and gaps in the literature

This review hints at the reason why the academic literature was slow to develop: drone warfare touches upon many different areas of study. It is of interest to lawyers, philosophers, psychologists, military strategists… – "drone studies" is clearly a field which lends itself to interdisciplinarity. Indeed, some of the best drone books currently available are edited volumes that include contributions by academics from different backgrounds.[213]

Two observations regarding the drone literature are most relevant for this thesis. First, although many authors imply that there is an Unmanned Revolution, they do not agree what it consists of. Second, based on the existing literature it is impossible to make substantive claims about drones' potentially revolutionary characteristics: the empirical evidence is simply insufficient. Empirical evidence is lacking because the literature's focus is firmly placed on a very specific type of drone use; the US use of armed drones for

[212] Autonomy literature: Armin Krishnan, *Killer robots : legality and ethicality of autonomous weapons* (Farnham: Ashgate, 2009). "Autonomes Töten durch neue Technologien?," *Ethik und Militär*, no. 1 (2014), Werner J.A. Dahm, "Drones now and what to except over the next ten years," in *Killing by remote control*, ed. Bradley Strawser (New York: Oxford University Press, 2013). "Autonomy levels for Unmanned Systems," ed. National Institute of Standards and Technology. Robert Sparrow, "Killer Robots," *Journal of Applied Philosophy* 24, no. 1 (2007). Elinor Sloan, "Robotics at War," *Survival* 57, no. 5 (2015).

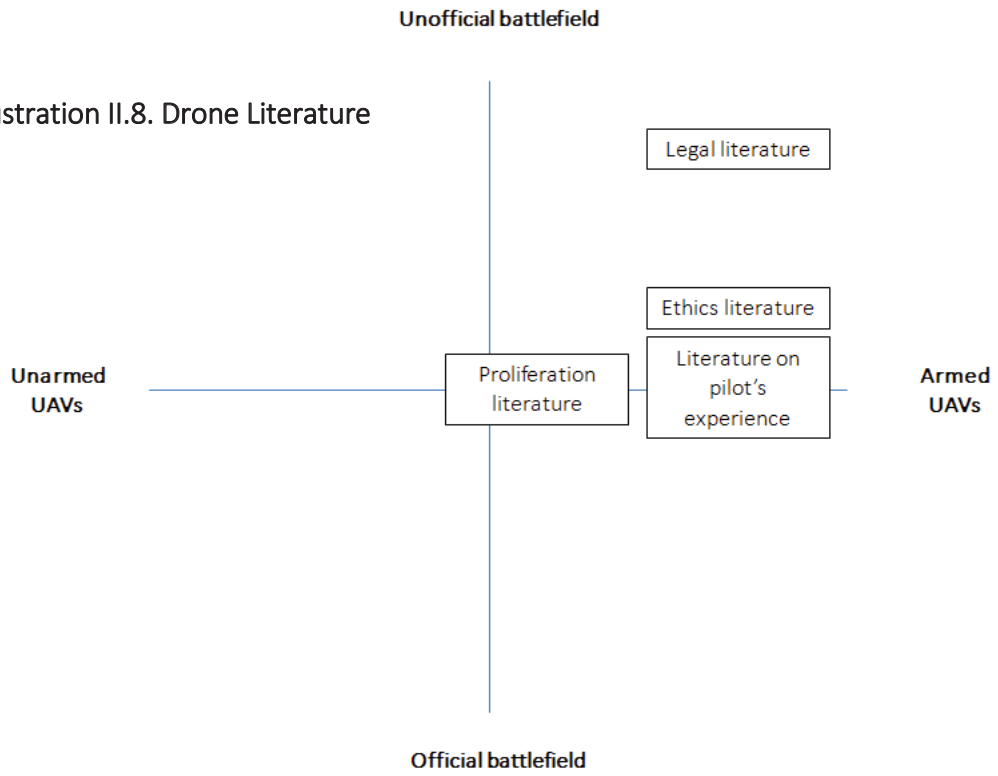
[213] Peter Bergen and Daniel Rothenberg, *Drone Wars. Transforming Conflict, Law, and Policy* (New York: Cambridge University Press 2015). Peter Strutynski, *Toeten per Fernbedienung. Kampfdrohnen im weltweiten Schattenkrieg* (Wien: ProMedia, 2013). Bradley Jay Strawser, ed., *Killing by remote control: the ethics of an unmanned military* (Oxford: Oxford University Press, 2013).

targeted killing. Only proliferation studies systematically look at drone users other than the US. But even this research is often motivated by such questions as whether drones will be used against the US and whether other countries will adopt current US drone policies once they acquire their own unmanned systems.[214] Proliferation studies are also alone in systematically looking beyond armed systems. The rest of the literature is exclusively concerned with armed drones – to the extent that in many publications 'drone' has become a synonym for 'armed drone'[215] and their use outside conventional battlefields. On this last point, the literature on pilots' experiences represents something of an exception: due to the secrecy around the intelligence agencies' use of drone operations, pilots can talk about their experience above/looking at Afghanistan or Iraq rather than about classified missions such as in Pakistan.

Illustration II.8 visualises the literature's bias: a lack of empirical, in-depth studies of how drones are being used in any other context than targeted killings outside an official battlefield.

[214] Micah Zenko, "Reforming U.S. Drone Strike Policies," *Council on Foreign Relations, Centre for Preventive Action* (2013). Kristin Roberts, "When the Whole World has Drones," *National Journal* (2013).
[215] "In common parlance, though, 'drone' has come to refer to unmanned combat aerial vehicles (UCAVs), which are UAVs equipped with combat capabilities, most commonly the ability to launch missiles." Dylan Matthews, "Everything you need to know about the drone debate, in one FAQ," *Washington Post Wonkblog*, 8 March 2013.

Illustration II.8. Drone Literature



It could be argued that this focus in the literature is explained by the fact that the use of armed drones for targeted killing by the US is the most important change caused by the introduction of drones. But there are three problems with this reasoning.

First, claims about the Unmanned Revolution predate the US targeted killing campaigns. In 1973 Bill Gunston claimed that UAVs "without fear of contradiction, will revolutionise warfare",[216] and in October 2001, Thomas Ricks in the *Washington Post* announced that "The use of the armed RQ-1 Predators is a revolutionary step in the conduct of warfare".[217]

Second, the large majority of all military drones in use worldwide are surveillance and reconnaissance drones: out of approximately 90 countries that have military UAVs, less

[216] Bill Gunston, "Unmanned Aircraft - Defence Applications of the RPV," *RUSI* 118, no. 4 (1973).p.41.
[217] Thomas E. Ricks, "US Arms Unmanned Aircraft; 'Revolution' in Sky Above Afghanistan," *Washington Post*, 18 October 2001.

than a dozen possess armed drones (most of which acquired them very recently). Drone development and use have a history of at least half a century, while armed drones only gained momentum after 2001 when the US Predator was fitted with Hellfire missiles. Hence, the history of drones is in fact a history of unarmed systems and deserves attention.

Third, given that the US use of armed drones outside official battlefields is the only drone use that has been studied extensively, the claim that US drone use is revolutionary follows a circular logic. With all attention turned to the CIA's operations in Pakistan, Yemen, and Somalia, drone use in conventional operations is being neglected. Afghanistan, although it is the most drone-bombed country in the world is in fact "a blind spot for drone analysis".[218] Chris Woods underlined that "[w]hile most controversy focused on America's secret wars, the drone's primary impact had actually been on the conventional battlefield".[219]

My research, by including two cases of ISR drones use in conventional battlefields (Germany and the UK) helps to close some of the gaps in the literature, as shown in illustration II.9. below.

[218] Sarah Kreps quoted in "US drone strikes outnumber warplane attacks for first time in Afghanistan," *Guardian*, 21 April 2016.
[219] Woods, *Sudden Justice. America's secret drone wars*.p.xv.

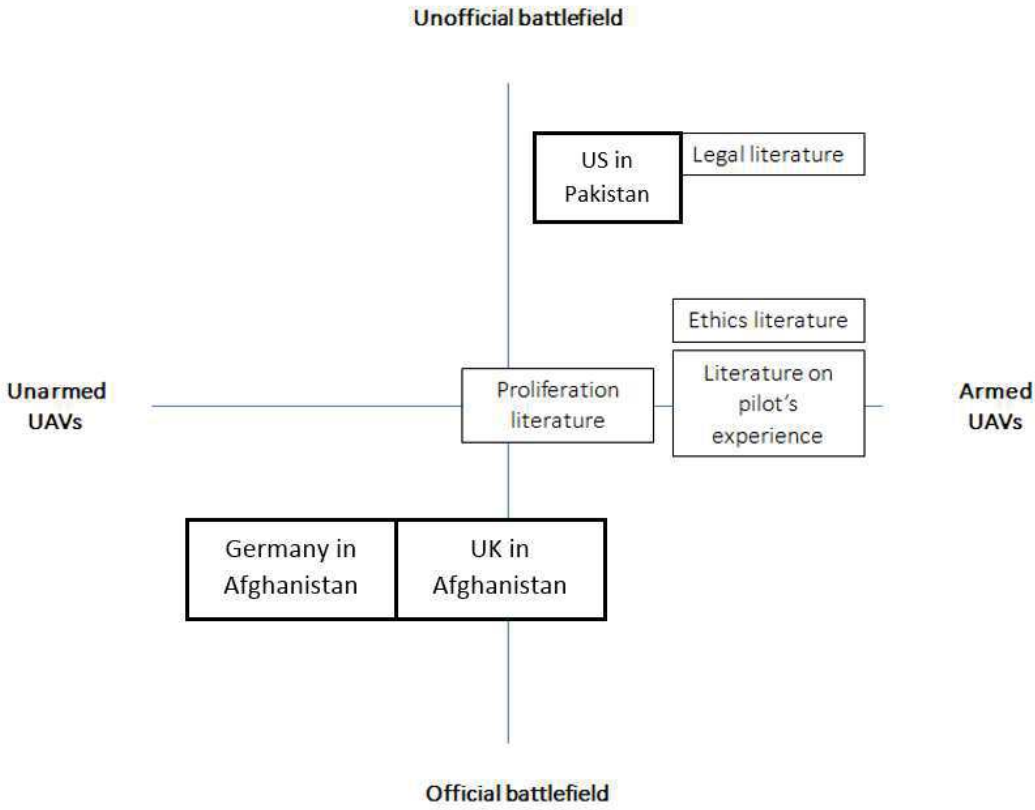


Illustration II.9. Filling gaps in the drone literature

III. A Framework to Study the Unmanned Revolution

This chapter develops the framework to study the Unmanned Revolution. It begins with a discussion of the origins of the RMA and addresses the most important controversies. Based on the extensive RMA literature, I identify five characteristics of an RMA: (1) operational change, (2) doctrinal change, (3) strategic change, (4) organisational changes in the armed forces, and (5) social and societal change. These are areas in which the RMA literature has detected changes during previous RMAs and which authors consider indicative of an RMA. But, as will be shown, changes in these areas have in the past not proven sufficient to explain which military reforms were eventually considered an RMA, as the RMA label remains a subjective one. Therefore, the labelling of an RMA as such by the elite and general public is introduced as an additional element that influences RMAs. The chapter ends with a discussion of the changes in this area as described or predicted by the drone literature.

It has been noted that "[t]here are no agreed-upon criteria by which military change, especially qualitative developments can be measured, or, more significantly, revolution discerned."[220] Yet, the conceptual skeleton of the RMA can serve as a tool to study possibly revolutionary changes in general, and the alleged Unmanned Revolution in particular. The RMA framework helps identify areas that deserve attention and allows to widen the approach beyond the direct impact a new military technology has on the battlefield.

[220] Jeremy Black, "The Revolution in Military Affairs: The Historian's Perspective," *RUSI Journal* 154, no. 2 (2009). p.89.

1. The Revolution in Military Affairs

Many authors use the term 'Revolution in Military Affairs' or variations thereof when discussing drones: James DeShaw Rae, Noel Sharkey, and Adam Stulberg call drones a "revolution in military affairs", Matthew Crosston and Daniel Sukman speak of "the robotics revolution in military affairs", Peter W. Singer and Arthur Herman of a "revolution in warfare".[221] Others compare drones with historical RMAs such as the invention of gunpowder and the crossbow,[222] or nuclear weapons.[223] Even authors who argue that drones are not revolutionary often do so by contrasting them with other, allegedly more revolutionary, weapons.[224]

But 'Revolution in Military Affairs' (RMA) is more than an elegant turn of phrase; it refers to a specific concept. The RMA was a highly influential idea in military and strategic circles from the 1980s to early 2000s, so much so that it became the "most widely used, and abused, acronym in the US defense community".[225]

The RMA concept is generally dated back to 1955 when historian Michael Roberts designated changes in Swedish warfare between 1560 and 1660, and particularly the reforms under King Gustavus Adolphus in the early 1600s, as revolutionary. Roberts argued that changes in the tactics, strategy, and scale of warfare, and the impact of war

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[221] Sharkey, "America's mindless killer robots must be stopped." Sniderman and Hanis, "Drones for Human Rights." Stulberg, "Managing the unmanned revolution in the US Air Force." Crosston, "Future Challenges in Drone Geopolitics." p.i. Sukman, "Lethal Autonomous Systems and the Future of Warfare." Singer, *Wired for War. The Robotics Revolution and Conflict in the 21st Century*. pp.11,10. Arthur Herman, "By the Drones' Eerie Light," *National Review*, 26 May 2016.

[222] Ryan J Vogel, "Drone warfare and the law of armed conflict," *Denver Journal of International Law and Policy* 39, no. 1 (2011).

[223] Metin Gurcan, "Drone warfare and contemporary strategy making: Does the tail wag the dog?," *Dynamics of Asymmetric Conflict* 6, no. 1-3 (2013).

[224] Golo Bartsch, "Drones as a Means of a Pre-emptive Security Strategy," *Atlantic Community* (2013).

[225] Douglas C. Lovelace in Gray, *Recognizing and understanding revolutionary change in warfare: The sovereignty of context*. p.iii.

on society were so profound as to be considered a revolution.[226] Roberts' idea was well received by historians, but it gained momentum in national strategy circles only two decades later when it re-emerged in form of the "Revolution in Military Affairs", which developed out of a back-and-forth between military strategists from the Soviet Union and the US.[227]

1.1. The primordial "Revolution in Military Affairs": The IT-RMA

By the end of the 1970s Soviet strategists had grown concerned with US technological progress. They worried that, despite the Soviets' numerical advantage, the USSR's defence industry would not be able to keep up with American technological capabilities. Russian strategists called what they observed in the US a 'military-technical revolution'[228] (sometimes 'scientific-technical revolution').[229] The American side adopted the notion, aiming explicitly to reinforce Soviet fears:

> "As the Soviets appeared very concerned about these developments, we concluded that it would be useful to intensify those concerns by further investment in the 'reconnaissance-strike complexes' (as the Soviets called them) that were central to their vision of how future warfare would change."[230]

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[226] Michael Roberts, *The military revolution, 1560-1660: an inaugural lecture delivered before the Queen's University of Belfast* (Belfast: Marjory Boyd, 1956).

[227] The following analysis of the RMA is adapted from Ulrike Franke, "Die Revolution in Militärischen Angelegenheiten," in *Studienbrief zur Friedens- und Konfliktforschung*, ed. Tobias Ide (Fernuniversitaet Hagen, 2016), and Franke, "A Tale of Stumbling Blocks and Road Bumps: Germany's (non-) Revolution in Military Affairs."

[228] Marc DeVore, "A dangerous utopia: The military revolution from the Cold War to the War on Terror," in *The global 1989*, ed. Chris and Cox Lawson George; Armbruster, Michael (2011). p.222.

[229] Fanourios Pantelogiannis, "RMA: The Russian Way," *Cyberwar, Netwar and the Revolution in Military Affairs* (2006). p.158.

[230] Andrew Marshall quoted in Andrew F. Krepinevich, *The Military-Technical Revolution: A Preliminary Assessment* (Center for Strategic and Budgetary Assessments, 2002).

Through projects financed by the Defense Advanced Research Projects Agency, DARPA, the US initiated the (second) Offset Strategy, causing a high-tech arms race that eventually became known as the Revolution in Military Affairs.[231]

Andrew Marshall, director of the US Office of Net Assessment for over 40 years, is considered the father of RMA thinking and coined the best-known definition:

> "a major change in the nature of warfare brought about by the innovative application of new technologies, which, combined with dramatic changes in military doctrine and operational and organisational concepts, fundamentally alters the character and conduct of military operations".[232]

The idea that a revolutionary change was taking place before their eyes gripped US strategic thinkers' imagination. RMA adherents argued the transition from the Industrial Age to the Information Age would alter the way war was waged in a revolutionary manner. This idea was most poignantly formulated by Arthur Cebrowski:

> "Society has changed. The underlying economics and technologies have changed. American business has changed. We should be surprised and shocked if America's military did not. We are in the midst of a revolution in military affairs unlike any seen since the Napoleonic Age, when France transformed warfare with the concept of *levée en masse* […] and it will prove to be the most important RMA in the past 200 years."[233]

[231] DeVore, "A dangerous utopia: The military revolution from the Cold War to the War on Terror." p.223.
[232] Cited in Thierry Gongora and Harald Von Riekhoff, *Toward a revolution in military affairs?* (Westport, Conn.: Greenwood Press, 2000). p.1
[233] Arthur K Cebrowski and John J Garstka, "Network-centric warfare: Its origin and future" (paper presented at the US Naval Institute Proceedings, 1998). p.1.

RMA enthusiast Bill Owens, Vice-Chairman of the US Joint Chiefs of Staff from 1994 to 1996 predicted a "lifting of the fog of war".[234] The digitalisation of the battlefield – the collection, processing, and distribution of information during battle through a "system of systems" - would, it was argued, create a new level of battle-space awareness, and shorten decision-making.[235] "Network-centric warfare" became the buzzword of the time. Because of the centrality of Information Technology, some labelled the changes 'IT-RMA'.[236]

The hype (and controversy)[237] surrounding the IT-RMA influenced the US's, and subsequently NATO's, strategic communities. The IT-RMA was seen as a goal to be pursued by investing in specific programmes and adopting specific strategies. Technologies identified as part of the RMA enjoyed practically unlimited funding and support by high-level political personalities. A four-star general noted: "They say, 'There's an RMA [underway], we're going to use it to transform the military', and anybody who disagrees with us is a Luddite.'"[238]

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[234] William Owens, *Lifting the fog of war*, 1st ed. (New York: Farrar, Straus and Giroux, 2000). p.15. Also see David Kirkpatrick, "Revolutions in Military Technology, and their Consequences," *RUSI Journal* 146, no. 4 (2001).

[235] David F. Ronfeldt and John Arquilla, *In Athena's camp: preparing for conflict in the information age* (Santa Monica, Calif.: Rand, 1997).

[236] "Special Issue: The Information Technology Revolution in Military Affairs," *Journal of Strategic Studies* 33, no. 4 (2010).

[237] On sceptical accounts regarding the IT-RMA and the RMA more broadly see Christopher M Schnaubelt, "Whither the RMA?," *Parameters* 37, no. 3 (2007). Antulio Echevarria, "Challenging transformation's clichés," (DTIC Document, 2006). Stephen Biddle, "Speed kills? Reassessing the role of speed, precision, and situation awareness in the Fall of Saddam," *Journal of Strategic Studies* 30, no. 1 (2007).

[238] Vernon Loeb, "For the US Military, A Transforming View From the Maginot Line," *Washington Post*, 6 October 2002.

Although primarily a "Revolution in *American* Affairs",[239] the IT-RMA became the model to emulate, influencing thinking and procurement around the world, particularly in NATO states, and creating "a normative view of a modern conventional military".[240]

1.2. The RMA concept

Academic thinking soon transcended the debate on current changes. The notion that technological changes were causing a Revolution in Military Affairs inspired scholars to think more conceptually about RMAs and provided "a happy hunting ground for academic historians",[241] who sought out past RMAs. Historians had of course studied changes in military operations before.[242] But through the RMA this research gained momentum – and acceptance in the strategic community.

Because of the context in which it came about, the term 'RMA' acquired a double meaning, referring on the one hand to the *specific IT-RMA* of the 1990s/2000s, and on the other to the *general concept of Revolutions in Military Affairs*. To this day, the term is afflicted by vagueness: "RMA is at once description, analysis, prospectus and mission".[243] In this thesis, 'IT-RMA' refers to the 1990s RMA, while 'RMA' stands for the concept.

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[239] Götz Neuneck and Christian Alwardt, "The Revolution in Military Affairs, its Driving Forces, Elements and Complexity " *IFSH Working Paper* (2008).

[240] Dima Adamsky and Kjell Inge Bjerga, "Introduction to the Information-Technology Revolution in Military Affairs," *Journal of Strategic Studies* 33, no. 4 (2010). p.464. Also see Theo Farrell, Terry Terriff, and Frans Osinga, *A Transformation Gap: American Innovations and European Military Change* (Stanford University Press, 2010).

[241] Gray, *Recognizing and understanding revolutionary change in warfare: The sovereignty of context*.

[242] Such as Campbell Dalrymple, *A Military Essay: Containing Reflections on the Raising, Arming, Cloathing, and Discipline of the British Infantry and Cavalry; with Proposals for the Improvement of the Same* (D. Wilson, 1761). John Frederick Charles Fuller, *Armament and history: The influence of armament on history from the dawn of classical warfare to the end of the Second World War* (Da Capo Press, 1998 (1945)). Geoffrey Parker, *The Military Revolution. Military innovation and the rise of the West, 1500 - 1800* (Cambridge: Cambridge University Press 1988). Roger Edwards, *Panzer: a revolution in warfare, 1939-1945* (Arms & Armour Press, 1989). Parson, *Missiles and the Revolution in Warfare*.

[243] Black, "The Revolution in Military Affairs: The Historian's Perspective." p.98.

Despite a fast-growing body of research, RMA studies were plagued by analytical difficulties. Marshall's RMA definition did not unite scholars, as the crucial question of what designated a 'major change in the nature of warfare' could not be answered definitively. Lawrence Freedman notes: "revolution involves more than change, and certainly more than simple change of an incremental variety. It represents a moment of transformation".[244] But how to define and quantify this 'moment of transformation' remains a mystery.

Hence, there is no agreement on which historic developments constitute RMAs. Alvin and Heidi Toffler identified three RMAs in human history, including the current Information Revolution.[245] Tim Benbow on the other hand gathered a list of 27 possible RMAs, which includes changes that differ widely in scope, importance, type, or timeframe.[246] The RMA remains an essentially contested concept.

[244] Tim Benbow, *The Magic Bullet? Understanding the Revolution in Military Affairs* (London: Brassey's, 2004).p.21.
[245] Alvin Toffler and Heidi Toffler, *War and anti-war: survival at the dawn of the 21st century*, 1st ed. (Boston: Little, Brown, 1993).
[246] Benbow, *The Magic Bullet? Understanding the Revolution in Military Affairs*. p.18.

27 RMAs

List by Tim Benbow (2004) p.18

- Assyrian combined arms tactics (from around 9th century BC)
- Cavalry stirrups (5th century AD)
- Persian and Byzantine heavy cavalry (6th and 7th centuries)
- Infantry pikes and longbows (early 14th century)
- Gunpowder
- Cannon (early 15th century)
- Ship-borne cannon (early 16th century)
- French military reforms of 16th century
- Efficient fortress construction methods (1600)
- Musket
- Swedish adoption of massed volley gunfire (16th and 17th centuries)
- British financial revolution
- Societal and political upheavals of French revolution
- Introduction of corps system into armies
- Introduction of the modern staff system to armies
- Railroad, rifle, and telegraph (mid-19th century)
- Naval steam engines, metal ships and armour (late 19th century)
- Medical revolution
- Indirect fire and the deep battle (1917-1918)
- Submarine warfare
- Mechanised warfare in the 1930s and 1940s
- Blitzkrieg, strategic bombing, offensive carrier aviation, amphibious warfare
- Nuclear weapons and ballistic missiles (1950 and 1960s)
- Peoples' War
- The microchip
- Cybernetics and automated troop control, 1970s onwards
- The information era

With the onset of the new millennium, the IT-RMA's appeal faded, as more and more problems dominated the Afghan and Iraqi theatres. Scott Stephenson noted: "The exact location of the phrase's collapse is open to speculation, but one place to look for it might be along Route Irish, between the Green Zone and the Baghdad International Airport."[247] It was briefly replaced by 'Transformation' – a more active and less normative approach to

[247] Scott Stephenson, "The revolution in military affairs: 12 observations on an out-of-fashion idea," *Military Review* 90, no. 3 (2010). p.38.

military change that focused on flexibility and adaptability[248] – but eventually both sank into oblivion.

1.3. Controversies

1.3.1. Technology

Since the emergence of the RMA concept, there has been a debate about whether technological change is its necessary pre-condition – a controversy particularly central for this thesis. From Benbow's list of 27 RMAs, one could deduce that the scholarship is evenly divided on the question: ten of 27 lack an obvious technological component. But this ratio is misleading; most authors consider technological change key and the majority of commonly named RMAs have technological drivers. For the archetypical Information-*Technology*-RMA, technology was the linchpin. And although the father of the RMA concept Michael Roberts did not explicitly single out technology, technological change was in fact a constituent element in his military revolution. His tacit acceptance of technology's primacy is also shown in the past revolutions he cites which all refer to new weapons or technologies: "the coming of the mounted warrior, and of the sword, in the middle of the second millennium B.C.; the triumph of the heavy cavalryman, consolidated by the adoption of the stirrup, in the sixth century of the Christian era; the scientific revolution in warfare in our own day".[249] Andrew Krepinevich neatly associates each of the ten RMAs he argues have happened since the 14th century with a specific technology:

[248] Although the two concepts are sometimes used synonymously, they are not identical as transformation refers to military change while not necessarily claiming to be revolutionary. Some authors see transformation as the path towards an RMA, "the act of creating and harnessing a revolution in military affairs". Hans Binnendijk, *Transforming America's military* (Washington, D.C.: National Defense University Press, 2002).

[249] Roberts, *The military revolution, 1560-1660: an inaugural lecture delivered before the Queen's University of Belfast*. p.4.

RMAs & associated technology according to Andrew Krepinevich[250]	
RMA	Associated technology
Infantry Revolution	Longbow
Artillery Revolution	Gunpowder, Lengthened gun barrels, Metallurgy
Revolution of Sail and Shot	Sailing
Fortress Revolution	Fortification
Gunpowder Revolution	Muskets
Napoleonic Revolution	Industrial processes
Land Warfare Revolution	Railroad, Telegraph
Naval Revolution	Metal-hulled ships
Revolution in Mechanisation, Aviation, and Information	Internal combustion engines, Aircraft, Radio, Radar
Nuclear Revolution	Atomic Bomb

In fact, the only RMA recognised by most scholars which does not have an obvious technological driver is the French Revolution – and several authors have made the argument that technological changes also underlie the French Revolution RMA.[251]

I consider the introduction of a new technology, a necessary criterion for an RMA.[252] There are three reasons to take this approach. First, as shown, the majority of the RMA literature takes this view. Marshall, in his seminal definition, first mentions the "innovative application of new technologies". Only then do "dramatic changes in military doctrine and operational and organisational concepts" come into the equation.

[250] Andrew F Krepinevich, *Cavalry to computer: The pattern of military revolutions* (National Affairs, 1994).
[251] See Colin S Gray, *Strategy for chaos: revolutions in military affairs and the evidence of history* (Psychology Press, 2004). p.149. Ken Alder, *Engineering the revolution: arms and the Enlightenment in France 1763-1815* (Princeton University Press, 1997). Although many list the French Revolution as RMA, there are few RMA studies on it. One exception is Peter Paret, "Napoleon and the Revolution in War," in *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, ed. Peter Paret, Gordon A. Craig, and Felix Gilbert (Oxford: Oxford University Press, 1986).
[252] I define technology in the broadest terms, meaning any kind of tool.

Second, the focus on technology helps to distinguish RMAs from other changes. Without this limitation, it would be practically impossible to make any meaningful distinction between changes in military practices and revolutions in military affairs.

Third, it is not by accident that the first development designated as an RMA had such an obvious technological element. Technology is prone to exponential growth and sudden leaps, as described by Moore's law of exponential growth. The idea of revolutionary military changes was to a large part influenced by the revolutionary technological changes that were happening before the IT-RMA advocates' eyes. Dividing the RMA from its technological origin would hence be misguided.

An RMA can be compared to an avalanche which, starting small at the mountain peak, gathers momentum sweeping downhill. The new technology is the first rock that makes its way down the valley. Not every rock causes an avalanche, as not every new technology changes operational practices or causes the development of fundamentally new ways of operation – meaning that the introduction of a new technology is not a sufficient criterion for an RMA. Whether this happens depends on several factors – the criteria outlined below. But without the first rock there can be no avalanche, and without technology there is no RMA.

By adopting this technology-focused view, I side with what Stephen Biddle has dubbed the 'Contingent Innovation School', (as opposed to the 'Economic Determinist School'). Whereas the latter sees military revolution as the inevitable outgrowth of basic changes in economic production, the Contingent Innovation School focuses on how technologies are

utilised by innovators to create new organisations and military doctrines to exploit them.[253]

This does not negate that changes in the conduct of war can take place without technological innovations. Michael Horowitz in this context talks about 'Major Military Innovations' (MMI): "major changes in the conduct of warfare, relevant to leading military organisations, designed to increase the efficiency with which capabilities are converted to power."[254] RMAs and MMIs can happen simultaneously or consecutively, but I posit that the consequences of the latter are generally less ground-breaking.

I consider my approach complementary rather than contradictory to the 'Economic Determinist School', best envisioned by Alvin and Heidi Toffler. In 1993 Toffler and Toffler argued that "a revolutionary new economy is arising based on knowledge, rather than conventional raw materials and physical labour. This remarkable change in the world economy is bringing with it a parallel revolution in the nature of warfare."[255] Significant changes in the functioning of the economy and social exchanges impact warfare, but they are not limited to the military realm. Furthermore, they are extremely rare. Toffler and Toffler identify only three such revolutions during human history – the agrarian, industrial, and now information revolution. Of course, RMAs are influenced by these civilisational changes: without the agrarian revolution, there would be no fortification and catapult, and tank warfare would have been unthinkable without the industrial revolution. But recalling the avalanche metaphor, these fundamental alterations of the functioning of

[253] Stephen Biddle, "The past as prologue: Assessing theories of future warfare," *Security Studies* 8, no. 1 (1998).
[254] Michael C Horowitz, *The Diffusion of Military Power: Causes and Consequences for International Politics* (Princeton University Press, 2010). p.22.
[255] Toffler and Toffler, *War and anti-war: survival at the dawn of the 21st century*. p.19.

societies can best be understood as the tremors that shake loose pieces of rock, thus allowing for their eventual tumble. Hence, one can divide history into areas of larger societal change, and associate specific technological changes to them, which in turn are associated to RMAs – as illustrated in Illustration III.1. below.

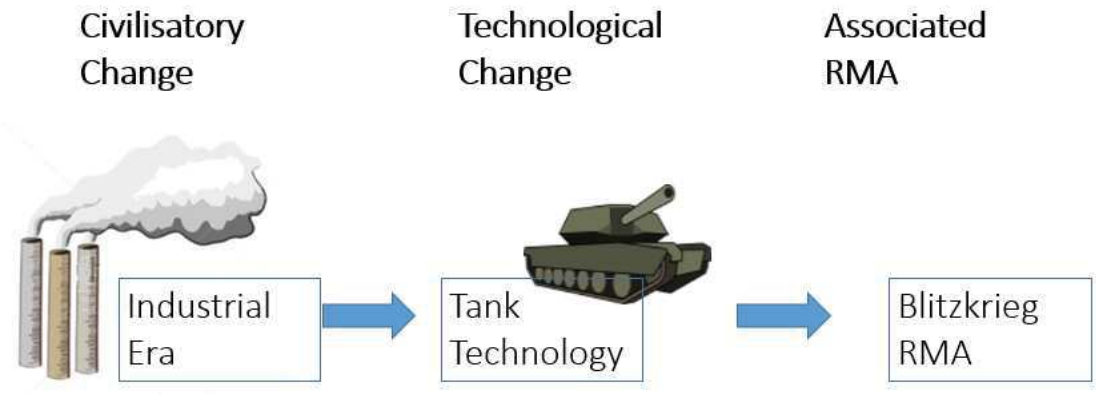

Illustration III.1. Civilisational changes and associated RMAs using the Blitzkrieg example

Knox and Murray similarly distinguish between Military Revolutions and Revolutions in Military Affairs, the former being the "earthquakes" – systemic, uncontrollable, and unpredictable changes in politics and society, of which they identify five in western history – and the latter being the associated RMAs.[256] In my view, the IT-RMA would probably better be considered a civilisational change, rather than an RMA. The invention of the computer and information technology has much more fundamental impacts than solely or primarily military ones, and it has too many constituent parts. Hence, the Unmanned Revolution (if considered an RMA) could be seen as associated RMA to the IT-RMA.

[256] MacGregor Knox and Williamson Murray, *The dynamics of military revolution, 1300-2050* (Cambridge, UK ; New York: Cambridge University Press, 2001). On this also see Ofer Fridman, "Revolutions in Military Affairs that did not occur: A framework for Analysis," *Comparative Strategy* 35, no. 5 (2016).

1.3.2. Velocity

Does an RMA need to happen within a certain timeframe to be a revolution (as opposed to an evolution that happens over a longer time)? This question has engaged researchers since the introduction of the concept.

I do not consider temporal velocity a criterion for the RMA. The idea of revolutionary change does not refer to the change's suddenness, but to the fundamentality of the change. RMAs can take decades to develop, as Geoffrey Parker shows in his study of military revolutions between 1500 and 1800.[257] In fact, the confusion about speed likely stems from the fact that some authors confound the RMA with its underlying technology, arguing that the RMA happens when the technology is introduced. But revolutionary usages of new technologies can take time to develop. In the avalanche metaphor, the rock may fall for a time without anything happening before it suddenly catches on when arriving at a certain point. This was the case for tanks which had been on the battlefield for two decades before the Blitzkrieg RMA. It also took two decades before the machine-gun was adopted on a large scale and made an impact. Technology historian David Edgerton points out that our linear understanding of technological development and technology's introduction is flawed. Most technologies develop, disappear, and then reappear; therefore, focusing on the moment of the invention rather than on the use of a technology is misleading.[258] Michael Horowitz in fact notes that those technologies which require "large scale organizational changes in recruitment, training, and war-fighting

[257] Parker, *The Military Revolution. Military innovation and the rise of the West, 1500 - 1800*. p.7.
[258] David Edgerton, *Shock of the Old: Technology and Global History Since 1900* (Profile books, 2011), p.xiii.

doctrine" – hence, the kind of changes required for an RMA – will take longer to implement.[259]

Addressing the question of velocity is also important because the swift rise in the use of drones and their fast proliferation is likely to make it seem like a transformative phenomenon independent of its actual consequences. But the decisive factor is the change it causes. Krepinevich puts this best:

> "what is revolutionary is not the speed with which the entire shift from one military regime to another occurs, but rather the recognition, over some relatively brief period, that the character of conflict has changed dramatically, requiring equally dramatic – if not radical – changes in military doctrine and organizations. Just as water changes to ice only when the falling temperature reaches 32 degrees Fahrenheit, at some critical point the cumulative effects of technological advances and military innovation will invalidate former conceptual frameworks […].[260]

Speed is furthermore not a good criterion given that the pace of change – technological, social, etc. – has continued to increase for decades. Chris Hables Gray even argues that since 1945, the world has experienced a "perpetual revolution in military affairs".[261]

1.3.3. Victory

Many authors implicitly or explicitly link RMAs to military victory. Rogers argues that an RMA "can often be recognised by the ease with which 'participating' armed forces can defeat 'non-participating' ones."[262] Shapiro speaks of "an unexpected or extremely

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[259] Horowitz, *The Diffusion of Military Power: Causes and Consequences for International Politics*. p.iv.
[260] Krepinevich, *Cavalry to computer: The pattern of military revolutions*.
[261] Chris Hables Gray, *Peace, war, and computers* (New York: Routledge, 2005). p.27.
[262] Clifford Rogers, "Military Revolutions and Revolutions in Military Affairs: A Historian's Perspective," in *Toward a Revolution in Military Affairs?*, ed. Thierry Gongora and Harald von Riekhoff (Westport: Greenwood Press, 2000). p.22.

lopsided victory" as the harbinger of a military revolution.[263] Even RMA-father Roberts implicitly links RMAs to military success.[264]

Yet, such claims pose a conceptual problem. There are many kinds of victory in a war – battlefield victory, strategic success, 'meaningful victory',[265] etc. Achieving battlefield victory is indecisive; in any war but the most lopsided ones it can be expected that both sides will achieve battlefield victories. It is easy to conceive innovative applications of new technologies and dramatic changes in military doctrine that fundamentally alter the character and conduct of military operations yet do not lead to strategic success. A 'revolutionised' military could be denied victory through no fault of its own, for instance because a counter is found, or because it is facing a considerably stronger enemy. RMA or not, friction – "countless minor incidents, the kind you can never really foresee"[266] – always lowers the general level of performance and causes unforeseen surprises. Christopher Schnaubel uses the example of the corvus (a boarding bridge that allowed the Romans to latch on to Carthaginian ships and storm aboard, developed in 261 BC) to show that an RMA does not always lead to victory:

> "The corvus was revolutionary technology that gave the Romans an advantage which they successfully exploited in a totally new domain. This RMA, however, was not by itself decisive nor did it permit Rome to ignore the other elements of warfare necessary to win

[263] Shapiro, "Information and War: is it a Revolution?."
[264] Roberts, *The military revolution, 1560-1660: an inaugural lecture delivered before the Queen's University of Belfast*. p.8.
[265] See Beatrice Heuser, "Clausewitz' Ideas of Strategy and Victory," in *Clausewitz in the Twenty-First Century*, ed. Hew Strachan and Andrea Herberg Rothe (Oxford: Oxford University Press, 2007).
[266] Michael Howard, Peter Paret, and Rosalie West, *Carl Von Clausewitz: On War* (Princeton University Press, 1984). p.119.

against Carthage. […] A tactical error, as occurred at Bagradas, could (and did) result in the loss of an entire campaign."[267]

Winning the war on the other hand hinges on many elements that are outside military control. Incidentally, Blitzkrieg, the "paradigmatic RMA",[268] would not qualify, given Nazi Germany's eventual defeat. In modern wars, which rarely end with one side's surrender, victory becomes an even more problematic criterion. Victory is also not a useful litmus test as by definition other armed forces eventually emulate RMAs.[269] Would the RMA need to lead to certain victory for all these forces, or just for the first user? I hence do not consider victory a necessary criterion for an RMA.

2. A Framework to study the Unmanned Revolution

The RMA literature is divided on many points, but there is general agreement that, while technology can provide new capabilities, further changes that allow the technology to be adopted need to take place before an RMA can happen. As Donald Rumsfeld said about the IT-RMA in 2002: "A revolution in military affairs is about more than building new high-tech weapons – although that is certainly part of it. It is also about new ways of thinking and new ways for fighting".[270] Put simply: new weapons are not enough – armed forces need to find out how to best use them and integrate them into existing structures. This means that drones in themselves cannot be an RMA – whether they are revolutionary

[267] Schnaubelt, "Whither the RMA?."
[268] Hobson, "Blitzkrieg, the Revolution in Military Affairs and Defense Intellectuals." p.627. Also see Steve Biddle who uses Blitzkrieg as the "critical case" of the RMA literature. Biddle, "The past as prologue: Assessing theories of future warfare."
[269] Frederick W. Kagan, *Finding the target : the transformation of American military policy*, 1st ed. (New York: Encounter Books, 2006). p.210.
[270] Donald H Rumsfeld, "Transforming the military," *Foreign Affairs* 81, no. 3 (2002). p.21.

depends on the changes caused by and implemented because of the technology's introduction.

This list develops the five areas that are mentioned in the RMA literature as having been transformed during RMAs. Some authors suggest RMA characteristics, but few try to conceptualise or operationalise them, and often, they are only mentioned implicitly. This list is compiled from a variety of sources. Hence there is no reason to believe that any one author would agree on the full set of characteristics, much in the same way as no author is likely to agree to Benbow's list of 27 RMAs.

2.1. Five areas of change

Marshal suggests three areas in his RMA definition: "a major change in the nature of warfare brought about by the innovative application of new technologies, which, combined with dramatic changes *in military doctrine* and *operational* and *organisational concepts,* fundamentally alters the character and conduct of military operations".[271] Dima Adamsky discusses concepts and organisation. Benbow looks at changes in "organization, concepts and doctrine that form the immediate framework within which technology is used".[272] Parker studies changes in tactics, organisation, strategy, and society.[273] Krepinevich equally adds operational innovation and organisational adaptation to technological change as RMA conditions.[274]

Based on these and other accounts, I identify five criteria for an RMA: (1) operational change, (2) doctrinal change, (3) strategic change, (4) organisational changes in the armed forces, and (5) societal change.

[271] Emphasis added.
[272] Benbow, *The Magic Bullet? Understanding the Revolution in Military Affairs*. p.9.
[273] Parker, *The Military Revolution. Military innovation and the rise of the West, 1500 - 1800*. p.2.
[274] Krepinevich, *Cavalry to computer: The pattern of military revolutions*.

2.1.1. Operational change

Operational change is arguably the most important hallmark of an RMA. No military change can be of much importance if it does not translate into changes on the battlefield. As Knox and Murray note, "[o]nly the audit of war [...] will demonstrate that an RMA has occurred".[275]

Operational change means changes in tactics, in the way military operations are conducted and how battles are fought. Examples of new tactics in past RMAs would be the salvo following the introduction of firearms and artillery,[276] the mounting of cannons onto sailing boats following the Sail and Shot revolution, or the tendency to kill rather than capture for ransom, caused by the Infantry Revolution.[277] The most-often quoted example is the "revolutionary operational doctrine of Blitzkrieg".[278] Tanks had already been introduced onto the battlefield in 1916. But it was the Wehrmacht's introduction of independent armoured divisions and their innovative use of radio which allowed the rapid breakthrough of enemy lines, with operational effects, and enabled tanks to become the basis of an RMA.

In the context of operational change, it has been suggested that a revolutionary technology should be expected to replace older systems.[279] Some technologies did indeed eclipse an existing one; the bow was replaced by muskets, sailing ships made oar-driven galleys obsolete, and were in turn replaced by metal-hulled ships. But other revolutions, such as the Fortress Revolution or the Land Warfare revolution did not replace present

[275] Knox and Murray, *The dynamics of military revolution, 1300-2050*. p.185.
[276] Roberts, *The military revolution, 1560-1660: an inaugural lecture delivered before the Queen's University of Belfast*. p.8.
[277] Krepinevich, *Cavalry to computer: The pattern of military revolutions*.
[278] Hobson, "Blitzkrieg, the Revolution in Military Affairs and Defense Intellectuals." p.626.
[279] Peter W. Singer, "Wired for War: The Future of Military Robots," *Brookings* (2009). p.304.

systems but rather added to them – the use of railroad and telegraph caused manoeuvres to speed up, but did not replace existing technologies. The atomic bomb was considered so novel that all other weapons became classified as 'conventional' – yet it did not render these weapons obsolete. Aircraft opened up a new dimension of warfare, but did not end land or naval warfare. Similar examples exist outside the military realm: it was argued that television would replace the radio, and electronic readers the book, yet all these technologies have found a place in today's world alongside each other. In fact, one-to-one substitutions of new weapons are unlikely to yield the best results. A new military technology thus needs to be assessed by the changes it has caused in a military operation.

2.1.2. Doctrinal change

Almost all authors mention doctrinal change as a crucial element of an RMA. The most famous RMA doctrine is the Blitzkrieg doctrine which allowed the Wehrmacht to take advantage of its tanks.[280] Doctrine can be understood as the "software of military power" that makes the technological hardware run smoothly.[281] It is the principles by which armed forces guide their actions in support of the objectives as defined by strategy.

Doctrinal change is directly related to operational change – it can precede it, develop alongside, or follow it. Operational changes can be introduced by military decision-makers through doctrine, that is then adopted – and possibly adapted[282] – on the battlefield (top-down adoption). Operational changes can however also be introduced from the bottom-

[280] Some authors have argued that there was no Blitzkrieg *doctrine* – Harris for instance notes that the term was never employed in German official documents. (Harris, "Debate the Myth of Blitzkrieg.") But rather than proving that there was no doctrinal change, he shows that there was no official, formulated Blitzkrieg doctrine, which reinforces my argument about looking beyond written documents as discussed in Chapter I.
[281] Magnus Petersson, Thomas Slensvik, and Palle Ydstebo, "Introduction " *Journal of Strategic Studies* 39, no. 2 (2016). p.175.
[282] As the Tofflers note "A new war-form does not spring full-blown out of anyone's manual, no matter how good". Toffler and Toffler, *War and anti-war: survival at the dawn of the 21st century*. p.103.

up: new ways to operate are devised on the battlefield, by the new technology's users. If these changes are sensible, they are expected to eventually be codified into doctrine. Hence, to fully grasp operational changes, one has to study doctrine – and to fully grasp doctrinal changes, one has to study operations. Studying operational and doctrinal changes in parallel can also tell the story of *how* changes have come about. If major operational changes can be observed but there are little or no changes in official doctrine, it can be assumed that doctrine had not yet caught up with bottom-up developments.[283] If doctrinal changes have been introduced but little has changed on the battlefield, this means that these doctrines have yet to be implemented.

Furthermore, doctrinal writing also testifies as to how a new technology is planned to be used in future conflicts. The integration of UAVs in official doctrine indicates plans about future investment and procurement, and so allows predictions to be made about future use. In 1989, Ian Curtis deplored the fact that the history of remotely piloted vehicles was cyclic and interest in them fleeting. Moments of crisis provoked intensive research, but as soon as they ended, funds gradually dried up – because "there [was] no real place for [the technology] in the user's established doctrine".[284]

Critics may argue that studying current doctrine for an ongoing RMA is misguided as doctrine is focused on fighting the last war, and hence by definition outdated.[285] Yet, it is the declared aim of armed forces to integrate lessons learned "into joint doctrine, organization, training, materiel, leadership and education, people, and facilities".[286] Given that the military conflicts studied in this thesis have been going on for more than a decade

[283] Or it could mean that doctrinal decision-makers oppose the operational changes.
[284] Ian Curtis, "Flying in the Sun: RPVs Are In Vogue Again," *Defense & Foreign Affairs* (1989).
[285] Paul Yingling, "A failure in generalship," *Armed Forces Journal* 43 (2007).
[286] "Joint Lessons Learned Program," ed. Chairman of the Joint Chiefs of Staff (2000). p.B-1. Also see Raphael S. Cohen, "A Tale of two Manuals," *Prism* 2, no. 1 (2010).

and that drones have been part of them for almost the same time, it can be expected that some lessons learned have already been integrated into doctrinal thinking.

As discussed in chapter I, studying doctrinal change goes beyond studying doctrinal documents. Doctrinal changes have been observed in all past RMAs, but the written military doctrine is a comparatively recent phenomenon that emerged at the beginning of the 20th century.[287]

2.1.3. Strategic change

Strategy is one level above doctrine and prescribes how to best use military force in order to achieve the aims defined by political decision makers: it is "the art of distributing and applying military means to fulfil the ends of policy".[288]

The prime example of an RMA that caused strategic change is nuclear weapons. The advent of the atomic bomb caused a significant change in strategic thinking, culminating in the formulation of deterrence theory and the emphasis on second-strike capability. Strategic logic changed under the impression of the attacks on Hiroshima and Nagasaki, as Bernard Brodie pointed out shortly after: "Thus far the chief purpose of our military establishment has been to win wars. From now on its chief purpose must be to avert them. It can have almost no other purpose".[289] The stockpiling of costly weapons whose purpose was to never be used became sensible policy. Even American foreign policy more broadly was shaped by concerns about nuclear proliferation.[290]

[287] Van Creveld, *The Age of Airpower*. p.236.
[288]Definition by Liddell Hart. Basil Liddell Hart, *Strategy* (London: Faber & Faber, 1967).
[289] Quoted in Andrew L Ross, "The Role of Nuclear Weapons in International Politics: A Strategic Perspective," *Foreign Policy Research Institute* (2009).
[290] Black, "The Revolution in Military Affairs: The Historian's Perspective." p.101.

2.1.4. Organisational change

Fourth, the literature suggests that to allow the best use of a new technology and for best practices to be developed, armed forces must integrate new technologies into their organisation, and adapt it accordingly. Michael Roberts notes that the introduction of new weapons in the 17th century required a new style of warfare that "made demands upon the administration which could be met only by new methods, new standards, and new officers".[291] This means for instance the creation of new institutions, new training regimes, and the integration of the technology's users into the military hierarchy.

A prime example for such changes during past RMAs is the creation of Air Forces following the introduction of the aircraft, and the creation of a new set of service elites, the Air Force pilots. New organisations were also created for nuclear weapons (such as the Strategic Air Command), including civilian structures such as the Atomic Energy Commission and the National Nuclear Security Administration. 'Cyber' – the other technological development that is being discussed as a contemporary RMA contender[292] – is already leaving its mark in this regard, with Denmark and Germany founding cyber commands and the US military designating cyber as the fifth domain of warfare among like air, sea, space, and land.

Why, when, and how military organisations change have been the focus of much research. The literature distinguishes between inside-out explanations, that look at changes from

[291] Roberts, *The military revolution, 1560-1660: an inaugural lecture delivered before the Queen's University of Belfast*. p.21.
[292] See for instance Kello, "The meaning of the Cyber Revolution: perils to theory and statecraft."

within, or outside-in approaches that see changes as reactions to exogenous events such as wars – or technological changes.[293]

But the organisational change of armed forces is difficult, the "Achilles heel" of transforming the military.[294] Armed forces' organisational inertia is a design feature rather than a flaw: military institutions are designed to maximise consistency and foster continuity. This is reinforced by attraction of military organisations for conformist and stability-seeking personality-types, who are likely to show "an implacable resistance to the 'uncertainties' of innovation, novelty and new scientific aids to warfare".[295] Accordingly, once an organisational change has happened, it can be expected to have long-lasting impacts. For instance, the US Air Force was dominated for over 30 years by the 'bomber mafia' – former bomber pilots turned decision-makers who emphasised bombers in the Air Force. In 1982, the first fighter pilot became Air Force chief of staff – and for 26 years, power rested in fighter pilots' hands, and a fighter spending spree began.[296]

2.1.5. Social and Societal change

Social and societal change is the most ambiguous and, probably for that reason, least conceptualised element of the RMA. Societal change refers to the impact that the introduction of the new military technology and the new ways of conducting war has had on society and social realities such as norms.

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[293] Adam Stulberg and Michael Salomone, *Managing defense transformation: agency, culture and service change* (Burlington: Ashgate, 2007).
[294] Ibid. p.4/5.
[295] Psychologist Norman Dixon quoted in John Stone, "The British Army and the Tank," in *The Sources of Military Change: Culture, Politics, Technology*, ed. Theo Farrell and Terry Terriff (London: Lynne Rienner, 2002). p.188.
[296] Lawrence Spinetta and Mary Cummings, "Unloved Aerial Vehicles," *Armed Forces Journal*, no. November (2012). p.32.

The societal impact of military technology has been in effect from the very beginning of warfare, as Ronald Haycock shows: the very first military tools such as clubs and spears could be used by everyone. But this changed "when machines became complex and expensive and required specially skilled craftsmen to make them. Technology then began to act upon society, giving some groups access to superior machines of war and denying it to others".[297] Technology thus created a warrior class. Acting in the opposite sense, technology democratised warfare during the transition from the Middle Ages to the Modern Era, as Michael Roberts observed: "In the Middle Ages war had been almost the privilege of a class; by the seventeenth century it had become almost the livelihood of the masses. Men flocked to the swollen mercenary armies […] because the new warfare offered fresh prospects of a career [and] the new armies served as the social escalators of the age".[298] Equally, the introduction of new munitions against which expensive heavy armour could no longer protect, had social implications: it obliterated the old distinction between cavalry and foot, and hence gentlemen and others.[299]

One widely-accepted RMA has predominantly societal changes at its heart: the French Revolution. The *levée en masse,* the forced mass military conscription following the French Revolution, was a fundamental change to the professional military France had had until this point and the main factor in France's initial victories during the Napoleonic wars. The *levée* played a crucial role in the formation of the French identity, creating the ideal of the nation in arms.

[297] Ronald Haycock and Keith Neilson, *Men, Machines & War* (Wilfrid Laurier Univ. Press, 1988). p.4.
[298] Roberts, *The military revolution, 1560-1660: an inaugural lecture delivered before the Queen's University of Belfast*. p.24.
[299] Ibid. p.24.

One element of the potential social change a revolutionary technology can have is understudied in the RMA literature: the individual soldier's experience of warfare. Roberts touched upon it when he claimed that the introduction of the cavalry pistol made the cavalry become "very generally perverted and degenerate."[300] In the context of the IT-RMA, Jean Baudrillard famously declared in 1991 that "the Gulf War did not take place", because the war's heavily mediated nature meant that the soldiers sitting in front of computer screens or looking through night-vision goggles did not actually experience the reality of the battlefield.[301] Still, rare are the RMA studies that emphasise the effect on the individual behaviour and war experience of soldiers – even though this is a recurring topic of study within the wider military and strategic studies literature.[302] As John Keegan notes "allowing the combatants to speak for themselves, is not merely a permissible but, when and where possible, an essential ingredient of battle narrative and battle analysis".[303] He notes one of the reasons why this element is largely understudied; "The almost universal illiteracy, however, of the common soldier of any century before the nineteenth makes it a technique difficult to employ." As this has changed, today's researchers have a unique opportunity to take advantage of soldiers' accounts.

2.1.6. Mutual dependency of the RMA criteria

While the distinction between these criteria is conceptually helpful, it cannot be absolute. Already in the above, some overlap can be detected. As an example, the creation of new military-civilian institutions to control nuclear weapons could be labelled both an

[300] Ibid. p.6.
[301] Jean Baudrillard, "The Gulf War Did Not Take Place," (Bloomington: Indiana University Press, 1991).
[302] One of the best-known works is John Keegan's, who studies in detail how different historic battles were experienced by the combatants Keegan, *The face of battle: a study of Agincourt, Waterloo and the Somme*. Also see Anthony Kellett, *Combat motivation: The behaviour of soldiers in battle* (Springer Science & Business Media, 2013).
[303] Keegan, *The face of battle: a study of Agincourt, Waterloo and the Somme*. p.32.

organisational and social change.[304] Doctrinal and strategic changes are notoriously difficult to separate.[305] Furthermore, there is a chicken-and-egg problem with technology: does technology come first, causing all these changes, or do doctrinal changes cause the technology to be developed?

Moreover, some of the changes are second-order, rather than first-order effects: instead of being caused by the technology's introduction, they are the consequences *of changes caused by the introduction of the new technology*, thus once removed from the technology. For instance, Michael Roberts describes how new technologies allowed armies to grow, requiring more structure and discipline (organisational change). This in turn meant that the individual soldier had to follow stricter orders which impacted on how he experienced combat (societal change).[306]

The five criteria provide a useful guide to studying potentially revolutionary developments. But looking at past RMAs suggests that change is not required in all areas. For example, the nuclear RMA had a decisive impact on military strategy. Yet, as nuclear weapons have not been used in combat since Hiroshima and Nagasaki, one can question the operational change the nuclear revolution has caused. Tanks, on the other hand, changed operations, enabling the Blitzkrieg RMA, yet caused few societal changes. Even more revealing, one would easily imagine examples of technological advances that caused some changes in all five areas – but there is no reason to believe these changes would necessarily amount to an RMA if none of these changes were fundamental.

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[304] On this see Peter D Feaver, *Guarding the guardians: Civilian control of nuclear weapons in the United States* (Cornell University Press, 1992).

[305] Doctrinal and strategic changes will be studied together in the case studies.

[306] Roberts, *The military revolution, 1560-1660: an inaugural lecture delivered before the Queen's University of Belfast*. p.22.

2.2. The overlooked element

2.2.1. Labelling an RMA

Despite the efforts to tease out empirical, quantifiable characteristics and criteria for an RMA, a subjective element remains: "change is a phenomenon based on perception and personal position, therefore it defies neat categorisation", Brian Steed noted.[307] For the RMA this means the introduction of a circular logic: namely, it is *through the labelling as an RMA that an RMA becomes one*. After all, Benbow's 27 RMAs are little more than a list of events or technological changes that scholars feel merit the RMA title. A military change, even a revolutionary one, to which no one pays attention will not be seen as an RMA. Unlike the proverbial tree in the forest that still falls even if no one is around to witness it, an RMA that no one notices, is no RMA. The military change of course is still real – but the RMA is dependent on someone designating the change as an RMA. This also explains why even the most comprehensive RMA collections rarely list more than one or two non-Western RMAs; as the RMA is a western concept and most research is done by western scholars.[308]

This circular logic is not unique to RMAs. There is a similar debate between the schools of thought on statehood. Whereas the declaratory school argues that a state is a state if and when it meets three factual criteria (population, effective public authority, and defined

[307]Brian Steed, "Piercing the Fog of War," (Minneapolis: Zenith Press, 2009). p.23

[308] Exception to this rule include Tonio Andrade, Hyeok Hweon Kang, and Kirsten Cooper, "A Korean Military Revolution?: Parallel Military Innovations in East Asia and Europe," *Journal of World History* 25, no. 1 (2014). Matthew Stavros, "Military Revolution in Early Modern Japan," *Japanese Studies* 33, no. 3 (2013).

territory), the constitutive school contends that a state only becomes a state *by virtue of recognition* by the governments of other states.[309]

For ongoing change – such as the Unmanned Revolution – the impact of labelling a technology as revolutionary is even more significant. An RMA needs to be encouraged, nurtured, and promoted.[310] Jeremy Black notes: "[t]he RMA can be seen as a discourse designed to win the argument – both within and outside the military – for investment in a particular doctrine and force structure".[311] Claiming a revolutionary development helps to make an argument for change. In hindsight, analysts are tempted to make it seem as if a wave of technological change just washed over the nation, causing an RMA. The point of view of a contemporary is different, Shapiro notes: "the historian's [revolution] happens [but] the strategist's revolution is made".[312]

This can be observed with regard to the IT-RMA, the first RMA with live commentary. As the RMA concept was developed while the IT-RMA's changes took place, the military change of the time was seen through RMA lenses. The IT-RMA was predicted and observed, rather than analysed in hindsight, as authors working on the IT-RMA were contemporaries. In fact, a good part of the IT-RMA literature was a call to (further) action. Bill Owens's influential book for instance could double as an IT-RMA pamphlet: "I believe the computer revolution, *if correctly applied*, presents us with a unique opportunity to lift the 'fog or war' and transform the US military".[313] At this time, the IT-RMA was "essentially a speculation in futuristic possibilities which did not yet have a public budget line

[309] Stefan Talmon, "The Constitutive versus the Declaratory Doctrine of Recognition: Tertium Non Datur?," *BYIL* 75 (2004).
[310] Knox and Murray, *The dynamics of military revolution, 1300-2050*.p.185.
[311] Black, "The Revolution in Military Affairs: The Historian's Perspective." p.102.
[312] Shapiro, "Information and War: is it a Revolution?." p.137.
[313] Owens, *Lifting the fog of war*. back cover. Emphasis added.

attached".[314] Still, few of the authors questioned their own role in bringing the RMA about, as Shapiro observed: "The currently proposed information-based revolution in military affairs has been the most self-conscious military revolution in history, yet most commentators have largely passed over the question of whether they see themselves as creating a strategist's revolution or predicting an historian's."[315] These questions are crucially important for the study of the Unmanned Revolution, the second alleged RMA to be studied in real time – while being heralded as an RMA by some.

2.2.2. Who does the labelling?

If the labelling of a technology as revolutionary plays such an important role, the crucial question is: who does the labelling? For past RMAs which are labelled in hindsight, military historians take on that role. But for ongoing changes the process is less obvious.

The RMA literature recognises that military and government elites play a role in how revolutionary changes come about. As the political realm has control over the defence budget, political leaders are well placed to influence national strategy, military doctrine, and the various implementation processes by which the armed forces are trained, organised, and equipped.[316] In this regard, single individuals can play a decisive role by enabling or hindering change. Several politicians have played this role for the IT-RMA;

[314] Edward F Halpin et al., *Cyberwar, netwar and the revolution in military affairs* (Palgrave Macmillan, 2006). p.3.
[315] Shapiro, "Information and War: is it a Revolution?."p.138.
[316] Peter J Dombrowski and Eugene Gholz, *Buying military transformation: Technological innovation and the defense industry* (Columbia University Press, 2006). p.7.

Andrew Marshall was an important actor, as were Secretaries of Defense Cheney and Rumsfeld.[317]

However, by focusing exclusively on the elite decision-makers, the RMA literature generally neglects the role of the public. The people, if they appear in the RMA literature at all, are usually placed on the receiving end of an RMA, as the discussion of the social impact above shows.

This approach may have been influenced by the controversial status public opinion has in the scientific literature.[318] The main criticism is that the public is not one defined group, and public opinion varies. But the verdict on this is still out as other authors consider public opinion to be sufficiently stable and reliable on matters such as foreign policies and international relations.[319] George Gallup, founder of the now famous Gallup Polls, noted that particularly in military matters the people may have a rather good grasp of relevant issues, including military technology: "All during the period of the 1930's military experts themselves were disagreed as to the importance of air power in modern warfare; but the people, who were not military experts, saw with a kind of common, salty, judgment the part that air power would play in the next war."[320]

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[317] See Stephen Rosen, "The Impact of the Office of Net Assessment on the American Militarz in the Matter of the Revolution in Military Affairs," *Journal of Strategic Studies* 33, no. 4 (2010). Also see DeVore, "A dangerous utopia: The military revolution from the Cold War to the War on Terror." p.222.

[318] Malešič, Kümmel, and Bonneau, *Security and the Military between Reality and Perception*. p.43.

[319] A 2013 study on the nuclear taboo for instance shows that the public view of nuclear weapons depends on the circumstances. (See Daryl Press, Scott Sagan, and Benjamin Valentino, "Atomic aversion: Experimental evidence on taboos, traditions, and the non-use of nuclear weapons," *American Political Science Review* 107, no. 01 (2013).) Gelpi, Feaver and Reifler show that despite a widespread belief about the US public's casualty aversion, the public will in fact tolerate significant numbers of combat casualties if it believes that wars are fought for the right reasons and have a reasonable likelihood of success. Christopher Gelpi, Peter Feaver, and Jason Reifler, "Success matters: Casualty sensitivity and the war in Iraq," *International Security* 30, no. 3 (2006). Also see Benjamin Page and Robert Shapiro, "The rational public: Fifty years of trends in Americans' policy preferences," (Chicago: University of Chicago Press, 1992).

[320] George Gallup, "How Important is public opinion in time of war?," *Proceedings of the American Philosophical Society* 85, no. 5 (1942). p.441.

I believe that when studying a revolutionary change, public opinion is important, also because it influences elites' views. Particularly in the 21st century, it is important to soften the dichotomy between the elite and the public – an assessment inspired by Carl von Clausewitz.[321]

The wondrous trinity (*'wunderliche Dreifaltigkeit')* is one of the best-known and controversial[322] tenets in Clausewitz's *Vom Kriege*:

> "Der Krieg ist [...], in Beziehung auf die in ihm herrschenden Tendenzen eine wunderliche Dreifaltigkeit, zusammengesetzt aus der ursprünglichen Gewaltsamkeit seines Elementes, dem Haß und der Feindschaft, die wie ein *blinder Naturtrieb* anzusehen sind, aus dem Spiel der Wahrscheinlichkeiten und des Zufalls, die ihn zu einer *freien Seelentätigkeit* machen, und aus der untergeordneten Natur eines politischen Werkzeuges, wodurch er *dem bloßen Verstande* anheimfällt."[323]

How to translate this passage into English has been subject to intense debate,[324] with the most widely-used translations differing in their interpretations. I prefer John Graham's 1873 translation of the trinity's first element:

> "the original violence of its elements, hatred and animosity, which may be looked upon as blind instinct"

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[321] I situate myself firmly in the "inspirationist" school of Clausewitz readers, as defined by Christopher Bassford: "primarily present-minded political scientists, students of strategic affairs, and business theorists, who are interested in freely adapting Clausewitzian concepts exclusively to current issues. Christopher Bassford, "The Primacy of Policy and The Trinity in Clausewitz's Mature Thought," in *Clausewitz in the Twenty-First Century*, ed. Hew Strachan and Andreas Herberg-Rothe (Oxford University Press, 2007).p.75/76.

[322] British military strategist Basil Liddell Hart accused Clausewitz of advocating unlimited warfare through the trinity, and being responsible for the carnage of WWI. More recently, John Keegan similarly argued that Clausewitz advocated unconstrained warfare. Bart Schuurman, "Clausewitz and the" New Wars" scholars," *Parameters* 40, no. 1 (2010). p.92.

[323] Carl von Clausewitz, *Vom Kriege* (1832). book1, chapter1.

[324] On this see Jan Willem Honig, "Clausewitz on War: Problems of Text and Translation," in *Clausewitz in the twenty-first century*, ed. Hew Strachan and Andreas Herberg-Rothe (Oxford: Oxford University Press, 2007).

combined with the more widely used 1984 Howard/Paret translation of the trinity's second and third elements:

> "the play of chance and probability within which the creative spirit is free to roam and of its element of subordination, as an instrument of policy, which makes it subject to reason alone".

Clausewitz associated the trinity's three elements respectively with the people, the military commander and his army, and the government. Clausewitz's trinity thus consists of two associated trinities; the *primary trinity* of 'Passion, Chance, Policy/Politics',[325] and the *secondary trinity* of 'the People, Military, Government'.

The primary trinity's first element is crucial here, as it refers to the human element: "the original violence of its elements, hatred and animosity, which may be looked upon as blind instinct". Howard and Paret translate this into "primordial violence, hatred, and enmity, which are to be regarded as a blind natural force".[326] But Bassford convincingly argues that "Clausewitz is not talking primarily about physical violence, but about violent emotion as a motive force".[327] I believe it was Clausewitz's intent to emphasise the human element in warfare, *das Menschliche*, how people feel and think about it, their emotions, beliefs, and perceptions. And I believe that Clausewitz never meant to associate this element of the primary trinity solely with the people. When associating the primary trinity's element with the secondary Clausewitz writes

[325] As translated by Thomas Waldman, "War, Clausewitz, and the Trinity" (University of Warwick 2009).
[326] Andreas Herberg-Rothe also emphasises the element of violence. See Andreas Herberg-Rothe, "Die wunderliche Dreifaltigkeit-Clausewitz'allgemeine Theorie des gewaltsamen Konflikts," *Osterreichische Militarische Zeitschrift* 46, no. 2 (2008). p.164.
[327] Christopher Bassford, "Tip-Toe Through the Trinity, the Strange Persistence of Trinitarian Warfare," ed. Clausewitz.com (Working Paper, 2006).

„Die erste dieser drei Seiten ist mehr dem Volke, die zweite mehr dem Feldherrn und seinem Heer, die dritte mehr der Regierung zugewendet."

The choice of words is crucial here: the first element is *more* turned towards the people, the second *more* towards the military, and the third *more* towards the government. Howard and Paret translate 'more' into 'mainly', which, I believe, does not fully capture Clausewitz's intention. As Bassford notes, "by substituting "mainly" for *mehr* […] Howard and Paret lock each of the elements of the actual trinity far too firmly and exclusively to each of these sets of human beings – violent emotion to the people, chance and probability to the commander and his army, and rational calculation to the government."[328] But this association is not exclusive – passion is not solely attributed to the people, in the same way that reason is not exclusively the government's. Actors within the military and political realm are equally influenced by emotions and perceptions.

This means that perceptions – how a technology is seen – are crucial and both the elites' and the public's views play a role. This is even more relevant in the 21st century where public opinion and elite views are in constant interaction, with the media playing the role of intermediary, and where the distinction between decision makers and the public is much less absolute: it is generally accepted that the elites are still 'members' of the people even when representing a military or political organisation. This is most clearly spelled out in the Bundeswehr's 'citizen in uniform' concept: "soldier and non-soldier are two aggregate states of the same citizen".[329]

[328] Ibid.

[329] Wolf von Baudissin, *Soldat für den Frieden: Entwürfe für eine zeitgemäße Bundeswehr* (S. Piper, 1969).

Hence, to study an ongoing RMA, it is crucial to also take into consideration the public's and decision-makers' view of the new technology, and in particular whether they consider the technology revolutionary.

3. What does the drone literature predict?

As shown in chapter II, the drone literature predominantly focuses on armed drones whose pilots are stationed far away from the battlefield. Accordingly, when looking at the consequences of the introduction of drones, they mainly pertain to these systems. Furthermore, many of the changes discussed relate specifically to the US.

3.1. Operational change

Writers who focus on drone-only operations such as the US Pakistan operations tend to argue that everything has changed with drones. The argument is that drones have removed humans from the battlefield, making zero-casualty and riskless wars possible.[330] Dowd writes "Because UCAVs remove humans from the battlespace, they remove the unique characteristics humans bring to the battlespace: deliberation, doubt, fear, gut instinct, and judgment."[331] Chamayou argues that drones have reduced warfare into a hunt, with the soldier turned into a hunter and the victim into prey.[332] Some advocate the replacement theory as outlined above. Michael O'Hanlon for instance argues that "the era

[330] Dowd, "Drone Wars: Risks and Warnings." p.13. Anders Henriksen and Jens Ringsmose, "Drone Warfare and Morality in Riskless War," *Global Affairs* 1, no. 3 (2015).
[331] Dowd, "Drone Wars: Risks and Warnings."p.11
[332] Chamayou, *Théorie du drone*. p.52.

of manned airplanes should be seen as over",[333] and the media likes to speculate about the last manned fighter.[334]

On the other hand, because remote-split operations are almost the only operations looked at, many writers neglect the operational theatre. There are very few theories as to how the advent of drones – all types of drones – has changed operational reality. The few contributions that do so are, tellingly, by non-US authors. RAF Air Chief Marshal Sir Brian Burridge, who was in charge of British forces during the 2003 invasion of Iraq, noted that drones have improved the "granularity of the Intelligence, Surveillance and Reconnaissance".[335] A Luftwaffe officer writes "more than anything else, drones change decision-makers' perception […] drones sharpen the view and improve battlespace awareness".[336] Burridge furthermore notes that because of drones' ability to loiter over a target, they can use small diameter, low payload bombs, which are particularly helpful in urban warfare.[337] A further operational consideration is the psychological impact of drones which can be used to induce vulnerability in the enemy's mind.[338]

3.2. Doctrinal and strategic change[339]

Doctrinal changes caused by the introduction of drones are an understudied field. While several studies have titles such as "the drone doctrine", these publications exclusively

[333] Quoted in Megan Braun, "Predator Effect," in *Drone Wars*, ed. Peter Bergen and Daniel Rothenberg (New York: Cambridge University Press, 2014). p.253.
[334] "The last manned fighter," *Economist*, 16 July 2011.
[335] Brian Burridge, "UAVs and the Dawn of Post-Modern Warfare: A Perspective on Recent Operations," *RUSI Journal* 148, no. 5 (2003).p.20. Horowitz, Kreps and Fuhrman also note the operational advantages stemming from sustained persistence over potential targets that drones deliver. Horowitz, Kreps, and Fuhrmann, "Separating Fact from Fiction in the Debate over Drone Proliferation." p.16.
[336] Ralph Thiele, "Veränderung in Sicht? Zur Bedeutung von Drohnen für die deutsche Aussen- und Sicherheitspolitik," *Zeitschrift für Aussen- und Sicherheitspolitik* 4, no. 2 (2011).p.184. Own translation.
[337] Burridge, "UAVs and the Dawn of Post-Modern Warfare: A Perspective on Recent Operations."p.19.
[338] Ibid.p.20.
[339] While the difference between doctrinal and strategic changes work in theory, in practice it is impossible to keep them apart. I will therefore discuss them together, here as well as in the case studies.

focus on drone strategy rather than military doctrine and how it has been affected by drones. Scholars have largely neglected armed forces' publications on drone doctrine.

Many writers state that the introduction of drones has caused new strategies to be devised, although few go into detail. Many argue that the options offered by UAVs are or will make states use them in a certain way – namely for targeted killings.[340] Kindervater argues that drones have caused the processes of intelligence surveillance, reconnaissance, and targeted killing to collapse into each other, culminating in a "strategy of lethal surveillance".[341] Anti-drone activists in this context worry about a "slippery slope" that leads armed drone users inevitably to their use for extrajudicial killings outside official battlespaces. Metin Gurcan goes furthest in this argument, arguing that the advent of (armed) drones has turned the logic of military strategy around, as UAVs have begun to determine (US) strategy.[342] Namely, drones lead to short-term, immediate fixes, such as targeted killings of terrorists, at the expense of long-term strategic consequences.

Secondly, there is a widespread concern that drones lower the threshold for the use of force, meaning that drones equal more wars. As drones (in this logic) do not put soldiers in harm's way and the systems themselves are expendable, "more willing to lose is more willing to use," as Daniel Haulman notes.[343] Drones are seductive: "The temptation to gain all the benefits of kinetic military operations with none of the costs, consequences, or risks may be too strong for the Executive branch to resist. Even if the Executive's

[340] Hugh Gusterson, *Drone: Remote Control Warfare* (MIT Press, 2016). O'Connell, "Seductive drones: Learning from a decade of lethal operations."
[341] Kindervater, "The emergence of lethal surveillance: Watching and killing in the history of drone technology."
[342] Although he notes that his may change with further drone proliferation. Gurcan, "Drone warfare and contemporary strategy making: Does the tail wag the dog?."
[343] Daniel L. Haulman, "U.S. Unmanned Aerial Vehicles in Combat, 1991 - 2003," *Defense Technical Information Center* (2003).

inclination toward war is not new […] the prospect of risk-free war afforded by pilotless planes is".[344] The US operations in Pakistan, Somalia or Yemen would not have happened (to the same extent or at all) without the availability of drones, these authors argue, cautioning that the proliferation of drones could mean a rise in the global number of wars and conflicts.[345] Some welcome this phenomenon as it may also lead to more humanitarian interventions.[346]

Geographers like Derek Gregory see drones at the basis of the US's "everywhere war": borders lose their significance as the US expands its War on Terror over more and more countries, grouping countries together, such as Afghanistan and Pakistan into 'AfPak'.[347] Related to this is the notion that drones are creating an "endless war".[348] In addition to making going to war easier, drones also may make it easier to keep wars going. Paul Miller, a former National Security Council official, publicly wonders "When, and under what conditions, will the U.S. government stop using drones to bomb suspected terrorists around the world?"[349]

3.3. Organisational change

The literature on the organisational changes caused by the introduction of drones consists of two strands. The first predicts the end of the pilot. This is a literature with a long history; already in 1982, Noel Falconer noted that "today, and even more tomorrow, it is the pilot who must justify his position in a vehicle, not the UMV [Unmanned Vehicle]

[344] Dowd, "Drone Wars: Risks and Warnings."p.11.
[345] Zenko and Kreps, "Limiting armed drone proliferation." p.9.
[346] Zack Beauchamp and Julian Savulescu, "Robot Guardians: Teleoperated Combat Vehicles in Humanitarian Military Intervention," in *Killing by Remote Control. The Ethics of an Unmanned Military*, ed. Bradley Jay Strawser (Oxford: Oxford University Press 2013).
[347] Derek Gregory, "The everywhere war," *The Geographical Journal* 177, no. 3 (2011).
[348] Marge van Cleef, "Drones and Endless War," *Peace and Freedom* 73, no. 1 (2013).
[349] Paul Miller, "When Will the US drone war end," *Washington Post*, 17 November 2011.

advocate who must establish a case for these techniques".[350] Dowd argued three decades later that "the emergence of an unmanned Air Force is not far away".[351]

The second strand looks at the role of drones in the militarisation of the CIA and the development of Joint Special Operations Command (JSOC).[352] As this literature is exclusively US focused, it will be discussed in the US case study.

3.4. Social and societal change

There are two strands of thinking on social and societal changes caused by the introduction of drones in the drone literature. The first strand is concerned with drone use's impact on democratic processes. Because drone warfare allegedly only causes casualties for the opponent while one's own soldiers are put out of harm's way, these authors argue that the public is largely uninterested in drone operations. "When a robot dies, you don't have to write a letter to its mother," is an often-quoted statement. Michael Ignatieff wondered already in 2000, "[i]f war becomes unreal to the citizens of modern democracies, will they care enough to restrain and control the violence exercised in their name […] if they and their sons and daughters are spared the hazards of combat?"[353] This public disinterest gradually undermines democratic checks-and-balances and may make it too easy for policy-makers to start remote-controlled wars. Drones "decrease and render less visible the costs of war", John Kaag and Sarah Kreps agree. Without apparent costs, "what mechanisms hold leaders accountable?"[354] Dowd puts this best: "[it] is a good thing for the airmen kept away from harm; however, it may be a bad

[350] Noel Falconer, "Why an RPV," *RUSI Journal* 127, no. 2 (1982). p.66/67.
[351] Dowd, "Drone Wars: Risks and Warnings."p.10.
[352] See for example Fuller, "The Eagle Comes Home to Roost: The Historical Origins of the CIA's Lethal Drone Program." Mazzetti, *The Way of the Knife*. Shah, "A Move Within the Shadows."
[353] Michael Ignatieff, *Virtual war: Kosovo and beyond* (Macmillan, 2001). p.4.
[354] John Kaag and Sarah Kreps, *Drone Warfare* (Cambridge: Polity, 2014).

thing for our republic. […] [H]aving humans in the battlespace can help the commander-in-chief make better judgments about when, where, and whether to wage war. The temptation to gain all the benefits of kinetic military operations with none of the costs, consequences, or risks may be too strong for the Executive branch to resist."[355] Niklas Schörnig and Frank Sauer even argue that because of this, democratic countries are particularly interested in drones, and more likely to procure them.[356]

Second, the drone literature focuses on soldiers. Singer argues that it is the change of actor that makes the Unmanned Revolution stand out, because: "all the past RMAs in history were about changing how wars were fought […]. By contrast, the introduction of unmanned systems to the battlefield doesn't change simply how we fight, but for the first time […] transforms the very agent of war."[357] Christopher Coker equally believes that eventually soldiers will be obsolete. Robotic warfare, Coker argues, will be the end of the warrior: "In the future, our combatants will be technicians divorced emotionally and psychologically from the battlefields. War will continue to be fought, but they will be fought without warriors."[358] Coker speaks of the "warrior-technician".[359] The terms "tele-spectator soldier", "cubicle warrior", and "desk jockey warrior" have equally been used and many – including UN special rapporteur Alston – worry about drone pilots' "PlayStation mentality".[360]

[355] Dowd, "Drone Wars: Risks and Warnings." p.11.
[356] Sauer and Schörnig, "Killer drones: The 'silver bullet' of democratic warfare?."
[357] Singer, *Wired for War. The Robotics Revolution and Conflict in the 21st Century*. p.194.
[358] Christopher Coker, "Waging war without warriors," *The changing culture of military conflict* (2002). p.172.
[359] Ibid. p.174.
[360] Cole, Dobbing, and Hailwood, "Convenient Killing, Armed Drones and the 'Playstation' Mentality." Alston, "Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Philip Alston. Study of targeted killings." p.25.

Robert Sparrow suggests that "the development and deployment of remotely operated weapon systems constitute a serious threat to current notions of martial virtue".[361] For a while, this 'end of the courageous warrior class' narrative was dominant. More recently, this view has been moderated. Jesse Kirkpatrick for instance concludes that "such arguments are predicated upon improperly truncated definitions of risk and a narrow conceptualization of courage".[362] Peter Lee who has interviewed RAF Reaper crews for a rare non-US study notes that "Most of the personal aircrew characteristics [...] – skill, duty, courage, perseverance, self-sacrifice – are still relevant, albeit in modified form."[363] He emphasises that the "consistently negative tone applied to remotely piloted aircraft systems and those who operate them" has implications for how the UAV capability is viewed by other branches of the armed forces and by the crew themselves.[364] One of the reasons the view is changing has to do with a growing number of studies pointing to the high psychological consequences of piloting drones, such as burnout, stress, and post-traumatic stress disorder.[365]

A final element of the societal impact of drones which goes beyond the scope of this thesis is the impact of drones on the other side of the conflict, the victims on which drones are used. Chamayou for instance argues that drones deprive the enemy of its opponent;[366] Jamie Allinson argues that drones draw a dividing line between 'worthy lives'

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[361] Robert Sparrow, "War without Virtue?," in *Killing by Remote Control*, ed. Bradley Jay Strawser (Oxford: Oxford University Press, 2013). p.102. Also see Christian Enemark, *Armed drones and the ethics of war: military virtue in a post-heroic age* (Routledge, 2013).

[362] Jesse Kirkpatrick, "Drones and the Martial Virtue Courage," *Journal of Military Ethics* 14, no. 3-4 (2015).p.213.

[363] Peter Lee, "Remoteness, risk and aircrew ethos," *Air Power Review* 15, no. 1 (2012). p.16/17.

[364] Ibid. p.12.

[365] Chappelle et al., "An analysis of post-traumatic stress symptoms in United States Air Force drone operators."

[366] Chamayou, *Théorie du drone*. p.93.

and a subjugated population unworthy of life, destined to death.[367] André Barrinha and Sarah da Mota argue similarly, that drones further implement the distinction between the 'insured' in the Global North and the 'non-insured' in the Global South.[368] A controversial study by Stanford and NYU Law School also looked at the impact of the US drone operations on the civilian population in Pakistan, from mental health to changes in cultural and religious practices.[369]

As a first observation, it can be noted that the two elements considered most important in the RMA literature, namely operational and doctrinal change, are those that are least prominent in the drone literature, while the strategic and societal aspects are emphasised. Organisationally, the focus of the literature is exclusively on the US case which, because of the use of drones by the intelligence service, is an outlier.

[367] Jamie Allinson, "The Necropolitics of Drones," *International Political Sociology* 9, no. 2 (2015).
[368] André Barrinha and Sarah da Mota, "Drones and the Uninsurable Security Subjects," *Third World Quarterly* 38, no. 2 (2017).
[369] "Living under drones. Death, Injury, and Trauma to Civilians from US drone practices in Pakistan," (Stanford Law School; NYU School of Law, 2012). Fair considers the report "not empirically robust" and "advocacy driven". Cf. Christine Fair, "Drones, spies, terrorists, and second-class citizenship in Pakistan," *Small Wars & Insurgencies* 25, no. 1 (2014).

IV. United States

This chapter studies the US's use of military drones. It begins with a brief overview of the US past drone use and current capabilities.[370] The US drone debate and the role the Unmanned Revolution narrative has played in it is analysed through an extensive study of the media coverage and political debate in the second part. The third part traces the important elements of the US drone operations in Pakistan through notable strikes, followed by an analysis of the doctrinal and strategic changes associated with the introduction of drones. Although the US has used its drones in several different conflicts – among others Afghanistan, Iraq, and Libya – this chapter focuses predominantly on the US use of drones in Pakistan and the changes associated with this operation. This choice has been made as the Pakistan operations are the most extensive and controversial US drone use, which have had crucial impact on other countries' views of drones, as shown in the analysis of the German and UK public drone debate in the next chapters.[371] The fifth and sixth part studies operational and societal changes.

1. Background on US drone use

The US developed the world's first surveillance UAV and the first armed drone, and, despite some ebbs-and-flows in interest, has been a leader in drone technology throughout the last 100 years. Drone funding has steadily increased over the last three decades: during the 1990s, DoD invested 3bn USD overall, 2003 was the first 1 billion-dollar year, and 2005 the first 2bn-dollar year.[372] The FY2017 budget proposal allocates

[370] As extensive work has been done on the US's use of drones, this part is shorter than for the other two case studies. The chapter also relies more heavily on the readily available secondary literature.
[371] Furthermore, the British use of drones in Afghanistan allows to gain some insights into US drone use there.
[372] "Unmanned Aircraft Systems Roadmap 2005-2030," ed. Office of the Secretary of Defense (2005). p.i.

4.6bn USD for drone-related spending.[373] The US drone arsenal has grown as a result: in 2001, it consisted of 13 Predators, four (developmental) Air Force GlobalHawks, four Army Hunters, and an undisclosed number of Navy Pioneers;[374] in 2017 it exploded to over 10 000 drones and at least ten drone types.[375] The US is one of eleven countries to use armed drones.

[373] Dan Gettinger, "Drone Spending in the FY17 Defense budget," (New York: Center for the Study of the drone, 2016).

[374] "US build-up highlights UAV shortage," *Jane's Defence Weekly* (2001).

[375] A 2014 report estimated 11 000 UAV in US possession. Samuel Brannen, "Sustaining the US lead in unmanned Systems," in *Center for Strategic and International Studies* (Washington DC: 2014). The US has a substantial covert budget, it can thus be expected that there are other, classified UAV systems.

US UAVs in use as of 2017[a] (from smallest to largest)					
Name	**Wasp RQ-12A**	**Raven RQ-11**	**Puma RQ-20**	**ScanEagle**	**Shadow AAI RQ-7**
Variations				**Blackjack RQ-21**	
Manufacturer	Aero-Vironment (US)	Aero-Vironment	Aero-Vironment	Boeing Insitu (US)	AAI (US)
In use since	2007	2003	2008	2004/5	2002
Type	Fixed-wing,	Fixed-wing, hand-launched	Fixed-wing, hand-launched	Fixed-wing, long endurance, tactical UAV	Fixed-wing, tactical
Dimension					
Wing Span	72cm	1.3m	2.8m	3.1m	4.3m
Length	38cm	90cm	1.4m	1.1m	3.4m
Height					1m
Max. Weight	430gr	1,9kg	5.9kg	22kg	170kg
(of which payload)				<6kg	
Performance					
Speed (max)	65km/h	30km/h	83 km/h	150kg	200km/h
Endurance/radius	45min/5km	60-90min	2h/15km	15h	6-9h
Ceiling	300m	4500m		5000m	4600m
Armament	No	No		No	No
Payload	High resolution, day/night cameras	Electro-optical or infrared cameras	Electro-optical and infrared cameras; IR Illuminator	Electro-optical and/or infrared camera	Infrared camera, daytime TV camera, a laser pointer
Numbers in use					
Army	n/a	7545[c]	n/a		416[g]
Navy/Marine	286[b]	534[d]	219[e]	125 vehicles [f]	68[h]
Air Force					
SOCOM/CIA		n/a	n/a	n/a	
Other	Various variations	Various variations	Increased endurance through auxiliary payload bay	ScanEagle is in constant development, receiving improvements	

[a] Not enough information is available on the classified RQ-170 Sentinel reconnaissance drone which is why it is not listed here.

[b] 143 systems à 2 vehicles

[c] 2515 systems à 3 vehicles

[d] 178 systems à 3 vehicles

[e] 73 systems à 3 vehicles

[f] 25 Blackjack systems à 5 vehicles

Name	**TigerShark RQ-23**	**Fire Scout MQ-8**	**Predator MQ-1**	**Reaper MQ-9**	**GlobalHawk RQ-4**
Variations			**Gray Eagle MQ-1C**		**Triton MQ-4**
Manufacturer	Navmar (US)	Northrop Grumman	General Atomics (US)	General Atomics	Northrop Grumman (US)
In use since	Mid-2000s	2009	1995	2007	2001
Type	Fixed-wing tactical	Vertical take-off helicopter	Fixed-wing, MALE	Fixed-wing, MALE	Fixed-wing, HALE
Dimension Wing Span Length Height Max. Weight (of which payload)	 6.7m 118kg 22.6kg	 Rotor 8.4 m 7.3m 2.9m 1430kg 272kg	 14.8-16.8m 8.2m 2m 1020kg 250-500kg	 20m 11m 3.8m 4760kg 1700kg	 39.9m 14.5m 4.7m 14600kg 1360kg
Performance Speed (max) Endurance/radius Ceiling Armament	 150km/h 10h 5480m No	 213kg/h 5-8h 6000m No	 217 km/h 24h 7620m Missiles	 482km/h >23h 15000m Missiles/ bombs	 629 km/h 32 h 18000m No
Payload	Daylight or infrared camera, laser radar, Synthetic Aperture Radar (SAR)	ISR equipment, mine-detection sensor	SAR Radar, cameras 2 Hellfire or; 4 Stinger; or 6 Griffin missiles	SAR Radar, cameras. Different armament configurations such as 4 Hellfire and 2 230kg Paveway bombs	Variety of SIGINT equipment – optical & electro-optical cameras
Numbers in use Army Navy/Marine Air Force SOCOM/CIA	 4	 42	 105 (GE) 145 n/a	 272 n/a	 4 & 4 Triton 36
Other		Can take off and land auto-nomously on warships			

The US drone arsenal is the largest in the world and discussing each system in detail would go beyond the scope of this thesis. Important elements to note are:

- All US military branches use UAVs, as do Special Operations (SOCOM/JSOC) and CIA.
- The mini-drones Wasp and Raven are by far the most common systems, making up 8000 of the US's 10 000 drones. Only four of the ten models weigh over 500kg.
- All but two systems, Predator and Reaper, are unarmed.
- All but one system are fixed-wing systems, thus requiring infrastructure to start and land (excluded from this are hand-launched systems).
- All drones used by the US military are produced by US manufacturers.[376] As recently as the early 1990s, the US used Israeli-built systems; since then US manufacturers have come to dominate the market (internationally, this dominance is now coming under pressure from China and Israel).
- All but the Predator were introduced in the early 2000s; the last new system was introduced almost a decade ago. All systems are undergoing regular modifications that improve capacity and reach.

The US is the only country able to conduct remote-split operations on a global scale. It has an extensive infrastructure, consisting of a network of airbases around the world from which drones can take off, and bases in the US from which drones are piloted, a process made possible by satellites, relay stations (notably Ramstein Airbase in Germany) and undersea cables.[377] As of 2017, the US officially uses force in six countries—Afghanistan,

[376] According to reports, the US Army uses Chinese-made DJI Phantom, but they were recently downed over cybersecurity concerns.

[377] Operations are flown from US Air Force bases, most importantly Creech outside Las Vegas and Holloman in New Mexico. A 2012 report found 64 UAV bases on US soil: Lorenzo Franceschi-Bicchierai, "Revealed: 64 drone bases on American Soil," *Wired*, 13 June 2012.

Iraq, Syria, Pakistan, Yemen, and Somalia. In the latter three, virtually all force has come in the form of drones.[378] For some, drone warfare has become the defining element of American foreign policy in the 21st century.

The US has two drone programmes: one under DoD command (JSOC), which controls the drones over Afghanistan and Iraq, but also Yemen and Somalia, and a covert CIA-led programme in Pakistan (and Yemen), although the distinction is much less clear than generally assumed.[379]

2. The US drone debate

2.1 The US media drone coverage

Three newspapers – *New York Times* (NYT), *Washington Post*, and *Wall Street Journal* (WSJ) – have carried the US drone coverage. Between January 2000 and January 2017, *NYT* published almost 15 000 drone-related articles; *Washington Post* and *Wall Street Journal* ran 13 000 and 10 000 articles respectively. *USA Today* and *New York Post* combined published only 3300 articles on drones in the same period.[380]

[378] David Cole, "The Drone Presidency," *New York Review of Books*, 18 August 2016.
[379] The covert CIA operations are carried out under title 50 of the US Code meaning that these operations are secret, as opposed to clandestine DoD operations carried out under title 10 which, if activity is discovered the government's role will ultimately be acknowledged. Though portrayed as clearly distinct, these distinctions are much less clear in practice than in theory as DoD's JSOC has played a more significant role than assumed in Pakistan, Yemen, and Somalia. See Joseph Berger, "Covert Action," *Joint Forces Quarterly* 67 (2012).
[380] These US five papers had the largest circulation in 2017.

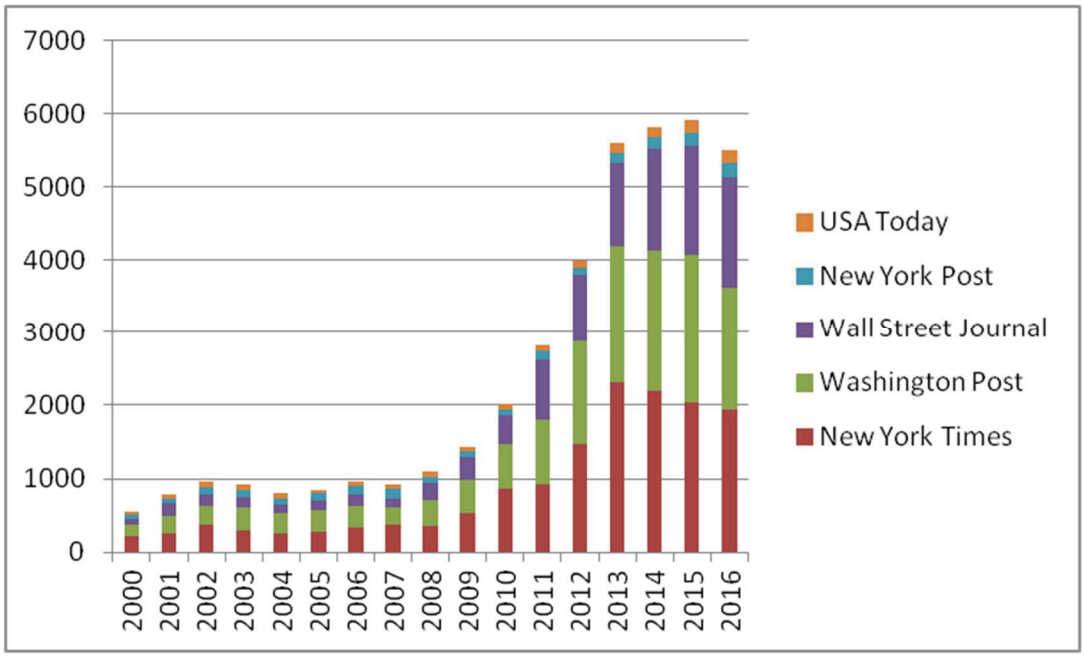


Illustration IV.1. US Media drone coverage. Data from Factiva

2.1.1. 9/11 and the Bush years

In the early 2000s, public interest in drones in the US was low. Few took notice when, in February 2001, the Predator conducted armed tests for the first time – a CNN crew was supposed to cover the test but did not show up.[381] With the 9/11 terrorist attacks and the start of the war in Afghanistan, coverage of military matters in general picked up notably.

There was no secrecy around drones; articles featured technical details and it was public knowledge that the CIA operated unmanned systems,[382] but drones were rarely singled out by the media. A notable exception was *Washington Post's* Thomas Ricks, who in early 2002 noted with regard to armed UAVs: "The star in the air campaign has been the lethal drone aircraft […] More than any other innovation, the use of a Predator reconnaissance

[381] Mazzetti, *The Way of the Knife*. p.97.
[382] Tim Weiner, "A Nation Challenged: The Hunt," *New York Times*, 8 October 2001. Judith Miller and Eric Schmitt, "A Nation Challenged: The Battle," *New York Times*, 23 November 2001. Vernon Loeb, "Pilotless Predators and Air Apparents," *Washington Post*, 4 April 2002.

drone to launch Hellfire missiles is likely to be what the Afghan war is remembered for."[383] He considered drones a "Revolution in the sky": "the use of the armed RQ-1 Predators is a revolutionary step in the conduct of warfare".[384]

The tone at the beginning of the Afghanistan war was bellicose. A 2001 *New York Post* editorial about an aborted drone strike criticised the US for "calling the lawyers" and deciding not to strike for fears of civilian casualties: "In wartime, what do you do when the enemy's in your sights? The answer, of course, is: Shoot! Anybody knows that. But do Bush officials?"[385] The newspaper adopted a similar stance five years later, criticising the military for not targeting a funeral.[386] When in November 2002 the US for the first time used an armed drone to kill an individual outside an official battlefield, all major newspapers took notice. The *NYPost* boasted about a kill "straight from the pages of a Tom Clancy novel".[387]

One drone system was continuously in the spotlight: The Predator, and later its successor system, the Reaper, "the glamorous face of UAVs".[388] Despite drones being used by all branches of the military, reporting focused almost exclusively on these Air Force systems.[389] Once the media began covering the Pakistan operations, they eclipsed reporting on UAVs in Afghanistan and Iraq. A rare article on Afghanistan noted: "The use

[383] Vernon Loeb and Thomas E. Ricks, "1's and 0's Replacing Bullets in US Arsenal; Success in Afghanistan Propels Shift to Equipping Forces With Digital Arms," *Washington Post*, 2 February 2002.
[384] Ricks, "US Arms Unmanned Aircraft; 'Revolution' in Sky Above Afghanistan."
[385] "Lawyers for Bin Laden," *New York Post*, 17 October 2001.
[386] Ian Bishop and Geoff Earle, "'Moral' mess of a miss- Pentagon admits wimping out on Taliban as Congress Fumes," *New York Post*, 14 September 2006.
[387] Niles Lathem and Aly Sujo, "Visit from Hell," *New York Post*, 6 November 2002. Also see: Eric Schmitt, "U.S. Would Use Drones To Attack Iraqi Targets," *New York Times*, 6 November 2002.
[388] "Fear the Reaper: operators look beyond the current iconic UAV," *Jane's International Defence Review* (2011).
[389] Notable exceptions include Richard A Clarke, "A Soldier's Eye in the Sky," *Wall Street Journal*, 18 July 2009.

of the drones has expanded quickly and virtually unnoticed in Afghanistan. [They] have carried out more than 200 missile and bomb strikes over the last year [...]. That is three times as many strikes in the past year as in Pakistan, where the drones have gotten far more attention."[390]

2.1.2. Reporting on covert drone operations in Pakistan

The US public slept through the beginning of the drone campaign in Pakistan. The first strike on 17 June 2004, as well as three that followed in May, November, and December 2005, were not picked up by the US press – there were no official statements, and US reporters could not (and had little reason to) travel to the Federally Administered Tribal Areas. Coverage only began in 2006, when a strike on a religious school killed over 80 people, including, possibly, up to 69 children (see below). Despite Pakistan's claims to the contrary, the US media speculated that the strike was carried out by CIA drones.[391] This and similar high-casualty strikes led to ex-post reporting on earlier attacks and, strike by strike, the revealing of the programme. From 2007 onwards, there was regular reporting, but still little debate. Already in February 2008, *NYT* reported on what would later become known and criticised as 'signature strikes' – strikes on unidentified individuals that were identified as enemy combatants based on their behaviour – yet, at the time, few took issue.[392] Only when the death toll rose in Pakistan, and non-governmental organisations began researching civilian casualties, the public debate grew, and commentators began discussing the ethical, political, and moral complexities of the attacks.

[390] Christopher Drew, "For Spying and Attacks, Drones Play a Growing Role in Afghanistan," *New York Times*, 20 February 2010.
[391] Salman Masood, "Pakistan Says It Killed 80 Militants in Attack on Islamic School," *New York Times*, 31 October 2006.
[392] Eric Schmitt and David Sanger, "Pakistan Shift Could Curtail Drone Strikes," *New York Times*, 22 February 2008.

An important impetus for the increased interest was the killing of Anwar al-Awlaki in Yemen in September 2011, the first American citizen to be targeted and killed in a drone strike.[393] Because of al-Awlaki's nationality, the case drew a lot of attention in the US media, including in the popular press.[394] For many Americans, this was likely the first time they heard about targeted killings with drones. Also, with this strike, US drone operations expanded to Yemen and, shortly after, Somalia.

The Unmanned Revolution narrative was largely absent from the US media coverage of drones. Whether seen positively or negatively, drones were rarely portrayed as revolutionary by the media. There were some exceptions. The *Chicago Tribune* for instance wrote that "Drone pilots and crews are the vanguard of a revolution in warfare",[395] and *USA Today* noted "The use of unmanned surveillance planes over Iraq has soared, revolutionizing the way U.S. troops wage war".[396] Peter W. Singer made the Unmanned Revolution argument in several op-eds.[397] And yet, the *WSJ* noted: "Drones are an evolution in military technology, not a revolution in warfare."[398] Also absent from the US coverage was the 'killer drone' narrative. The US public showed little concern over robots with the ability to kill – or became quickly accustomed to it: "once the idea of an

[393] Al-Awlaki was the first US citizen who died in a US drone strike after having been targeted, but there had been previous killings of US passport holders, for instance in an attack on a training camp in Waziristan in 2008.
[394] Chuck Bennett, "Remote-control really hits the splat," *New York Post*, 1 October 2011. "Al-Awlaki was a uniquely American threat," *USA Today*, 3 October 2011. "Al-Qaida confirms militant cleric's death," *Chicago Daily Herald*, 11 October 2011.
[395] David Zucchino, "Drone pilots have a front-row seat on war, from half a world away," *Chicago Tribune*, 21 February 2010.
[396] Tom Vanden Brook, "Drones reshaping Iraq's battlefields; Use of U.S. pilotless spy planes soars," *USA Today*, 7 July 2006.
[397] Peter W. Singer, "Robots replacing soldiers in the front lines of war," *The Leader-Post*, 3 February 2009. Peter W. Singer, "America's new killing machines; A robotics revolution is changing the way we do battle," *The Record*, 9 February 2009.
[398] Mark Jacobson, "Five Myths about Obama's drone war," *Washington Post*, 8 February 2013.

unmanned aircraft was kind of shocking and weird," Scott Shane noted; "Now we're used to it."[399]

2.1.3. Media stance

Of the major newspapers, the *NY Post* was consistently most supportive of the covert drone programme. A 2010 editorial criticised UN Special Rapporteur Philip Alston, arguing that "it's absurd for the UN to imply the US is acting illegally in taking out murderous al Qaeda thugs. […] Washington has no reason to apologize – and no need to change its tactics."[400] The *Wall Street Journal* was also favourable to the strikes: "Is the world better off with these people dead? We think so. [...] unmanned bombs away."[401] The *Washington Post* was more balanced. The newspaper showed particular interest in federal agency jurisdiction, reporting regularly on the question of who controls the drones. In late 2012 its editorial board argued that "Drone strikes should be carried out by military forces rather than by the CIA […]. [T]o institutionalize a secret process of conducting covert drone strikes against militants across the world is contrary to U.S. interests and ultimately unsustainable."[402] The same editorial board however also made the decision not to include civilian casualty data in its drone reporting.[403] The *NYT* adopted the clearest anti-drone stance, growing more critical the longer the covert drone operations went on.

[399] Michael Calderone, "Drone Media Debate Picks Up In 2013, But Coverage Remains Tough To Sustain," *Huffington Post*, 15 January 2013.
[400] "Targeting an Anti-Terror Tool," *New York Post*, 14 June 2010.
[401] "Predators and Civilians," *Wall Street Journal*, 13 July 2009.
[402] Editorial Board, "US drone war demands accountability," *Washington Post*, 1 November 2012.
[403] Chris Woods, "How Washington Post Strips Casualties from Covert Drone Data," in *Informed Comment*, ed. Juan Cole (2012).

It focused on issues of legality and morality,[404] and showed particular concern about the precedent the US set for other countries.[405]

2.2. Political debate

Compared to the level of controversy drones and the US drone programme in particular, have caused internationally, the political debate in the US has been tame. The technology has received political support from several directions, most notably President Bush, who three months after 9/11 said: “Before the war, the Predator had skeptics, because it did not fit the old ways. Now it is clear the military does not have enough unmanned vehicles.” Congress was consistently pro-drone: in FY1998, it appropriated several million more for drone-related spending than the President had requested,[406] and in 2000 it set the goal of making “one-third of the aircraft in the operational deep strike force aircraft fleet” unmanned.[407]

Yet, overall, the level of support for and attention to the technology has been nowhere near the political support for the IT-RMA. The Unmanned Revolution narrative did not play a prominent role in the political realm.[408] Instead, the political controversy revolving around two issues: the political oversight of drones when used for targeted killings, and the legality of targeting American citizens. On political control, one side argued for CIA

[404] Scott Shane, "The Moral Case For Drones," *New York Times*, 14 July 2012.
[405] Anderson, "Written Testimony Submitted to subcommittee on National security and Foreign Affairs: rise of the Drones - Unmanned Systems and the Future of War." Yet, in Jan 2012 criticised that the two-month lull in American drone strikes in Pakistan has helped “embolden Al Qaeda and several Pakistani militant factions to regroup, increase attacks against Pakistani security forces and threaten intensified strikes against allied forces in Afghanistan” Eric Schmitt, "Lull In Strikes By U.S. Drones Aids Militants," *New York Times*, January 8 2012.
[406] "UAV Annual Report FY 1997." p.3.
[407] "National Defense Authorization FY2001," ed. Congress (Washington DC: 2000).
[408] It was, unsurprisingly, discussed at a 2010 Hearing at which Peter W. Singer testified. "Hearing House of Representatives: Rise of the drones: Unmanned systems and the future of war," ed. Subcommittee on national security and foreign affairs of the committee on oversight and government reform (Washington DC: 2010).

control because the Pentagon could not handle the intelligence level necessary for the job.[409] Other voices considered the CIA insufficiently qualified or accountable.[410] Obama attempted in January 2014 to remove the CIA from drone operation, a plan supported by Republican Senator John McCain,[411] yet opposed by his Democratic colleague Diane Feinstein and the (Democratic) Senate.[412] Equally, one of the biggest events in the debate on lethal operations against US citizens, Republican Senator Rand Paul's March 2013 filibuster "was showered with praise by both the Tea Party movement and the provocateurs of the peace group Code Pink",[413] but criticized by Republicans Lindsey Graham and McCain. The 13-hour speech was aimed at stopping the confirmation as CIA director of John Brennan, "Obama's Drone-Master", the man behind the US targeted killing campaign.[414] Support for the US policy of targeted killing outside official battlefields was thus largely bipartisan. For one, criticising a President during wartime is frowned upon. It can also be assumed that targeted killings by drones would have attracted more opposition from the left if it had been done under a Republican President, and not Nobel Peace Prize laureate Obama. Most importantly, political debate was hindered by the fact that, officially, these strikes were not happening. The White House press secretary (2009 – 2011), revealed that "one of the first things they told me was, you're not even to acknowledge the drone program."[415] The President's first official mention of strikes in

[409] Daniel Benjamin and Steven Simon, "A War the Pentagon Can't Win," *New York Times*, 24 July 2007.
[410] David Ignatius, "Getting the CIA We Need," *Washington Post*, 8 July 2007.
[411] Jon Prior, "Mccain eager for Military to run drone strikes," *politico*, 26 April 2015.
[412] Bryan Bender, "'I don't think the CIA should be in the business of carrying out wars," *Politico*, 23 April 2015, Greg Miller, "Lawmakers seek to stymie plan to shift control of drone campaign from CIA to Pentagon," *Washington Post*, 15 January 2014.
[413] Richard Stevenson and Ashley Parker, "A Senator's stand on drones scrambles partisan lines," *New York Times*, 7 March 2013.
[414] Reid Cherlin, "Obama's Drone-Master," *CG Magazine*, 17 June 2013.
[415] David Taintor, "Gibbs: I was told not to acknowledge drone program," *TalkingPointsMemo*, 25 February 2013.

Pakistan was on 30 January 2012 in a Google+ interview – eight years after the first Pakistan strike – during which he underlined that the strikes had "not caused a huge number of casualties" and "were kept on a tight leash".[416] President Obama's involvement in the drone programme was in fact extraordinary. He personally had the last word, "approving every new name on an expanding 'kill list'".[417] Through this personal involvement, Obama linked his name forever to the programme, leading to reports portraying him as Roman emperor lowering his thumb over gladiators: "the President [is] judge, jury and executioner, he determines who lives and who dies."[418] Another commentator noted "And they called George W. Bush a cowboy? All Obama lacks is a Stetson".[419]

The secrecy of the programme, while helping to stifle criticism from official stakeholders, incited popular opposition. "Because the administration has been so opaque [there has been] a growing perception that the program is not lawful and necessary, but illegal, unnecessary, and out of control," the State Department's Legal Adviser noted.[420] The secrecy also increased the relevance of leaks, the most prominent of which happened in October 2015 with the release of 'The Drone Papers'. Although the documents did not reveal much that had not already been known, they added to the impression that the US government was waging wars in secret, fuelling opposition from non-governmental organisations, such as *CodePink*. Co-founded by Medea Benjamin, the peace organisation

[416] Jon Russel, "Watch President Obama's Drone Google+ Hangout in its entirety here," *Next Web*, 31 January 2012.
[417] Jo and Shane Becker, Scott, "Secret 'Kill List' proves a test of Obama's principles and will " *New York Times*, 29 May 2012. The exact extent of this control remains unclear, Becker and Scott suggest that Obama personally signs off every strike by the military but not the CIA strikes.
[418] Jeff Bachman, "Growing Opposition to US drones Program," *Common Dreams*, 22 November 2012.
[419] Adam Brodsky, "Obama the Cowboy," *New York Post*, 9 May 2011.
[420] Mark Landler, *Alter Egos: Obama's Legacy, Hillary's Promise and the Struggle over American Power* (Random House, 2016). p.104.

organised protests (including in Pakistan and at drone bases worldwide), and petitions for its "Campaign of Non-violent Actions to Ground Killer Drones". Although the Unmanned Revolution narrative was not prevalent among activists, they regularly warned of "killer drones", or "killer robots".[421]

The drone programme also led to the establishment of various research programmes and centres, most notably the drone research programme at New America Foundation which started collecting data about US drone strikes and casualties in 2009, and the foundation of the Center for the Study of Drones at Bart College.

2.3. DoD and armed forces

Neither Pentagon nor DoD did contribute much to the US drone debate, most likely because it centred on the secret policy of targeted killings outside official battlespaces, in which the DoD was (officially) only tangentially involved, as the strikes were under CIA command. In its official writing, the military did not portray drones as revolutionary, neither the technology itself, nor any of its particular uses (only the 2005 'Unmanned Roadmap' noted that "UA and unmanned systems in general, are changing the conduct of military operations in the [Global War on Terror]")[422] (see more on DoD writing below). This caution around the RMA narrative was possibly a reaction to the disappointments of the IT-RMA, which the military had advocated forcefully.

Some of the most influential criticism of the US drone programme, however, came from veterans. Most prominently, Brandon Bryant, a USAF Predator operator between 2006 and 2011, became an important voice in the anti-drone movement. Bryant gave hundreds

[421] Benjamin, *Drone Warfare. Killing by remote control*.pp.28,15. "Losing Humanity, The case against killer robots."
[422] "Unmanned Aircraft Systems Roadmap 2005-2030." p.i.

of interviews and testified in front of the UN, becoming a figurehead for the anti-drone campaign.[423] In 2015, 44 veterans urged US drone operators "to refuse to play any role in drone surveillance/assassination missions", arguing that "such missions profoundly violate domestic and international laws".[424]

2.4. Conclusion – An inward-turned debate focused on targeted killings

The US public debate revolved mainly around the specific use of drones for targeted killings outside official battlefields, rather than around drone technology. The Unmanned Revolution narrative did not play an important role in the debate – the media only used it sometimes, while the political realm and the military largely refrained from calling drones revolutionary. Only activists used the narrative. Interestingly, the public debate was fuelled more than anything else by the secrecy around drone strikes, which in turn stifled the political debate and the military's ability to participate in the discussion. The secrecy fuelled misperceptions and anger and motivated reporters and activists.

3. US UAV operation in Pakistan

When US troops moved into Afghanistan following 9/11, Taliban and al-Qaeda fighters used the Afghanistan-Pakistani borderland, the Federally Administered Tribal Areas (FATA), as refuge. But whereas militants could cross into Pakistan without problems and regroup there, for the US forces, the war ended at the Pakistani border.

The CIA had flown Predators over Afghanistan already pre-9/11 in their search for Osama bin Laden, and in 2001 extended its drone operations to include the FATA. For three years, CIA drones carried out intelligence missions only. This changed on 17 June 2004 when a

[423] See for instance Matthew Power, "Confessions of a Drone Warrior," *GQ*, 23 October 2013.
[424] "Veterans urge drone operators to refuse orders to fly," *RayMcGovern.com*, 20 June 2015.

Hellfire missile killed militant leader Nek Mohammad in South Waziristan. It was only the second time that the US had used drones for a strike outside a warzone, after killing an al-Qaeda operative in Yemen in 2002. Over the next 13 years, the CIA carried out hundreds of strikes in Pakistan (65% of all US strikes outside Afghanistan and Iraq), killing between 2500 and 4000.[425] As of 2017, the strikes are ongoing, continuing into a third US administration.

During the 16 years of operations studied (2001-2017), the CIA used two drone types, the Predator and the Reaper. Predator and Reaper are similar-looking fixed-wing MALE systems, with the Reaper being larger and able to carry over triple the Predator's payload.

Predator & Reaper Comparison		
Name	**Predator MQ-1**	**Reaper MQ-9**
Manufacturer	General Atomics	General Atomics
In use since	1995	2007
Type	Fixed-wing, MALE	Fixed-wing, MALE
Dimension		
Wing Span	14.8-16.8m	20m
Length	8.2m	11m
Height	2m	3.8m
Max. Weight	1020kg	4760kg
(of which payload)	250-500kg	1700kg
Performance		
Speed (max)	217 km/h	482km/h
Endurance/radius	24h	>14h
Ceiling	7620m	15000m
Armament	Missiles	Missiles/Bombs
Payload	2 Hellfire or; 4 Stinger; or 6 Griffin missiles	Different configurations such as four Hellfire and two 230kg Paveway bombs

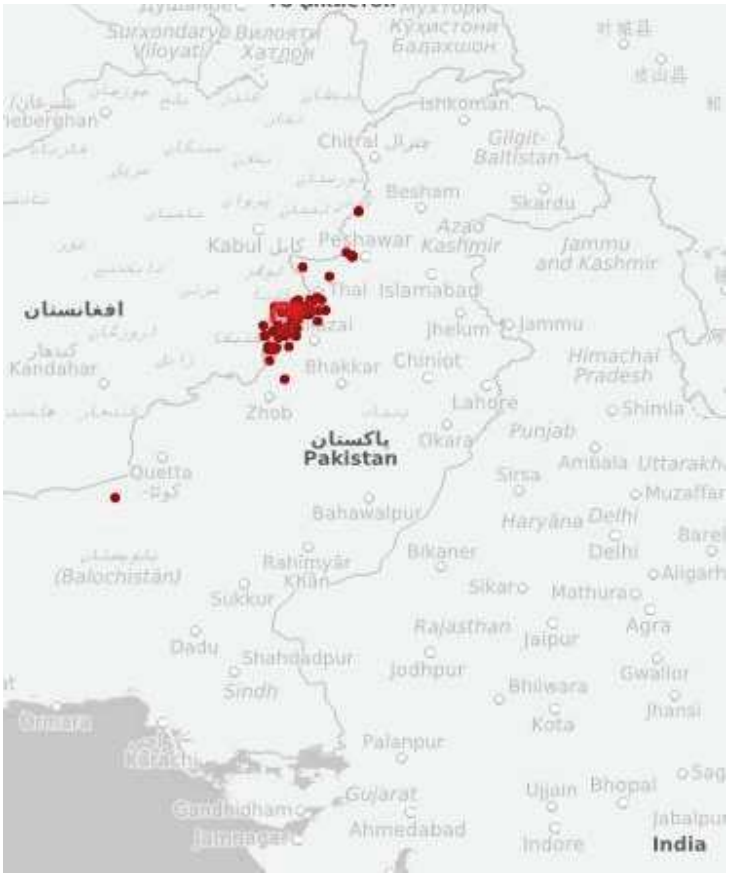
[425] Unless specified otherwise, this analysis uses numbers from the Bureau of Investigative Journalism (*BIJ*). There is an intense debate on the best methodology of data collection (on this see Avery Plaw, "Counting the Dead: The Proportionality of Predation in Pakistan," in *Killing by Remote Control. The Ethics of an Unmanned Military*, ed. Bradley Jay Strawser (Oxford: Oxford University Press, 2013).) No organisation can claim to have the exact numbers, but I consider the Bureau's methodology most transparent. This decision has also been taken for the sake of consistency and comparability, the last point being particularly important as for this analysis, as the absolute numbers are less important than changes over time. I do not expect my analysis to change dramatically with different numbers.

In their typical configuration, both systems carry electro-optical daytime sensors and night cameras. While the Predator was built as ISR system and only armed later on, the Reaper has been built specifically as a hunter-killer, carrying an array of weapons, the typical configuration being four Hellfire missiles and two 230 kg bombs. Its speed is double the Predator's.

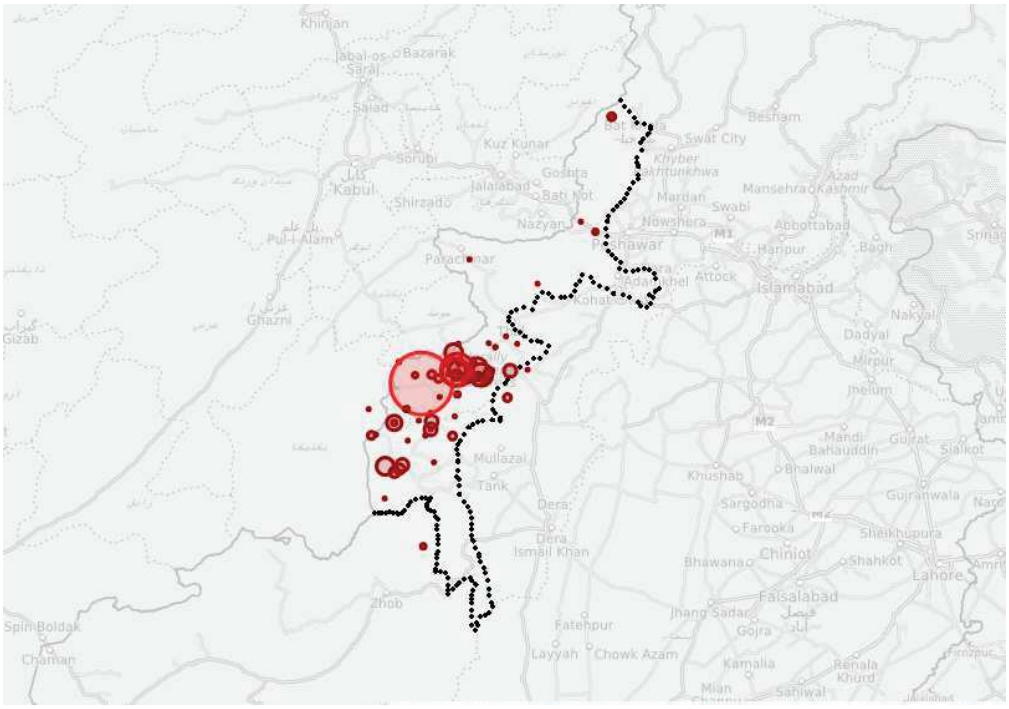
Estimates put the number of CIA Predators at 80 and Reapers at 30.[426] While MALE drone systems were in short supply in Afghanistan and Iraq,[427] reports suggest that by 2009 there were so many drones in the air over Pakistan that "arguments have erupted over which remote operators can claim which targets".[428] By 2011, the CIA reportedly had fourteen combat air patrols of three-to-four drones that ensured uninterrupted coverage.[429] In addition, the classified RQ-170 Sentinel reconnaissance drone was also used at least once in Pakistan: the famous War Room photograph taken during the Bin Laden raid shows President Obama and advisors watching the Sentinel's stream.[430] Reports of GlobalHawk crashes furthermore suggest use of this system in the area – although the drones could have involuntarily ventured into Pakistani airspace during their descent.[431]

[426] David Axe, "Just how many Predator drones does the CIA have?," *Medium*, 15 October 2014.
[427] Brett Velicovich, *Drone Warrior. An Elite Soldier's Inside Account of the Hunt for America's Most dangerous Enemies* (Harper Collins, 2017). Appendix.
[428] Jane Mayer, "The Predator War," *New Yorker*, 26 October 2009.
[429] Adam Entous, Siobhan Gorman, and Julian E. Barnes, "US tightens drone rules," *Wall Street Journal*, 4 November 2011.
[430] Nicholas Schmidle, "Getting Bin Laden," *New Yorker* (2011).
[431] As happened in 2002: Staff, "Global Hawk crash investigation," *Aviation Week & Space Technology* (2002).

CIA drone strikes have almost exclusively hit targets in FATA, predominantly in the southern regions of North and South Waziristan.[432] The maps below show all strikes by US drones between June 2004 and January 2017, as collected by the *BIJ*.



[432] There have been three exceptions to this: strikes in Khyber Pakhtunkhwa on 21 November 2013 and 13 June 2017; May 2016 strike in Balochistan.



Maps IV.2. IV.3. Location of US drone strikes in Pakistan 2004 – 2017
Size of circles illustrates number of casualties.
Source: *BIJ*

FATA, located in Pakistan's north-west, hosts a population of 3-4 million (2% of the Pakistani population). It is mountainous territory, with narrow strips of valleys, which, together with selected towns, endured most of the strikes. FATA has little precipitation, but an extreme range of temperature, going up to over 30°C in summer and below freezing in winter. Drones were flown from two airfields in Pakistan: Shamsi in Balochistan and Shahbaz at Jacobabad, both located c.700km south of FATA, and from airbases in Afghanistan.

Map IV.4. Location of Shamsi and Shahbaz airbases used for US drone operations

CIA strikes in Pakistan began under President George W. Bush. During Bush's time in office (2001-09), 51 strikes were carried out in Pakistan, killing between 410 and 595. In the first four years of lethal operation (2004 – 2008), strikes were rare, with only eleven until 2008. The frequency increased in the second half of 2008, with 40 strikes (sometimes several a day) as a growing number of reports pointed to the FATA sanctuary as the main obstacle to pacifying Afghanistan, and the intelligence community worried about terrorists using the lawless area for plotting attacks against the US.[433]

[433] Bob Woodward, *Obama's wars* (Simon and Schuster, 2011). p.105,99.

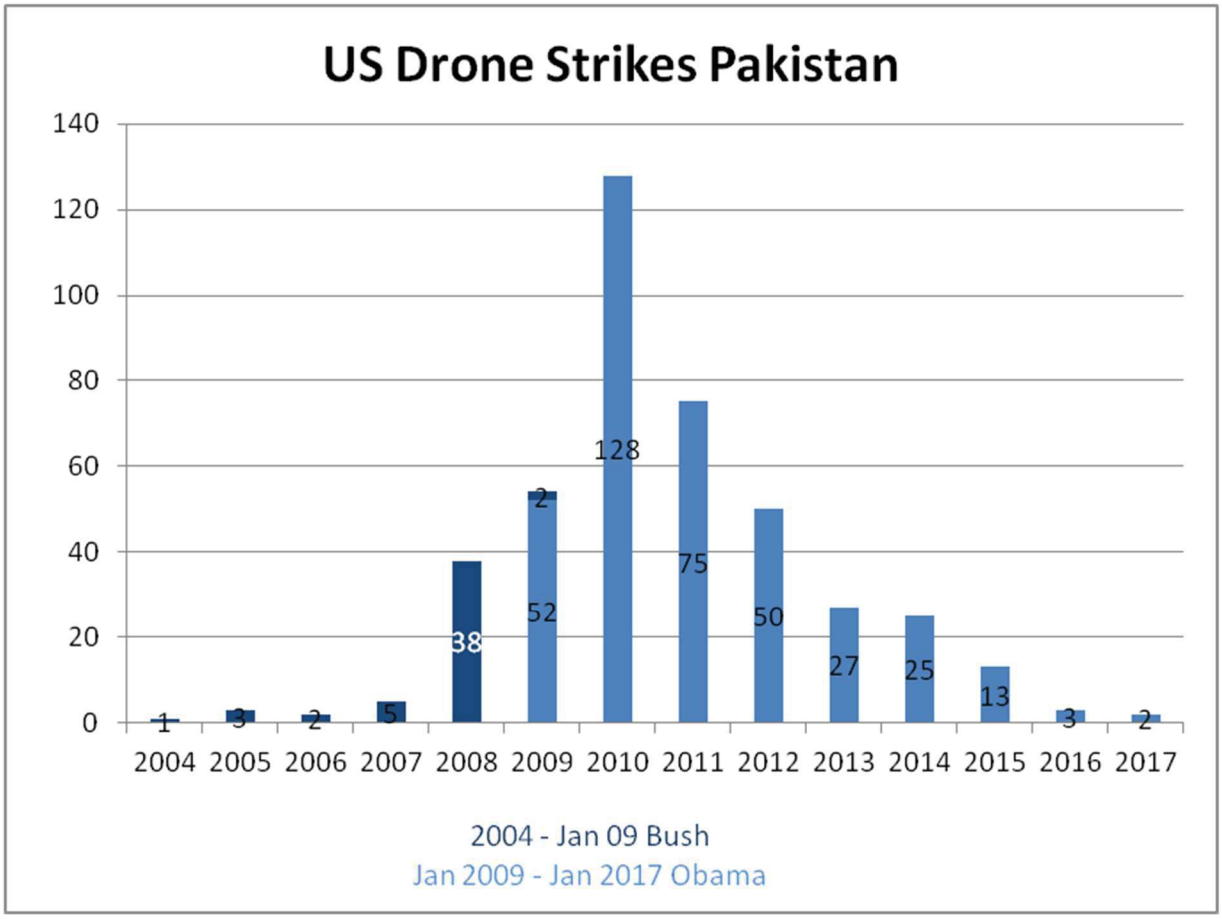


Illustration IV.5. US Drone Strikes Pakistan
Source: own illustration, data from *BIJ*

Barack Obama showed concern over the impact of the war on 'AfPak'[434] early on, announcing his willingness to attack without Pakistani approval already during his presidential campaign.[435] Three days after his inauguration, Obama authorised two strikes in FATA. Notwithstanding the *Guardian*'s hope that Obama would "flood the world with

[434] The term AfPak was coined by the Obama administration: "This is not just an effort to save eight syllables. It is an attempt to indicate and imprint in our DNA the fact that there is one theatre of war, straddling an ill-defined border". Richard Holbrooke, "Rede auf der 45. Münchner Sicherheitskonferenz 08.02.2009," *Munich Security Conference* (2009).
[435] See for instance Steve Holland, "Tough talk on Pakistan from Obama," *Reuters*, 1 August 2007.

diplomats rather than pilotless drones,"[436] during the eight years of Obama's presidency, 373 drone strikes were carried out in Pakistan.

Presidency	Strikes	Minimum people killed	Maximum people killed	Minimum civilians killed	Maximum civilians killed
George W. Bush 20 Jan 2001 – 20 Jan 2009	51	410	595	167	332
Barack Obama 20 Jan 2009 – 20 Jan 2017	373	2089	3406	257	634

US drone operations in Pakistan have been irregular, with periods of low and of intense activity, many of which can be directly linked to specific events. The first spike suggests an effort by the Bush administration to kill Osama bin Laden before leaving office, as well as a generally increased attention to Pakistan. The January 2010 spike followed the 30 December 2009 attack on base Chapman in Afghanistan that killed seven CIA officers and contractors: "in the aftermath […], political sensitivities were no longer a reason not to do something. The shackles were unleashed."[437] On the other hand, the period of low activity in the early months of 2011 was a consequence of the arrest of CIA contractor Raymond Davis in Lahore and the high-casualty Datta Khel attack (below). The slump at the end of 2011 was related to a border skirmish on 26 November during which US-NATO troops killed 28 Pakistani soldiers, and which led to Pakistan ordering the US to vacate Shamsi Airfield.

[436] "The transition: Steep learning curve," *Guardian*, 12 January 2009.
[437] Joby Warrick, *The Triple Agent*, cited in Woods, *Sudden Justice. America's secret drone wars*. p.165.

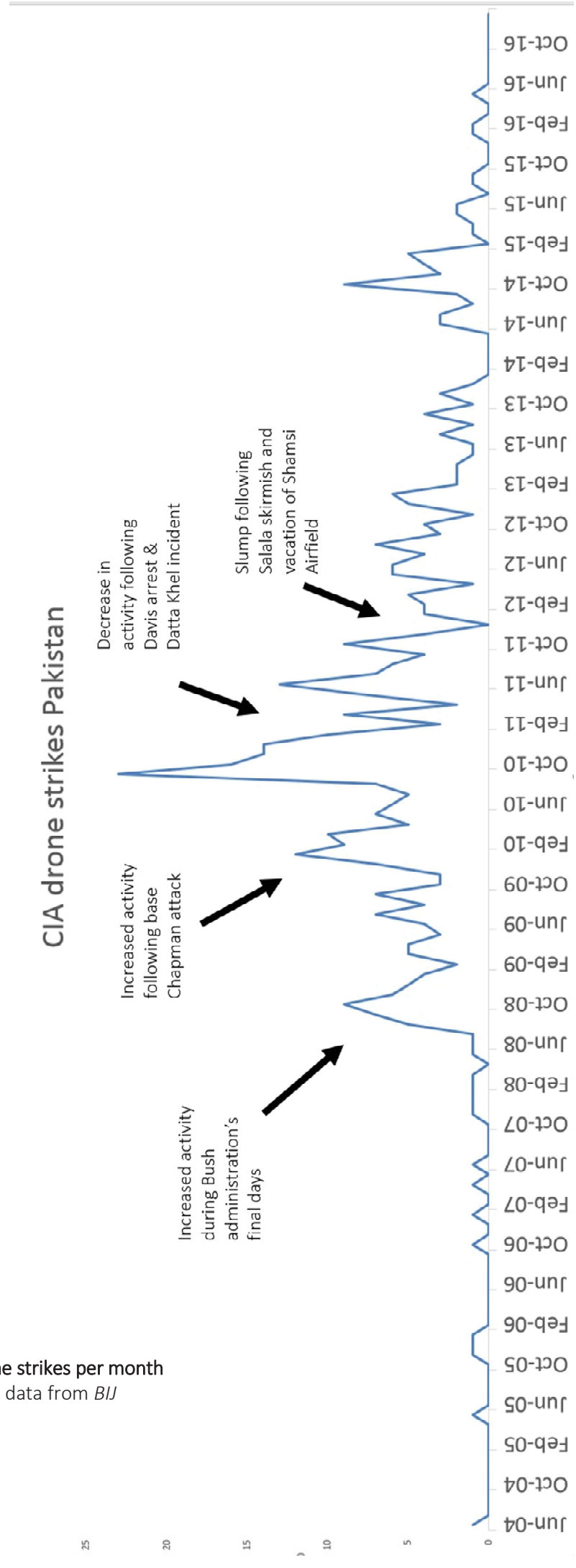


Illustration IV.6. CIA Drone strikes per month
Source: Own illustration, data from *BIJ*

3.1. Pakistani complicity

3.1.1. The first strike. Nek Mohammad (17 June 2004)

On 17 June 2004, notorious Pakistani militant leader Nek Mohammad was killed by a missile in South Waziristan. Pakistani armed forces had fought him through weeks of air and artillery strikes, killing hundreds of people, but were eventually forced to sign a peace deal with him.[438] When Mohammad was killed only two months later, Pakistan's top military spokesperson announced he was killed by Pakistani rockets.[439]

There were open questions. The attack was highly accurate; fragments of the missile reportedly carried the writing 'made in USA'.[440] But Pakistan rejected US involvement as "absurd".[441] Yet, Nek Mohammad was the first victim of a US drone strike in Pakistan, the second US drone kill outside an official battlefield. It later transpired that the CIA, after lobbying for months to get permission for Predator flights in the tribal areas, had made a deal with Pakistan: if the CIA killed Mohammad – a thorn in Pakistan's side for years – Pakistan would allow the flights. Mohammad was "a good-will-kill".[442] Christine Fair notes: "[This strike] inked, with Mohammad's blood, a secret bargain between the CIA and Pakistan's ISI […] that would grant the CIA access to Pakistan's air space."[443]

The mainstream belief has been for a long time that the drone operations were carried out against the will of Pakistan. Two elements reinforced this narrative: the secrecy around the strikes, and the fact that many Pakistani stakeholders publicly protested the

[438] Ibid. p.101.
[439] Mazzetti, *The Way of the Knife*. p.108.
[440] Shah, "My Drone War ".
[441] Woods, *Sudden Justice. America's secret drone wars*. p.101.
[442] Mazzetti, *The Way of the Knife*. p.108.
[443] Fair, "Drones, spies, terrorists, and second-class citizenship in Pakistan." p.207. Good-will-kills continued throughout the years; another notable example is Taliban's deputy leader Waliur Rehman in 2013. Mark Mazzetti and Declan Walsh, "Pakistan says US drone killed Taliban leader," *New York Times*, 29 May 2013.

strikes.[444] But the first strike on Mohammad shows that Pakistani decision-makers were involved from the outset. Leaked documents list six more strikes in 2006 and 2007 that were requested by Pakistan.[445] Then-President Zardari even complained to the Bush administration that not enough of Pakistan's enemies were killed.[446] Even without information about secret deals, Pakistani complicity could have been suspected. US drones were (partly) flown from and maintained at Pakistani airbases. Pakistan also deconflicted the airspace for the operations.[447] The strikes relied on human intelligence which the US could not have developed alone. Last, Pakistan could have legally (and militarily) denied access to its airspace. But even after UN Rapporteur Emmerson criticised the strikes as "a violation of Pakistan's sovereignty and territorial integrity", Pakistan decided not to lodge a complaint with the UN. The cooperation survived high-casualty strikes, public protests, and President Musharraf's removal from office in 2008. Pakistani protests were therefore either organised by actors ignorant of the cooperation, or deliberately staged for domestic consumption to increase the price of American access to Pakistani air space.[448] Still, the US-Pakistani cooperation was not without hiccups: in 2008, after reports that targets appeared to have been warned of imminent strikes, President Bush changed the procedure from asking permission to letting Pakistani officials know of a strike only as it was underway.[449] The cooperation took further hits after the arrest of CIA contractor Davis as well as after the Salala border skirmish in 2011. Yet, Pakistani officials

[444] Adriana Jones, "Hidden from the public: The United Kingdom's Drone Warfare," *Just Security* (2017).
[445] Jonathan Landay, "US secret: CIA collaborated with Pakistan Spyagency in drone war," *McClatchy*, 9 April 2013. Also see "Secret Memos show Pakistan Endorsed US Drone Strikes."
[446] Woodward, *Obama's wars*. p.117.
[447] Fair, "Drones, spies, terrorists, and second-class citizenship in Pakistan." p.213.
[448] Ibid. p.207.
[449] Woodward, *Obama's wars*. p.5.

not only consented at various times to the strikes, the Pakistani military even tried to take credit for US attacks, particularly in the early years.

3.1.2. Madrassa strike – 30/31 October 2006

In the night of 30 October 2006, a religious school in Chenegai, (northern FATA), exploded, leaving up to 81 dead, including many children. The Pakistani Army claimed responsibility and authorities in Islamabad issued a statement designating the madrassa a terrorist training camp.[450]

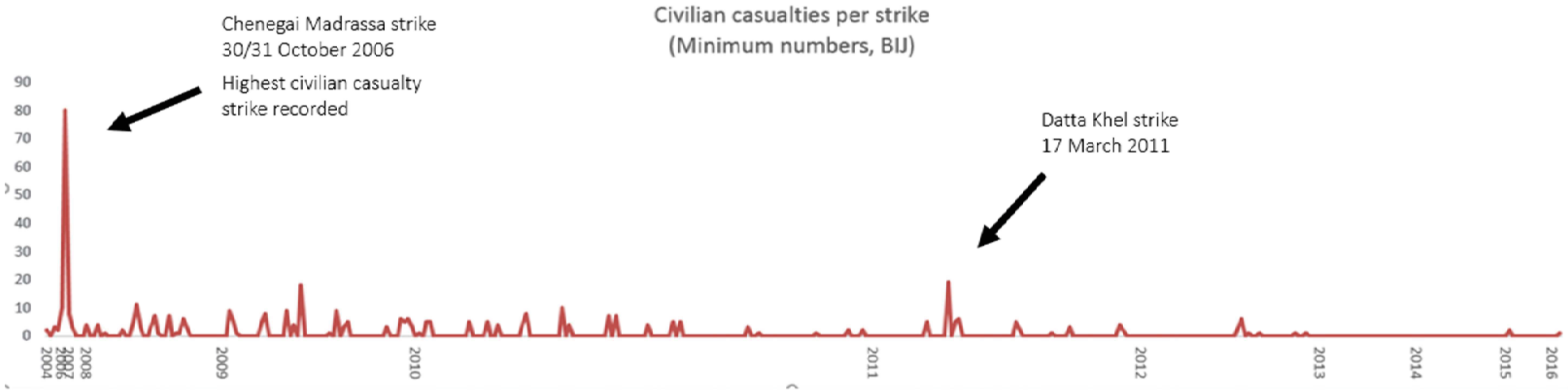
A week later, 42 Pakistani soldiers were killed in a revenge attack.[451] By late November, Pakistan no longer claimed the attack. An aide to Musharraf told the *Sunday Times*: "We thought it would be less damaging if we said we did it rather than the US. But there was a lot of collateral damage and we've requested the Americans not to do it again".[452]

To this day, neither the US government nor the CIA has admitted responsibility for the strike - which would remain the highest civilian-casualty event of the Pakistani operations – even though on the day ABC reported it as a US strike, aimed at killing al-Qaeda leader Ayman al-Zawahiri.[453]

[450] Woods, *Sudden Justice. America's secret drone wars*. p.95. Also see Emmerson, "Report of the Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism." p.13.
[451] Woods, *Sudden Justice. America's secret drone wars*. p.95.
[452] Quoted in ibid. p.96.
[453] Alexis Debat, "Zawahiri Was Target in U.S. Attack on Religious School in Pakistan," *ABC*, 1 November 2006.

Illustration IV.7. Civilian Casualties

Source: Own Illustration, Data by *BIJ*



3.2. Targeted killings

Initially, strikes targeted individuals on the kill list, or 'disposition matrix', such as Taliban leader Mohammad in 2004. The matrix, "a sophisticated grid […], containing biographies of individuals believed to pose a threat to US interests, and their known or suspected locations as well as a range of options for their disposal", formed the basis of the "Terror Tuesday" White House meetings during which targets were nominated.[454]

3.2.1. Niaz Wali Mehsud/ Baitullah Mehsud Strike (23 June 2009)

In the morning of 23 June 2009, missiles killed Niaz Wali Mehsud and five others in South Waziristan. But the mid-level Taliban commander was not the primary target – Wali's death was only the first step in the plan to trap Taliban head Baitullah Mehsud, who the CIA was certain would attend Wali's funeral. When the 5000 funeral guests dispersed, three missiles killed between 60 and 83, many of whom remain unidentified.[455] Mehsud, however, was not among them.

Despite this failure to kill Mehsud (who was killed in a later strike), the set-up shows a remarkable level of planning that went into some of the CIA's strikes. A single strike could involve up to four drones, each having different tasks, such as identifying the target, launching the weapon, or evaluating the effect, including collateral damage.[456] Drone operators followed high-level targets for days, sometimes weeks, developing pattern-of-life analyses that allowed them to identify out-of-the-ordinary behaviour. An intelligence officer reported: "Not only did we need to understand a target so well that we could recite an enemy's life story, but we also were constantly [...] predicting a target's next

[454] Ian Cobain, "Obama's Secret Kill List - the Disposition Matrix," *Guardian*, 14 July 2013.
[455] Joby Warrick, *The Triple Agent: The Al-Qaeda Mole who infiltrated the CIA* (Vintage books, 2012).p.73.
[456] Austin Long – interview with Damian Mencini, "Blast from the Past: Using History to shape targeted strikes policy," *Georgetown Securit Studies Review* (2014).

move."[457] Yet, the fact that Mehsud survived despite the elaborate plan shows the difficulty of definitively identifying targets.

The CIA also used legally controversial tactics, most notably 'double taps', an initial strike followed by another one shortly after.[458] This meant targeting, sometimes deliberately, those coming to the victims' rescue. *BIJ* found at least fifteen attacks on rescuers reported by news media between May 2009 and June 2011.[459]

3.3. Signature strikes

In the opening years, the CIA pursued individuals whose name and affiliation they knew. Over time a new tactic developed: 'signature strikes'. Those targeted were not chosen because of who they were, but because of what they did; not their 'personality', but their 'signature'. Such behaviour could be the handling of weapons and explosives, being at known insurgent spots or in regular contact with insurgents, taking part in hostilities or training, or simply looking like Osama bin Laden.[460]

3.3.1. Datta Khel – 17 March 2011

On 17 March 2011, several missiles fired from a drone killed between 26 and 42 men who had gathered in Datta Khel in North Waziristan. No official statement was made, but a US official told *NYT*: "These people weren't gathering for a bake sale. They were terrorists."[461] The drone feed had shown a "large group of heavily armed men, some of whom were clearly connected to Al Qaeda and all of whom acted in a manner consistent with A.Q.-

[457] Velicovich, *Drone Warrior. An Elite Soldier's Inside Account of the Hunt for America's Most dangerous Enemies*.position 1136. It should be noted that the author was talking about his work on the Iraqi theatre.
[458] Dapo Akande, "US drone strikes in Pakistan: Can it be legal to target rescuers & funeralgoers?," *EJIL Blog* (2012).
[459] Chris Woods and Christina Lamb, "CIA tactics in Pakistan include targeting rescuers and Funerals," *Bureau of Investigative Journalism* (2012).
[460] Woods, *Sudden Justice. America's secret drone wars*. p.114.
[461] Salman Masood and Pir Zubair Shah, "CIA drones kill civilians in Pakistan," *New York Times*, 17 March 2011.

linked militants."[462] But the men gathered at Datta Khel were not 'terrorists'. They were elders meeting in a tribal council to resolve a dispute. *BIJ* later identified 33 of the up to 42 killed, listing all but one as civilian.[463]

The existence of signature strikes had first become known in early 2008, when *NYT* revealed that "[i]nstead of having to confirm the identity of a suspected militant leader before attacking, this shift allowed American operators to strike convoys of vehicles that bear the characteristics of Qaeda or Taliban leaders on the run, for instance."[464] The tactic had thus already developed under Bush, but was largely forgotten or ignored until 2011 when the term reappeared in media coverage and political debate.[465] Today, signature strikes are associated first and foremost with President Obama.[466]

The ratio of signature strikes to personality strikes remains unknown, though some sources claim that most US drone attacks in Pakistan have been signature strikes.[467] Yet, even when strike victims are identified, it is impossible to know whether an individual had been targeted because of their affiliation or because of their signature. The same goes for civilian casualties – were they killed because a high-value target was close-by, by accident, or because they were wrongly identified as militants because of their signature? Successful signature strikes – those that kill (high-level) militants – are rarely identified as

[462] Scott Shane, "Contrasting Reports of Drone Strikes," *New York Times*, 11 August 2011. Also see Woods, *Sudden Justice. America's secret drone wars*. p.114.
[463] "TBIJ strike ID: Ob202, North Waziristan 17/03/2011," *Bureau of Investigative Journalism*.
[464] Schmitt and Sanger, "Pakistan Shift Could Curtail Drone Strikes."
[465] First hits on Factiva on 'signature strikes' used in a drone context are in September 2011 Dexter Filkins, "The Journalist and the Spies," *New Yorker*, 19 September 2011.
[466] Dan De Luce and Paul Mcleary, "Obama's most dangerous drone tactic is here to stay," *Foreign Policy*, 5 April 2016.
[467] Heller, "One hell of a killing machine. Signature Strikes and International Law." p.89. Also see Entous, Gorman, and Barnes, "US tightens drone rules."

such subsequently. This is why the media could portray them as particularly ineffective[468] while US officials claimed the opposite.[469]

Signature strikes remain controversial. Human rights organizations have pointed out that some of the 'signatures', such as carrying weapons or associating with Taliban, is normal behaviour in FATA. A resident reported: "some Taliban had come to the house and asked for lunch. I feared them and was unable to stop them because all the local people must offer them food. They stayed for about one hour and then left. The very next day our house was hit."[470]

The introduction of signature strikes coincided with a general increase in the number of strikes (see illustration IV.6.), and a growing focus on Pakistan, which makes it difficult to draw conclusions. Yet, based on the available data, one can tentatively conclude that the new tactic led to an escalation of the number of drone strikes – but not a higher casualty rate *per strike.*

The development from targeted strikes to signature strikes is unsurprising insofar as it is to be expected as a result of the increased level of observation over an area. "It's like having Google Earth in one area, and you're looking at it constantly, day in, day out, 24-7" a senior US official noted.[471] It is to be expected that the operator will end up seeing something suspicious. Militarily speaking, signature strikes are not that different from strikes on targets of opportunity, a tactic is not drone-specific, but linked to air warfare. Samuel Weber, author of *Targets of Opportunity* notes that "the earliest documented use

[468] Luce and Mcleary, "Obama's most dangerous drone tactic is here to stay."
[469] Entous, Gorman, and Barnes, "US tightens drone rules."
[470] Christopher Rogers, "Civilian harm and conflict in Northwest pakistan," (New York: Center for Civilians in Conflict, Columbia Law School Human Rights Clinic, 2010).p.81.
[471] Greg Jaffe and Karen DeYoung, "US drones on hunt in Yemen," *Washington Post*, 7 November 2010.

I have found relates to [...] instructions given American pilots, who, after striking their assigned targets, were encouraged to look for 'targets of opportunity', that is, targets that were not foreseen or planned".[472] Yet, the level of intelligence and ability to identify highly specific 'signatures' much increased because of the sensors on drones. Drones turned targets of opportunity into signature strikes.

3.4. Debate about casualties

The question of how many civilian casualties have been caused by drone strikes remains one of the most hotly discussed issues and has motivated the work of many anti-drone groups. In July 2016 – twelve years after the first US drone strike in Pakistan – the Obama administration released a long-awaited assessment of the death toll US's drones caused. Focusing only on strikes between 20 January 2009 and 31 December 2015, it listed 473 strikes against "terrorist targets outside areas of active hostilities", meaning anywhere in the world excluding Afghanistan, Iraq, and Syria. While not broken down by country, most of the strikes can be assumed to have taken place in Pakistan. In the document, the US claims to have killed between 2436 and 2697, including 64 to 116 non-combatants. Notable here is the assumed small margin of error of 261 deaths (combatants and non-combatants). *BIJ* for the same period calculates a minimum number of deaths of 2753 for all strikes outside areas of active hostilities (2078 of which were in Pakistan), a number comparatively close to the government's maximum of 2697. But *BIJ*'s number ranges to 4333, almost 2000 more than the maximum the government admits to, and the number

[472] Samuel Weber, *Targets of opportunity: on the militarization of thinking* (New York: Fordham University Press, 2005).p.4.

of civilian casualties recorded by *BIJ* is between six and seven times higher than the US Government's figure.

It is important to note that all casualty estimates are speculative as independent information gathering in FATA is impossible. Pakistani officials rarely discussed casualty figures. President Zardari (2008-2013) remarked: "Collateral damage worries you Americans. It does not worry me."[473] There is no effective government control in FATA and foreigners have limited access; "there are no media organisations with 'deep reporting abilities' in this lawless Taliban-controlled area," Farhat Taj, a drone researcher from the region, underlines.[474] At least one reporter was killed following his reporting on the US involvement in the Pakistan strikes.[475] Furthermore, FATA is home to an entangled web of interest groups, some of which have an interest in inflating, others in lessening the numbers. By cordoning off the strike area, collecting the bodies, and burying them, they can influence the reported numbers and claim the victims were civilians.[476]

While (civilian) casualties have been one of the most contentious issues in the drone debate, and some commentators appear to determine the legality, strategic usefulness, and morality of the campaign by the number of civilian casualties alone, only a few have noticed the intimate relationship between drones and the casualty debate. Whetham notes: "if the weapons are as accurate as is widely asserted then, surely, whatever those weapons hit must be the intended target. This highlights the paradox of precision: that is, the more accurate the weapons employed, the more attention upon any misses or

[473] Quoted in Woodward, *Obama's wars*. p.26.
[474] Farhat Taj, "The year of the drone misinformation," *Small Wars & Insurgencies* 21, no. 3 (2010). p.530.
[475] Shah, "My Drone War ".
[476] Taj, "The year of the drone misinformation." p.530.

mistakes."[477] This perception is prevalent even among FATA inhabitants, making it harder for victims to clear their names in their local community if they have been wrongfully targeted.[478]

Based on the information available, one can conclude that the Obama administration did in fact work to reduce civilian casualties. A drone strike can cause civilian casualties for four reasons: 1) technical problems – the drones' sensors identify and designate the wrong target, or its missile swears off course; 2) faulty intelligence – the missile strikes its target, but the information on which the target assessment was made was faulty; 3) acceptance of civilian casualties – a commander may accept civilian casualties, even in high numbers, if the target is judged to be important (such as for high-value targets); 4) carelessness or deliberate targeting of civilians.

Under President Obama, drone strikes in Pakistan killed almost six times more people than under the Bush administration, and yet the strikes caused not even twice as many civilian casualties. The ratio of civilian deaths per strikes sunk notably over time.

[477] David Whetham, "Killer Drones: the Moral Ups and Downs," *The RUSI Journal* 158, no. 3 (2013).p.27.
[478] Christopher Rogers, "Civilians in armed conflict," *Campaign for Innocent Victims in Conflict* (2010). p.61.

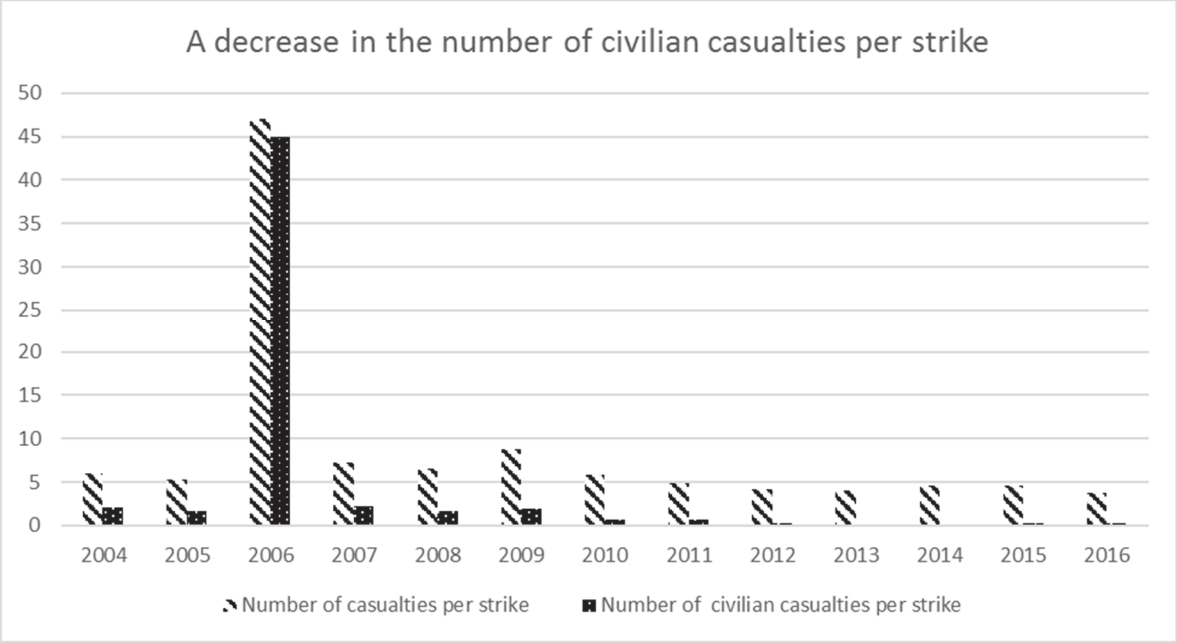


Illustration IV. 8. Casualties and Civilian Casualties

Presidency	Strikes	Minimum people killed	Maximum people killed	Minimum civilians killed	Maximum civilians killed
George W. Bush 20 Jan 2001 – 20 Jan 2009	51	410	595	167	332
Barack Obama 20 Jan 2009 – 20 Jan 2017	373	2089	3406	257	634

This could be explained by improved technology (1). But while US unmanned technology was continuously upgraded, and the Reaper eventually replaced the Predator, there have been no sufficient step-changes to explain the decrease in civilian casualties. Intelligence (2) may have improved with increased numbers of drones, and more experienced operators. The net of informants on the ground may also have grown – but this is speculation. A change in policy due to a desire to keep civilian casualty numbers down

appears more likely (3 & 4). This hypothesis is supported by a policy change in the Afghanistan campaign. ISAF forces saw civilian casualties as a key factor for the growth of the Taliban and from 2007 onwards, and particularly after 2009, ISAF introduced more stringent rules for airstrikes and raids. A new policy forbade attacks on civilian or religious structures in all but the most exceptional circumstances.[479] Operators also reported about practices such as 'shifting cold', to divert missiles at the last second: "If civilians came into view on our monitor, the sensor operator had a location on the ground to shift the laser, which would divert the Hellfire to a safe area with no civilians."[480] Most likely as a result of these policies, ISAF-caused civilian deaths as a percentage of total deaths in Afghanistan decreased from 39% to 9% between 2008 and 2012.[481] The rate of civilian casualties per airstrike decreased nearly three-fold.[482] Although this is not proven, it is likely that success of these measures, combined with the continuous debate about drone casualties, may have influenced the approach in Pakistan, leading to fewer civilian casualties there as well.

3.5. Adaptation and countermeasures

Despite the decade-long operations, there has been no effective development to counter drones by the Taliban or other militants in Pakistan, such as trying to shoot them down or jam their signals. Operators however noticed changes in behaviour, such as the avoidance of electronic devices (Osama bin Laden was famously found because his compound suspiciously had no internet connection). They would no longer gather in huge numbers,

[479] Woods, *Sudden Justice. America's secret drone wars*. p.162.
[480] Velicovich, *Drone Warrior. An Elite Soldier's Inside Account of the Hunt for America's Most dangerous Enemies*.1536
[481] Christopher Rogers, Rachel Reid, and Chris Kolenda, "The Strategic Costs of Civilian Harm," ed. Open Society Foundation (2016). p.4.
[482] Ibid. p.34.

and spent their nights outside for safety.[483] Reports have noted similar changes in the civilian population.[484] A drone operator recalls: “our targets drove to the desert to listen and look for us, or just stopped along an empty stretch or road. I could see the paranoia growing in our enemy – the worry about the unblinking eye.”[485]

3.6. Conclusion – A military operation conducted by an intelligence organisation

The US drone operations in Pakistan are the best-known and – notwithstanding the secrecy that surrounds them – the best researched drone operations. They appeared unique in so far as the drone was (almost) the only means used in this operation. Yet, aerial-systems-only operations are not uncommon; Operation Deliberate Force in Bosnia in 1995, or, more recently, the Libya operations, were exclusively done from the air. Priya Satia compares the US operations in AfPak with the post-WWI British aerial surveillance of present-day Iraq, arguing that “American military and intelligence institutions actively learned from British experience”.[486] In this regard, the “drone war” in Pakistan does not appear fundamentally different from previous operations.

Militarily, the exclusive focus on individuals, instead of military installations or collected bodies of troops, is unusual. Targeted killings and signature strikes, (that, militarily, are very similar to strikes on targets of opportunity) are not a new element of military operations, but it is unusual that they are the only element of a long-term military operation. This focus on individuals is however much less unusual for an intelligence agency operation, in particular the CIA, which carried out targeted killings before the

[483] Shah, "My Drone War ".
[484] "Living under drones. Death, Injury, and Trauma to Civilians from US drone practices in Pakistan."
[485] Velicovich, *Drone Warrior. An Elite Soldier's Inside Account of the Hunt for America's Most dangerous Enemies*.position1724.
[486] Satia, "Drones: a history from the British Middle East." p.15.

advent of drones (see more on targeted killing in the analysis of the drone doctrine below).

Thus, militarily speaking, the US operation in Pakistan is not revolutionary novel, although unusual. Instead, the particularity of the Pakistan operation is that it was an operation that normally would have been conducted by armed forces, was conducted by an intelligence agency (using military personnel, see below). Drones facilitated this development, but it is not inconceivable, and in fact not unlikely, that without drones, another type of Pakistan operation would have been mounted by the CIA.

4. UAVs in US doctrinal and strategic thinking

US doctrinal and strategic writing is extensive, with *National Security Strategies, Quadrennial Defense Reviews,* and *Joint Visions* detailing the superpower's strategic thinking. On UAVs specifically, there are *Unmanned Systems Roadmaps*, *Unmanned Aircraft Systems Flight Plans,* and *Unmanned Aerial Vehicle Battlelabs*. Yet, to the commentariat, it remains decisively unclear whether the US does in fact have a "strategy of drone warfare",[487] whether drones are the "centrepiece of US counterterrorism strategy",[488] or whether "using the predator [is] a tactic, not a strategy".[489] This confusion has been created by the secrecy around drone usage and the strategic thinking behind it, as well as the wealth of material.

4.1. A military doctrine for drones

Over the last 17 years, different branches of the US military and the DoD have published various studies and reports on how to best use unmanned aerial vehicles. Getting a grasp

[487] Fowler, "The Strategy of Drone Warfare."
[488] Daniel Byman, "Why Drones Work. The Case for Washington's Weapon of Choice," *Foreign Affairs* July/August (2013).
[489] Mayer, "The Predator War."

of this material is a challenge – not just for researchers but also for the military, as the question arises as how to coherently combine the thinking and how to translate it into practice. This struggle can be observed in the changes in the seven *Unmanned Systems Roadmaps* published between 2000 and 2013. The 2000 Roadmap predicted "a major role [for UAVs] in the increasingly dynamic battle control", and advocated that "whenever possible, UAVs should be the preferred solution over their manned counterparts for […] the dull, […] dirty, and dangerous." The first three Roadmaps emphasised that: "The potential for using UAS in new and innovative ways has long been acknowledged by many in the military establishment".[490] By 2005 that potential appeared to have materialised:

> "UA have matured to the point where one no longer needs to 'look for niche missions'. […] The U.S. can develop a UA to accomplish almost any mission imaginable. Instead of asking, 'Can we find a mission for this UA?' one will ask 'Why are we still doing this mission with a human?'."[491]

From there on, however, the roadmaps began to emphasise, ever more urgently, standardisation and jointness. By 2013, UAV development appeared out of hand: "Technology is evolving rapidly, and this fast evolution is challenging regulatory authorities to keep pace with needed rules and regulations as well as challenging military departments to keep costs down when abiding by DoD acquisition and management processes".[492] Phrases such as "immature" and "need for long-term sustainment" appeared, and "challenges introduced by the rapid acquisition and fielding of unmanned systems" were discussed.

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[490] Roadmap 2000, p.43; Roadmap 2003 p.45; 2005 p.64.
[491] Roadmap 2005, p.A1.
[492] "Unmanned Systems Integrated Roadmap FY2013-2038," ed. Department of Defence (Washington DC: 2014).p.91.

In the *Quadrennial Defense Reviews* (QDR 1997, 2001, 2006, 2010, 2014) one can trace the development from IT-RMA to drones – though drones never got the same level of enthusiasm as the IT-RMA. QDRs 1997 and 2001 were written during the IT-RMA heyday and defined the exploitation of the RMA as a main commitment to prepare for an uncertain future. By 2006, the RMA references had disappeared, but UAVs were increasingly mentioned, mainly for use by special forces and for counter-terrorism missions. 2006 outlined a US strategy with much stronger Special Forces, and more UAVs. QDR 2010 and 2014 advocated an expansion of UAV – "super-size my drone fleet", *Wired* commented.[493] QDR 2014 emphasised the role of drones in 'light footprint' operations.

Even the UAV Roadmaps – documents specifically written to take advantage of the new technology – saw UAVs through the prism of manned systems. They compared their capabilities to manned systems and aimed at substituting manned with unmanned. The 2002 Roadmap predicted that "ten years hence (2012), DoD will probably be operating F-16-size UAVs capable of supporting a variety of combat and combat support missions".[494] Early publications were more innovative; The 1993 *Joint Tactics, Techniques, and Procedures for Unmanned Aerial* describes a wealth of possible drone missions ranging from ISR, deception operations, electronic warfare, psychological operations, including leaflet delivery and broadcast, to radio and data relay, and more.[495]

As to the revolutionary nature of drones, the official documents mostly avoided the designation. The 2013 Roadmap referred to UAV's revolutionary potential – but

[493] Nathan Hodge, "Pentagon Master Plan. Super-size my drone fleet," *Wired*, 28 January 2010.
[494] Roadmap 2002,p.iv.
[495] "Joint Tactics, Techniques, and Procedures for Unmanned Aerial," ed. Office of the Chairman the Joint Chiefs of Staff (1993).

interestingly used it as an excuse: “There will always be regulatory uncertainty when a revolutionary technology is introduced, as is the case with unmanned systems“.[496]

Remarkably, the Roadmaps showed an early realisation of the role of public opinion on drones. Roadmaps 2002 and 2005 noted: “improving reliability is key to winning the confidence of the general public”.[497] The 2007 roadmap saw the public attention positively: “The attention such systems have received in the news media acts to increase public acceptance of these systems and to allay concerns over privacy issues raised in some quarters. Societal acceptance typically leads to market growth, which stimulates R&D that can lead to more capable, less costly unmanned systems for defense.”[498]

4.2. A strategy for secret drone warfare

The US has never fully laid out the strategy behind the extensive covert drone operations in Pakistan and elsewhere. National Security Strategy 2010 came closest: while not specifically mentioning drones,[499] NSS 2010 outlined a strategy focused on “waging a global campaign against al-Qaeda and its terrorist affiliates”, citing Afghanistan and Pakistan as epicentres of the violent extremism practised by al-Qaeda, and naming Yemen, Somalia, the Maghreb, and the Sahel as terrorist safe havens. The aim was to “keep the pressure on al-Qaeda” and “disrupt terrorist operations before they mature”. According to this document though, this was supposed to be achieved by “strengthen[ing] Pakistan’s capacity to target violent extremists within its borders, and continue to provide security assistance to support those efforts”.[500]

[496] Roadmap 2013, p.81.
[497] Roadmap 2002, p.48. 2005, Appendix.
[498] Roadmap 2007-2032, p.48.
[499] This is unsurprising as NSS are high level, grand strategy documents.
[500] "National Security Strategy," ed. President of the United States (Washington DC: 2010).

Of course, the actual US strategy was considerably more lethal than the NSS suggested. But this strategy has not been written down in official documents. Rather, it was revealed through actions, and, belatedly, some key speeches and declassified documents, among them, most notably, President Obama's speech at the National University on 23 May 2013, a fact sheet published alongside that speech, and the 2013 Presidential Policy Guidance (PPG, declassified in 2016 following a lawsuit by the American Civil Liberties Union).

The US strategy as explained by the Obama administration aimed to;

…disrupt terrorist attacks on the US and its allies: "we act against terrorists who pose a continuing and imminent threat to the American people, and when there are no other governments capable of effectively addressing the threat."[501] "Plots have been disrupted that would have targeted international aviation, US transit systems, European cities and our troops in Afghanistan. These strikes have saved lives."[502]

…anywhere in the world: While the Obama administration abolished the term Global War on Terror,[503] through its action it endorsed lethal operations on an unprecedented geographical scale. This is reminiscent of Israeli strategy: "We operate everywhere we can hit terrorist infrastructure – in nearby places, in places further away, anywhere we can strike them in a way that increases deterrence… everyone can use their imagination. Those who need to know, know there is not place where Israel cannot operate."[504]

[501] Barack Obama, "Remarks by the President at the National Defense University," *The White House* (2013).
[502] "Fact Sheet: The President's May 23 Speech on Counterterrorism," ed. The White House Office of the Press Secretary (Washington DC: 2013).
[503] Oliver Burkeman, "Obama Administration says Goodbye to 'War on Terror'," *Guardian*, 25 March 2009.
[504] Avery Plaw, Matthew S Fricker, and Carlos Colon, *The Drone Debate: A Primer on the US Use of Unmanned Aircraft Outside Conventional Battlefields* (Rowman & Littlefield, 2015). p.307.

…though the capture or killing of terrorists (with a particular focus on limiting civilian casualties): "Lethal force will not be proposed […] as a substitute for prosecuting a terrorist suspect in a civilian court or a military commission."[505] "Direct action will be taken only if there is near certainty that the action can be taken without injuring or killing non-combatants".[506]

But this strategy, which the Obama administration eventually made public, was incomplete insofar as it downplayed several elements. In an effort to limit debate about the strategy's more controversial aspects, the administration made its actions appear less strategic and thought-through that they were revealed to be. The complete US strategy, as demonstrated in Pakistan, can be formulated as thus: *A strategy of killings with drones, to reduce the geopolitical and domestic threat from terrorist groups anywhere in the world, carried out by secret services and with no defined end date.*

The underplayed elements included:

Centrality of drones: The Obama administration consistently downplayed the role of UAVs, barely mentioning the tool with which the lethal strikes were carried out. Sarah Kreps estimates that of the over 400 non-battlefield targeted killings undertaken by the United States between November 2002 and early 2014, approximately 98% were conducted by drones.[507] Drones were central to the strategy.

Focus on kinetic action (in form of targeted killings and signature strikes): Despite assertions to the contrary, killing rather than capturing has become US strategy. This

[505] *Unwinnable: Britain's War in Afghanistan, 2001–2014* (London Bodley Head, 2017).
[506] Ibid.p.1.
[507] The remaining attacks were JSOC raids, or attacks by gunships and cruise missiles. Sarah Kreps, "The Foreign Policy Essay: Preventing the Proliferation of Armed Drone," *Lawfare*, 13 April 2014.

change was at least partly a consequence of the scandals surrounding US prisoner rendition, detention, and interrogation practices. When President Obama came to power, he publicly opposed enhanced interrogation practices and vowed to close Guantanamo. By 2017, more than three times as many people have been killed by drones in Pakistan alone than had ever been imprisoned at Guantanamo.

Geopolitical approach: Despite the official focus on imminent threats, the US not only targeted those directly involved in the plotting of attacks, but aimed at suppressing the organisation of groups that could present a danger later. The US also carried out kills for its allies, as demonstrated by the good-will-kills in Pakistan, acting as the "counterinsurgency Air Force" of Pakistan, Yemen, and Somalia.[508]

'Lidism': The administration has not explained in detail the reasoning behind signature strikes. While signature strikes appear to have developed in an organic way, they represented a strategic change from "anti-individual" operations to "anti-network" operations, as an Obama advisor noted.[509] A CIA operative concurred: "there was a sense in the situation room that we were good at decapitating AQ, but not enough to dry up recruitment, not strategic enough".[510] Hence, instead of aiming at annihilating terrorist groups through a decapitation strategy, the strategy evolved into one of mitigation. The aim became to keep the threat below a certain level. Critical voices speak of 'a game of Whac-A-Mole', or 'mowing the grass', not only denouncing what they perceived to be a dehumanising approach but implying that no matter how often the grass is cut, it always grows back. A mitigation strategy is not aimed at winning. But, as a former Obama advisor

[508] Justin Elliott, "Have US Drones become a 'counterinsurgency Air Force' for our Allies?," *ProPublica*, 27 November 2012.
[509] Interview Anonymous July 2017.
[510] Interview Anonymous July 2017.

told me, this strategy is theoretically sustainable forever.[511] The Trump administration that came to power in January 2017 appears to agree with this assessment, continuing the strikes. As a Senator, Barack Obama had warned that the Iraq War would lead to a "US occupation of undetermined length, at undetermined cost, with undetermined consequences".[512] It is difficult to argue that is not what happened with the drone operations.

4.3. Conclusion – little official doctrinal change but the development of a secret global strategy

The study of official writing and the Pakistan missions have shown that the US military did not develop an official, revolutionary doctrine for drones. The documents see drones primarily through manned systems' lenses. The individual military elements of the strategy are not new. Despite executive orders banning assassinations from Presidents Gerald Ford, Jimmy Carter, and Ronald Reagan going back to 1976, and assertions from government officials that "the United States government is very clearly on the record as against targeted assassinations",[513] the US, and particularly the CIA, have a history of targeted killings. The 1976 executive order was in fact a direct reaction to the public outcry after a Senate Select Committee in 1975 revealed several assassination plots during the Cold War.[514] Furthermore, on 3 April 1984, Ronald Reagan signed National Security Decision Directive 138 which laid out "a military strategy that is supportive of an active preventive program to combat state-sponsored terrorism before the terrorists can initiate hostile acts", and which aimed to "shift policy focus from passive to active defense

[511] Interview Anonymous July 2017.
[512] Woodward, *Obama's wars*. p.375.
[513] Joel Greenberg, "Israel affirms policy of assassination militants," *New York Times*, 5 July 2001.
[514] Mencini, "Blast from the Past: Using History to shape targeted strikes policy."

measures".[515] Hence, as Christopher Fuller argues, the Obama Administration's drone program "marks a return to, rather than a departure from, counterterrorism methods developed in the decades preceding 9/11".[516] The killing of Hezbollah commander Imad Mughniyeh in 2008 and the killing of Osama bin Laden by a SEAL team in 2011 are examples of other recent, non-drone based targeted killings.[517]

Militarily speaking, targeted killings are not a revolutionary new tactic. Equally, signature strikes are too similar to strikes on targets of opportunity in a normal warzone to be considered revolutionary. All this means that the US doctrine – how the drone is used – cannot be considered fundamentally novel, or revolutionary.

Yet, although drones are not used in particularly innovative ways, the (largely secret) strategy that developed alongside their use presented a change – though it is unconvincing to argue that drones were the sole catalyst for this strategy. In the same way that drones did not come about because of one single technological change, but the combination of several, the US strategy around drones consists of several aspects, that together are more than the sum of its parts. US strategy in Pakistan started out with the tactic of targeted killings used in a counterterrorism context, but over time evolved into a more complete strategy. Signature strikes moved the US from a counterterrorism to a counterinsurgency strategy, meaning that no longer known individual terrorists were the target but the (unknown) members of networks. From what is known, this development may only have partly been due to a deliberate change in strategic thinking, and may have come out as the continuous ISR revealed targets of opportunity. Yet, as of 2017, one can

[515] Quoted in Fuller, "The Eagle Comes Home to Roost: The Historical Origins of the CIA's Lethal Drone Program."p.778.
[516] Ibid. p.769.
[517] Plaw, Fricker, and Colon, *The Drone Debate: A Primer on the US Use of Unmanned Aircraft Outside Conventional Battlefields*. p.332.

identify a coherent strategy aimed at depressing the formation and organisation of terrorist groups in ungoverned places around the world, in which drones play a crucial role.

5. Organisational changes[518]

5.1. A new class of soldiers

Operating drones – 'unmanned' as they may be – requires personnel. UAVs' introduction led to the creation of a new class of soldiers: the UAV operator. The US trained thousands of operators in the last decade. The Air Force initially reassigned pilots of manned systems who retrained in a four-month course. As USAF pilots carried out remote-split operations, the training period was the only time that pilot and aircraft were at the same location.[519] In 2009, USAF created a special track for UAV pilots who had no experience flying manned systems. These soldiers first attended an undergraduate UAS training, during which they learned to fly small manned aircraft and then followed the former pilots' training regime.

The US military branches did not – and as of 2017 still do not – have a unified training regime for drone operators, nor common standards for which personnel could operate which systems, or even common job titles. Rather, the 2013 Roadmap deplores, there were "varying mixes of organic and nonorganic UAS training, a variety of approaches for the different groups of UAS, and various personnel strategies".[520]

[518] This section focuses on the experiences of US Air Force only, as USAF pilots flew the Pakistan operations.
[519] Robert Dorr, "Booth Flying " *Air International* (2012).
[520] Unmanned Systems Integrated Roadmap 2013-2038, p.103.

Table 1: Position Terms and Personnel Staffing Strategies Used by the Military Services for Unmanned Aerial System Pilots

Service	Term used for Unmanned Aerial System (UAS) pilots	Personnel assigned to be UAS pilots	Use of manned-aircraft pilots as UAS pilots	UAS pilot specialist career	Manned-aircraft training of personnel
Air Force	Remotely piloted aircraft pilot	Officers	Yes	Yes	• All personnel receive manned-aircraft flight training
Army	Unmanned aircraft system operator	Officers overseeing enlisted personnel[a]	No	Yes	• No personnel receive manned-aircraft flight training
Marine Corps	Unmanned aircraft commander	Officers overseeing enlisted personnel[b]	Yes	Yes	• All personnel receive manned-aircraft flight training
Navy	Air vehicle operator	Officers	Yes	No	• All personnel are manned-aircraft pilots and receive manned-aircraft flight training

Source: GAO analysis of DOD data | GAO-15-461

[a]The Army also assigns warrant officers who specialize as UAS Operations Technicians. These personnel develop UAS requirements, coordinate airspace requirements, and act as the Army liaisons for all UAS missions.

[b]The Marine Corps assigns enlisted personnel to operate the flight controls of a UAS and to operate UAS sensors as well as officers as part of the UAS aircrew to oversee the actions of the enlisted aircrew.

Illustration IV.9. Training Situation as of 2015

Source: Government Accountability Office (2015)[521]

As UAVs were rapidly introduced into the military and quickly sent into theatre, the services struggled to provide adequate training, which ended up being "always one or more steps out of phase with the capabilities being incrementally fielded".[522] Despite this issue being raised early on, it persisted. Four years later, in 2009 a USAF official noted "instead of establishing weapons schools when we should have, we've just pushed our assets to the fight."[523] Four years after that, the next Roadmap warned that the military was "playing catch-up to provide training support for the rapid fielding of unmanned systems".[524] There are no detailed statistics, but several accidents of US drones have been attributed to pilot error,[525] possibly linked to insufficient training.

[521] "UAS Actions needed to improve DoD Pilot training." p.8.

[522] Roadmap 2005-2030, p.63.

[523] Caitlin Harrington, "USAF moves ahead with UAV training plans," *Jane's Defence Weekly* (2009).

[524] Roadmap 2013-2038, p.103.

In addition to struggling with streamlining training, the US, particularly the USAF, lacked pilots. USAF had over 1000 Predator and Reaper operators in 2017, more than for any manned systems,[526] and a yearly output of c.180 pilots per year, but almost double that was needed.[527] Because of these shortfalls, drone pilot would log 900-1800 hours/year compared to 300 hours/year for other Air Force pilots, and work six or seven days a week.[528] In this context, USAF struggled to retain its pilots. In 2015, according to a DoD report, 240 trained UAV pilots quit their jobs.[529] A 2015 internal Air Force service memo described the manning problem as so acute that it would not be able fulfil DoD's demand for 65 drone CAPs per day. (The number was later reduced, for the first time in eight years).[530] The Air Force only had eight people to operate one CAP – below the absolute minimum of 8.5 and significantly below the ideal crew number of ten.

USAF officials acknowledged stress as a reason pilots were leaving the service,[531] but were more reluctant to admit that internal problems added to pilots' discontent. Namely, drone pilots reported feeling like second-class citizens, scorned by their colleagues. This was at full play in 2013, when protests by servicemen and veterans led newly-minted Secretary of Defense Hagel to abandon the Distinguished Warfare Medal, a service medal for drone pilots that his predecessor had created only months earlier.[532] The Air Force tried to solve the problem with money, giving pilots bonuses of up to 50 000 USD. Yet, an operator

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[525] Craig Whitlock, "Drone crashes pile up abroad," *Washington Post*, 1 December 2012.
[526] Oriana Pawlyk, "Drone Milestone: more RPA jobs than any other pilot position," *Military.com* (2017).
[527] Marina Malenic, "USAF reduces MQ-1/9 Caps to ease 'stress' on UAV pilots," *Jane's Defence Weekly* (2015).
[528] Pratap Chatterjee, "American Drone Operators are quitting in record numbers," *Nation* (2015).
[529] Ibid.
[530] Dave Majumdar, "Exclusive: US Drone fleet at 'breaking point' Air Force says," *Daily beast*, 1 April 2015. And Malenic, "USAF reduces MQ-1/9 Caps to ease 'stress' on UAV pilots."
[531] Chatterjee, "American Drone Operators are quitting in record numbers."
[532] "Statement by Secretary of Defense Chuck Hagel on the distinguished Warfare medal," ed. Department of Defense (2013).

complained: “What the Air Force doesn’t get is that they can’t throw money at us to make us happy. I didn’t even know how much a pilot made when I enlisted.”[533]

While the USAF personnel were not pleased, drone operations presented an opportunity for the Air National Guard (ANG). From 2007 onwards, over a dozen ANG units phased out manned aircraft and converted to UAVs.[534] ANG units staffed Predator or Reaper surveillance missions over Iraq or Afghanistan, and in 2015 flew eleven out of the Air Force’s 60 CAPs[535] - a development that considerably changed the ANG personnel’s work, as they suddenly came to fight in Afghanistan and Iraq every day.

5.2. From intelligence service to military organisation – the role of the CIA

The US armed forces attitude towards drones was ambivalent. The DoD’s FY2009-2034 Unmanned Systems Integrated Roadmap noted that there has been “no broad spectrum of acceptance” and “no consistent top-level advocacy” of drones in the military. Indeed, the military establishment in the US, particularly in the Air Force, was initially sceptical of drones. The Defense Airborne Reconnaissance Office, founded by Congress in 1993 with the explicit aim to provide increased support for airborne reconnaissance systems throughout the military, met resistance from Air Force officials. “The pilot-dominated Air Force hierarchy has always been biased against UAVs”, Kenneth Israel, the office’s head complained.[536] Defense Secretary Robert Gates (2006-2011) played an important role in helping the Air Force to overcome its “white scarf syndrome” – the organisation’s preference for manned versus unmanned systems.[537] Gates considered UAVs “a new piece

[533] Elijah Solomon Hurwitz, "Drone Pilots: ‘Overpaid, Underworked, and Bored’," *Motherjones* (2013).
[534] Dan Gettinger, "National Guard Drones," *Center for the Study of the Drone* (2015).
[535] "Posture Statement National Guard Bureau," ed. Department of Defence (2015).
[536] Thomas E. Ricks and Anne Marie Squeo, "Sticking to its Guns," *Wall Street Journal*, 12 October 1999.
[537] Patton, "Robots with the right stuff."

of the equation" and "an increasing part of the Air Force going forward."[538] He appointed the pro-drone Chief of Staff Michael Moseley who introduced important organisational reforms. Gates also supported the targeted killing programme, calling it "immensely useful" and "very precise".[539] Yet, the change in attitude seemed largely linked to his person; to some extent, UAVs remained "Unloved Aerial Vehicles".[540]

This (initial) reticence by the Air Force to embrace UAVs has helped their adoption by the Central Intelligence Agency. David Hambling goes as far as to argue that drones found their place in the US military "only with remarkable assistance from the CIA. […] Spies heart drones", he writes.[541] The adoption of modern drones in the US fundamentally changed the role of the CIA, and led to its militarisation.

The CIA used surveillance drones early – it deployed Predator's predecessor GNAT in Albania and Yugoslavia in the 1990s – but did not immediately jump on the opportunity to arm them. The CIA flew the Predator for the first time on 7 September 2000, to collect "actionable intelligence of on-the-ground terrorist activity" over Afghanistan.[542] That the CIA, rather than the military, operated these flights was the result of a policy that had evolved during the Cold War, according to which peacetime reconnaissance flights over the territory of a potential enemy power were entrusted to the intelligence agency.[543]

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[538] Rebecca Grant, "The Evolution of Airpower under Gates," *Air Force Magazine* 2011.
[539] Jack Goldsmith, "Robert Gates on drones," *Lawfare*, 15 February 2013.
[540] Spinetta and Cummings, "Unloved Aerial Vehicles."
[541] Hambling, *Swarm Troopers*. p.26.
[542] "The Rise of UBL and Al-Qa'ida and the Intelligence Community Response," in *Central Intelligence Agency Analytic Report* (2004).p.61.
[543] Pedlow and Welzenbach (1992) *The Central Intelligence Agency and Overhead Reconnaissance*. Washington, DC: History Staff Central Intelligence Agency, cited in Kindervater, "The emergence of lethal surveillance: Watching and killing in the history of drone technology."

The arming of Predator in 2001 led to a "considerable debate within the Agency" about whether the CIA should use the weapon.[544] In early September 2001, CIA director Tenet argued that it would be "a terrible mistake for the Director of Central Intelligence to fire a weapon like this".[545] Richard Clarke, the top White House official responsible for counterterrorism under Clinton and Bush, added: "The corporate view inside CIA was 'We don't want to do covert action. And if we do covert action, we want it to be neat and clean. We don't want to be involved in killing people. Because we're not like that. We're not Mossad'".[546] This view changed with 9/11.

9/11 was a watershed moment for the CIA's drone use, even more so than for the overall development of (armed) drones, as it led the CIA to abandon its concerns over using armed unmanned systems. The CIA's willingness to fly armed drones and resort to killing rather than capture was also augmented by the scandals around the CIA's detention and interrogation methods, and the CIA's extraordinary renditions programme. Renditions had already been a first step from information hunting to people hunting, a development that took another step with armed drones: "CIA case officers and analysts had once used the term 'targeting' as they made decisions about which foreign government official should be targeted for information or which foreign national could be turned into a CIA informant. Eventually, 'targeting' came to mean something quite different […]. It meant tracking down someone deemed a threat to the United States and capturing or killing him."[547]

As the CIA ventured into new terrain, equipped with a state-of-the-art weapons system, the division of assets and labour between CIA and Air Force became blurred. Despite initial

[544] "The Rise of UBL and Al-Qa'ida and the Intelligence Community Response."p.61.
[545] Quoted in Mayer, "The Predator War."
[546] Mazzetti, *The Way of the Knife*. p.88.
[547] Ibid. p.14.

reports to the contrary,[548] it eventually transpired that regular Air Force drone operators handled CIA operations in Pakistan.[549] For drone pilot Brandon Bryant this was pure bureaucratic cynicism: "The CIA might be the customer, but the Air Force has always flown it. A CIA label is just an excuse to not have to give up any information."[550]

This however created problems on another front. As the CIA was now handling a large-scale military operation, coordination with the DoD and State Department became ever more crucial. Woods describes how the CIA's very first drone strike in Afghanistan led to a three-way fight between Air Force, CENTCOM, and CIA, as the Air Force was kept out of the loop: he cited the USAF officer affected as saying, "Whether out of malice or incompetence I still don't know. […] The first I knew the Predator was [engaged] was when I heard an unknown voice on my radio say, 'You are cleared to fire".[551] These were not just teething problems. Secretary of State Clinton (2009 – 2013) was deeply frustrated by the lack of coordination between the CIA and the State Department about drone strikes which regularly sabotaged her diplomats' work.[552]

5.3. Conclusion – The emergence of a new CIA

The introduction of drones did not cause any immediately visible organisational changes such as the creation of an unmanned branch in the US military.[553] Nevertheless, UAVs' introduction lead to the creation of a new class of soldiers, a significant change. The

[548] Mayer, "The Predator War."
[549] Chris Woods, "CIA's Pakistan Drone Strikes carried out by regular US air force personnel," *Guardian*, 14 April 2014.
[550] Cited in Plaw, Fricker, and Colon, *The Drone Debate: A Primer on the US Use of Unmanned Aircraft Outside Conventional Battlefields*. p.42.
[551] Chris Woods, "The Story of America's very first drone strike," *Atlantic*, 30 May 2015.
[552] Landler, *Alter Egos: Obama's Legacy, Hillary's Promise and the Struggle over American Power*.p.202;116.
[553] The idea had been entertained by Dave Deptula, Deputy Chief of Staff for ISR at Air Force Headquarters, who tried to bring all aspects of armed drones under the control of the Agency, but failed. (Information over email by Chris Woods).

problems with the integration and training of drone personnel that caused pilot shortages and discontent appear to be due to the pace of the systems' introduction and their immediate deployment, rather than drone-specific elements. It will be interesting to see whether the resistance of the Air Force, and the negative reception of drone operators by some of their peers, is US specific or a more general problem.

Most importantly however, the use of drones by the CIA caused a significant transformation of the CIA from an espionage service to a military organisation. Interestingly, this development did not seem to be the result of deliberate decisions. Rather, it was a gradual development, influenced by 9/11, the controversy around enhanced interrogation and extraordinary renditions, and the military's initial reluctance to adopt drones, as well as the CIA's abilities that made it a good at targeted killings. CIA historians may point to previous targeted killings by the CIA and militarisation efforts. In this vein, Christopher Fuller notes that "the militarization of the CIA marks a return to a structure which was first proposed during the Reagan administration by a small group of counter-terrorism hardliners".[554] Yet, this proposed structure was never set up. The scale and extent of the CIA drone programme as it eventually materialised was unprecedented, and can be considered revolutionary.

[554] Fuller, "The Eagle Comes Home to Roost: The Historical Origins of the CIA's Lethal Drone Program." p.773.

6. Social and societal implications

6.1. Soldiers' experience

For the military's organisational structure, the emergence of drone operators[555] was a minor change. For the operators however, a completely different type of work emerged.

6.1.1. Daily work

Commuting to war: Drone pilots often pointed out the unusual situation of not being deployed to the operations theatre, and thus being able to commute to their job in the same way that office employees do. "You leave the house, drive three minutes, and walk into a metal box and it's like walking into central command or Pacific command or another theatre".[556] Although an unambiguous improvement from the outside, drone pilots have reported that it adds stress to their work: "In some ways it's harder. If you have a tough day – for whatever reason – all that stuff, the mission, is classified. You come home and have dinner with your wife and family and, well, you can't tell them anything about what happened."[557]

Continuously in combat: Drone operators are part of the war effort every time they enter the GCS, seeing more of the combat than even those deployed. While other military personnel are deployed for limited lengths of time (most USAF deployments last between 60 and 90 days and the USAF's aim is to not deploy soldiers for more than 90 days/year), drone operators are in combat operations for the whole length of their work, with the only breaks consisting of training or deployments to theatre as part of a forward operating team.

[555] This part focuses on the experiences of USAF drone operators who flew MALE drone missions over Pakistan, but also includes information from Afghanistan and Iraq.
[556] Jason Koebler, "The Curious, Stressful Life of a US Military Drone Pilot," *Motherboard* (2014).
[557] Ibid.

Not one mission, not one war: MALE UAVs are in the air longer than the length of an operator's shift, meaning that most of the time the crew takes over an aircraft that already is on a mission, and at the end of a shift hands it over to the next crew. Even more remarkable is that crews are not restricted to one operating theatre at one time, meaning that, in a given week, a pilot may be tailing a terror suspect in Pakistan, helping out with a search and rescue mission in Afghanistan, and later giving overwatch to troops in Iraq.[558]

A new master: Although it was initially thought otherwise,[559] it eventually transpired that the CIA drones were flown by Air Force drone operators rather than specific CIA operators.[560] Given the secrecy of this arrangement and mission, little is known as to how that impacted operators, but it can be expected that this meant that operators were less involved in the preparation of the operations and privy to information that led to individuals being targeted.

6.1.2. Experience and perception of warfare

No danger: The most obvious change to drone pilots' experiences compared to other military personnel is that drone operators are in no physical danger. This is not an unheard-of situation in the US military, but until the introduction of remote-split drone operations, there was a trade-off between being out of danger and being directly involved in fighting. ICBM commanders for example were stationed far away from the area of operation and thus out of danger – but they were not directly involved in the operation, sending their missile to a line of coordinates. On the other extreme, infantry soldiers were fully involved in the fighting – but had to put themselves in harm's way for it. This is the

[558] Martin and Sasser, *Predator, The remote-control air war over Iraq and Afghanistan: A Pilot's Story*.
[559] Mayer, "The Predator War."
[560] Woods, "CIA's Pakistan Drone Strikes carried out by regular US air force personnel.", Also see Plaw, Fricker, and Colon, *The Drone Debate: A Primer on the US Use of Unmanned Aircraft Outside Conventional Battlefields*. p.42.

first time in history of warfare that a soldier is in the fight, yet physically removed. “I see my effects, I watched, I listened […]. I’d say we are very much in the fight”, a drone operator underlined.[561]

Intimacy: UAV pilots spend long times monitoring individuals. They establish ‘patterns-of-life’, typical behaviour for a region or person, which allows them to notice something out of the ordinary, or to choose the most opportune moment to carry out a strike. Drone operators thus see their target persons in their everyday lives, while the observed are oblivious of the surveillance. This is an unprecedented level of one-sided intimacy and asymmetric intelligence.

Psychological pressure: It is this intimacy with targets that some operators describe as particularly psychologically taxing, as they may be asked to kill an individual they have spent many virtual hours with. The psychological impact of drone operations on their operators is a hotly debated aspect. An increasing number of studies address this issue,[562] but drone operators’ testimonies suggest that their perception of their role in combat, and their psychological reactions to it, vary widely. Some operators report an emotional distance from their targets: “In the pixels, I’d become desensitized to death”.[563] This fits the concerns of anti-drone activists, that the increased distance leads operators to be alienated from their actions.[564] Yet, other operators consider the distance particularly burdensome: “It was horrifying to know how easy it was. I felt like a coward because I was halfway across the world and the guy never even knew I was there. I felt like I was

[561] Cited in Walter Pincus, "Debates underway on combat drones," *Washington Post*, 25 April 2011.
[562] For the US, the work by Wayne Chappelle is most noteworthy. See for instance Chappelle et al., "Symptoms of psychological distress and post-traumatic stress disorder in United States Air Force “drone” operators."
[563] Velicovich, *Drone Warrior. An Elite Soldier's Inside Account of the Hunt for America's Most dangerous Enemies*.pos.3349.
[564] Laurie Calhoun, "The End of Military Virtue," *Peace review* 23, no. 3 (2011). p.379..

haunted by a legion of the dead. My physical health was gone, my mental health was crumbled".[565] This contradicts the PlayStation narrative of "convenient killing". In fact, many operators specifically reject such claims, as Mark Mazzetti experienced during his visit to an Air Force base: "As more than one pilot at Holloman told me, a bit defensively, 'We're not just playing video games here.'"[566]

6.2. Democratic accountability

As discussed in chapter II, authors have shown concern that the use of drones may undermine democratic control as the public becomes uninterested in military campaigns that do not require the deployment of troops and do not cause casualties on their side. Yet, the analysis of the media debate above has shown that – after they became known – the Pakistan operations have attracted a comparatively high level of attention. It is unlikely that there would have been considerably more public attention if the attacks had been carried out with manned planes. (Boots on the ground usually attract more interest, but it appears unlikely that that would have been the alternative if there had been no drones.) The initial public ignorance had to do with the operation's secrecy as covert operation, more so than with the means of operation. Also, after 16 years of operations, even the Afghanistan operations – which have caused more than 2000 US casualties – have become "the forgotten war", showing that the US public does not stay interested in military operations for a long time, even if they involve ground troops. Yet, once the novelty and controversial elements of drones have worn off, it is conceivable that their use will attract even less attention. Equally, the legal implications of the Pakistan

[565] Quoted in Chatterjee, "American Drone Operators are quitting in record numbers."
[566] Mark Mazzetti, "The Drone Zone," *New York Times*, 6 July 2012.

operations that some fear undermine the working of the political system – "Congress has never formally voted on the so-called "drone war" campaign", Laura Dickinson and Peter W. Singer noted[567] – is also related more to the secrecy of the covert operation than to the means of operation. As the Pakistan campaign is CIA-led and covert, it is not overseen by US Congress but by the House and Senate intelligence committees, while details are withheld from all other members of Congress and the public. This would be the case for any covert CIA campaign and is not particular to drones – though it is debatable whether this oversight is sufficient.[568]

Yet, the US executive has found a loophole that is particular to military UAV use. When the US used UAVs in Libya in 2011, the administration did not attempt to get Congressional approval for the campaign. Challenged on this decision, the White House argued that since only UAVs and some manned aircraft were used, no congressional approval was needed as the "operations [did] not involve sustained fighting or active exchanges of fire with hostile forces, nor [did] they involve the presence of US ground troops, US casualties or a serious threat thereof".[569] Laura Dickinson and Peter W. Singer concluded: "In other words: because US blood would not be at risk, it wasn't warfare".[570]

6.3. Conclusion – A new combat experience

Concerns about a loss of democratic oversight appear somewhat exaggerated with regard to the Pakistan operations, which have received a reasonable amount of attention, specifically *because* UAVs were used in the operation. However, it is likely that this

[567] Laura Dickinson and Peter W Singer, "The Future of War," *DefenceOne* (2015).
[568] "Letters: Sen. Feinstein on drone strikes," *LA Times* 2012. ibid.
[569] Julia Zebley, "Obama releases report justifying actions and cost in Libya," *Jurist* (2011). Also see Office of Legal Counsel memo: "Authority to use military force in Libya," ed. Opinions of the office of legal counsel (2011).p.13.
[570] Dickinson and Singer, "The Future of War."

interest, caused mainly by the novelty of the systems, will die down eventually. As first steps have been taken to justify the bypassing of democratic controls by the executive through the use of drones, the US may consider a reform of its legal system to take the new reality into account.

A fundamentally new situation has been created for drone operators. The new class of soldiers is experiencing combat in a way revolutionary different from any other military personnel. Remote-split operations have caused the end of the trade-off between being far away from the battlefield and being directly involved in operations. This has caused completely new psychological implications that need to be researched further.

7. Conclusion

Has the introduction of drones caused revolutionary change in the US military or the way it carries out its operations? And has the viewing of drones as revolutionary had an impact?

In the US public and media debate, interest in drones throughout the War on Terror was relatively high, but the narrative of drones as revolutionary was not as prevalent as expected. While the Unmanned Revolution appeared sporadically, it was not the determining narrative. Of the stakeholders, the political realm was supportive of this narrative, and the military most sceptical, most likely because of the mixed experiences with the IT-RMA.

The United States have the world's largest drone arsenal and have used it in the drone-only covert Pakistan operations, a type of operation that appears exceptional at first glance. Yet, militarily, the analysis reveals, this operation does not appear revolutionary,

combining well-known tactics of targeted killings and targets of opportunity. The US strategy, while never made completely public, is in fact a coherent strategy aimed at depressing the formation and organisation of terrorist groups in ungoverned places around the world, and so exceptional in its geographical extent. Drones played an important role in the development of the strategy, but were only one of several elements.

The most fundamental changes caused by the introduction of drones in the US were clearly organisational and societal. The transformation of the CIA from an espionage service into a military organisation, a development in which UAVs played a decisive role, fundamentally changed the balance of power within the US security sector and impacted the level of political accountability. The creation of a class of drone operators represents an organisational change, but the most crucial impact which the introduction of drones has caused concerns the individual experience of warfare by drone pilots that do remote-split operations. Their work in almost no way resembles the work of the generations of soldiers, combatants, and warriors that came before them. They face a new reality of warfare, marked by an exceptional level of intimacy with their targets while simultaneously being geographically removed.

V. Germany

This chapter provides a comprehensive review of German unmanned capabilities, use, and changes drones' introduction have caused. The first part details past and current military UAV use, starting in 1971 when the German armed forces made its first experiences with unmanned systems. This is followed by an analysis of the German public and political debate of drones. A third part provides an in-depth analysis of German drone use in Afghanistan between 2003 and 2014. The organic growth of German UAV capabilities allows to trace learning curves and to compare uses of different drone types. This part includes the study of two important incidents – the 'Battle of Good Friday' in April 2010, and 'Operation Halmazag' in October/November 2010. A study of doctrinal documents constitutes the fourth part of the chapter. Eight doctrinal documents published between 2003 and 2013 are being analysed with the aim of exploring whether Germany has developed a coherent drone doctrine and strategy and how drones have influenced doctrinal and strategic thinking. The chapter ends with the study of the organisational impact of drones in the German Bundeswehr and social/societal changes.

1. Background on German UAV use

The Bundeswehr was an early adopter of drone technology. It acquired drones in the 1970s and funded several programmes through the 1980s and 90s. The first Bundeswehr drone, CL-89, was never used outside of training but positive experiences with CL-289 in Kosovo led to support for further development. UAVs' use and development was driven as much by the wish to be a technological leader than by military need. The projects of the 1980s and 90s had been conceived with a Cold War logic of territorial defence in mind, meaning that the systems became largely obsolete while still in development. They also

faced technological difficulties as their requirements were ambitious and much of the technology had not yet reached maturity. While Germany to date does not have armed UAVs, two of five cancelled programmes were armed systems. Today, this is largely forgotten, leading to a mistaken sense of novelty.

1.1. Early beginnings – German UAV systems 1965 - 2009

1.1.1. CL-89[571]

In 1959, Canadair, with funding from the Canadian DoD, began working on a reconnaissance UAV; the UK and West Germany joined the effort in 1963 and 1965. Out of this cooperation developed Canadair CL-89 'midge' (NATO designation AN/USD-501), a 3m long, 90kg, rocket-launched UAV. It was fast (760km/h) but had a short endurance of below one hour. It also lacked the main advantages of today's UAVs: the pictures taken by its optical and infrared camera could only be retrieved and developed once the drone had landed. The drone's flight path was pre-programmed and could not be altered after its launch. CL-89 was eventually employed by the armed forces of Canada, the UK, Germany, France, and Italy, with the German Army acquiring the majority of the 500 systems produced in total. Germany introduced the system into service in 1972 for use by the observation battalion of the artillery.[572]

German CL-89s never saw active operation, contrary to British CL-89s which provided reconnaissance in the 1990/91 Gulf War. By the time of Germany's first participation in a military operation, the system had already been replaced by its successor, CL-289.

[571] Data from: "Canadair CL-89," *Flight Global* (1964), "Drone on test," *Flight Global* (1967), "Canadair CL-89" in: Jane's Information Group., "Jane's unmanned aerial vehicles and targets," (Coulsdon: Jane's Information Group, 1995), Karl Geiger, "Von der Aufklärungsversuchsgruppe zur Drohnen Lehr- und Versuchsstaffel," ed. Gemeinschaft der Heeresflieger Celle-Faßberg (2012).

[572] For a detailled review of CL-89's introduction see Geiger, "Von der Aufklärungsversuchsgruppe zur Drohnen Lehr- und Versuchsstaffel."pp.5ff.

Although CL-89 was never deployed in an operation, the Bundeswehr was very proud of it; a 1990 *Wehrtechnik* article considered the UAV to have done "pioneer work" for international UAV use, outshone, at the time, only by Israel.[573]

1.1.2. CL-289

The first German UAV to see active service was CL-289 (AN/USD-502). It was a German-Canadian-French production, developed in 1976. CL-289 was bigger than CL-89 and offered a greater range. It was launched with a rocket booster and landed with a parachute. CL-289's flightpath was pre-programmed as its predecessor's, but used the recently invented GPS system. Its maximum speed was c.740km/h, but its endurance remained below one hour.[574] The UAV had an optical camera able to take a high number of pictures in short time, and an infrared-camera. One of the most important advantages compared to its predecessor was that the infrared-camera could send back near real-time data to the control station, if within a 70km radius.[575] The daylight camera pictures however still had to be recovered manually, which proved problematic for monitoring moving forces.

CL-289 was introduced in November 1990. The Army (*Heer)* initially planned to buy over 150 vehicles, but reduced these numbers in 1992.[576] Special drone batteries were created (later integrated into observation battalions) each in charge of one CL-289 system. CL-289 was used at corps and divisional level for reconnaissance, target acquisition, and damage assessment, most importantly in Yugoslavia (IFOR/SFOR) in 1997 and Kosovo (KFOR). At

[573] "Drohnen in Deutschland."
[574] "Hochfliegende Pläne," *Y. Das Magazin der Bundeswehr* 2007.
[575] Zaloga, *Unmanned aerial vehicles: robotic air warfare 1917-2007*. p.24.
[576] "Canadair/Dornier CL-289" in: Kenneth Munson (ed.), *Jane's unmanned aerial vehicles and targets*, 1 v. (loose-leaf) vols. (Coulsdon: Jane's Information Group, 1995).

the start of the Kosovo conflict, the Bundeswehr's 100th *Drohnenbatterie* was the only NATO UAV unit in the southern Balkans.[577] German CL-289 flew 182 sorties.[578] An analysis of the Kosovo operations concluded that the drones "provided indispensable contributions" for the allied forces,[579] especially during winter, when CL-289s became the only means of reconnaissance because US Predators and other aircraft had to be withdrawn due to icing problems.[580] 70-90% of the imagery used in Kosovo came from CL-289; Germany lost six vehicles, the only German losses of the conflict.

The MoD was clearly proud of their drones: then-Defence Minister Rühe declared in the Bundestag that "if we did not have the most modern aircraft, if for example we did not have unmanned drones [...] it would be irresponsible to deploy the Armed Forces."[581] His successor Rudolf Scharping proudly (and incorrectly) claimed in the wake of the 1999 Kosovo mission that Germany was "the only country which can do unmanned reconnaissance".[582] Following Kosovo, a modernisation programme was conceived, which in 2003 added a synthetic aperture radar and a moving target indication capability. Yet, CL-289s were not sent to Afghanistan – most likely because the system lacked proper real-time imagery and had low endurance. Some sources also point to high operation costs.[583]

[577] "Germany - Wide Aspirations," *Jane's Defence Weekly* (2006).
[578] Ansgar Rieks and Dieter Weigold, "Der Kosovo-Konflikt," in *Kosovo-Humanitäre Intervention und kooperative Sicherheit in Europa*, ed. Joachim Krause (Opladen: Leske Budrich, 2000). p.31.
[579] Ibid. (particularly p. 32, 34, 49.)
[580] Ripley, "UAVs over Kosovo - did the Earth move?"
[581] "Stenographischer Bericht 248. Sitzung. Bonn, 16. Oktober 1998 ", ed. Deutscher Bundestag (1998). p.23135.
[582] "Geduld und Zaehigkeit," *Spiegel*, 25 January 1999.
[583] Sascha Lange, "Flugroboter statt bemannter Militärflugzeuge?," *SWP Studie* (2003). p.24.

The system was eventually decommissioned in 2009. In its 19 years of existence, German CL-289 had flown for 468 hours in operation.[584]

CL-89 and CL-289 in comparison		
Name	**CL-89**	**CL-289**
NATO designation	AN/USD-501	AN/USD-502
Manufacturer	Canadair	Canadair / Dornier
Beginning of development	1959	1975
In use by Germany	1972 - 1994	1990 - 2009
Type	Fixed-wing, reconnaissance UAV	Fixed-wing reconnaissance UAV
Dimension Wing Span Length Height Max. Weight (incl. payload)	 0,94m (excl. booster): 2,60m 0,33m 108kg	 1,30m (excl. booster): 3,5m 0,38m 295kg
Performance Speed Endurance/radius Ceiling Armament	 c. 740km/h n.a./60km 300m – 3000m none	 c. 740km/h 40 min/200km 125m- 5000m none
Payload	Optical and an infrared camera	Optical and infrared cameras and a radio down-link to base
Used by	*Heer* - Observation Battalion (artillery) (also used by Canada, the UK, and Italy)	*Heer* - *Drohnenbatterie* Used by France until 2010, and Austria
Used for	Division level surveillance	Reconnaissance, target acquisition, and damage assessment
Participation in German military operations	None	Yugoslavia 1997, Kosovo 1999
Other	Given to Turkish armed forces in 1994; Used by the UK in the 1991 Gulf War.	Infrared pictures could be retrieved in-flight, film with the pictures taken by the optical camera needed to be recovered. Later upgraded with a synthetic aperture radar

[584] This number appears low but can be explained by its non-use in Afghanistan, short endurance, and by its high speed that allowed to cover a large area in a short time. Email exchange with Wolfgang Richter, Oberst a.D., February 2014.

1.2 Cancelled German UAV projects

CL-89 and CL-289 do not tell the full story of German drone thinking, as throughout the years, there were several additional German UAV projects. Five such projects existed; KDH/Taifun, Mücke, Fledermaus, DAR, and one more recent, EuroHawk.[585] Even though these plans did not come to fruition, they show the potential the Bundeswehr and industry saw in UAVs. These projects went largely unnoticed, only the EuroHawk

Cancelled German UAV projects				
Name	**KDH/TAIFUN** (KZO family)	**Mücke & Fledermaus** (KZO family)	**DAR**	**EuroHawk**
Manufacturer	Rheinmetall (MBB, STN Atlas, Dornier)	Rheinmetall (STN Atlas Elektronik GmbH, EADS)	Dornier, (IAI)	Northrop Grumman/ Cassidian (EADS)
Type	Anti-tank, armed expendable "kamikaze" UAV	RF jamming and electronic support measures UAV	Anti-radar, armed expendable "kamikaze" UAV	HALE UAV with Signals Intelligence equipment (SIGINT)
Dimensions Wing Span Length Height Max. Weight (incl. payload)	 2,3m 2,8m 1,4m 160kg	 3,42m 2,25m 0,96m M: 190kg, F: 160 kg	 2m 2,3m 0,36m 120kg	 39,9m 14,5m 4,7m c. 14 000kg
Performance Speed Endurance Ceiling Armament	 c. 200km/h 4h > 4000m 20 kg warhead	 200-220km/h 5h 4500m none	 250 km/h- 3h/ 150km 3000m Fragmentation warhead	 575km/h 35h > 20km none
Programme start	1988	1990s	1989	2000
Programme cancellation	2006	M: 2007 F: 2003/ 2013	1992	2013
To be fielded by	1990s, eventually 2005-2011	2005/07	Mid-1990s	2012
Incurred costs	168 million €	17,4 million €	unknown	C.500 million €
Other	IAI's *Harpy* is based on the DAR	KZO variants		Based on the block 20 US *GlobalHawk*

[585] Only projects with Bundeswehr funding are discussed. Industry-only projects are not mentioned.

cancellation in May 2013 caused substantial public debate.

1.2.1 The KZO drone family

In 1979, an ambitious UAV project was conceived, the *KZO* drone family. It began as French-West German cooperation under the name *Brevel*. France withdrew its support in 1996. The system comprised a family of four different UAVs, based on the same model but carrying different payloads. Of the four types, only one saw the light of day – the KZO which was introduced with a delay of more than a decade (see below). Three other types – *KDH, Mücke,* and *Fledermaus* met an inglorious end.

KDH/Taifun, Heer (1989 – 2006)[586]

KDH *Kampfdrohne Heer* ('Combat drone for the Army') was planned to be a tactical-size, fixed-wing armed drone. The requirements for the KDH were ambitious even by today's standards: it should be "able to independently identify enemy tank formations, command posts, and helicopters, recognize them as targets and fight them on the ground".[587] Other sources further mention swarming and autonomy.[588] It was planned to fly for up to four hours at 150km/h and would have carried a 20kg armour-penetrating warhead. KHD, later renamed Taifun ('typhoon'), was clearly influenced by the Cold War as it was designed "for defence against invading enemy armoured formations".[589] The concept phase began in 1988, procurement was planned for the end of the 1990s; that date was later pushed to

[586] Data from "STN Atlas Elektronik KDH (TAIFUN)," *International Defence Review* (1995). Kenneth Munson (ed.), *Jane's unmanned aerial vehicles and targets*, 1 v. (loose-leaf) vols. (Coulsdon: Jane's Information Group, 2004). "Unmanned Aerial Vehicles-Part 1: European Programs," *International Defense Review* (1989). "Germany seeks hard-kill UAV," *International Defence Review* (1995).
[587] Bundesrechnungshof, "Bemerkungen 2009 zur Haushalts- und Wirtschaftsführung des Bundes," (Bonn: 2009). p.156.
[588] "Lenkwaffen/Dispenser-Drohnen," *Wehrtechnik* 1990. p.52.
[589] Ibid. p.52.

2005–2011.[590] The first prototype completed its maiden flight in 2002. The Heer's requirements were for c.1500 units, Austria also considered procurement.[591] The project caused rivalries between Heer and Luftwaffe (Air Force): initially, the Heer had been the more active actor on unmanned systems – but now, Luftwaffe officials found fault with Taifun's operating distance (up to 150km). The Heer, it argued, should only operate within reach of its artillery – c.40km.[592] But Taifun was more guided missile, to be used by the artillery, than a UAV: Taifun swooped into its targets in a terminal dive, the drone being destroyed as a consequence. After many problems, the project was eventually stopped in 2006. A highly critical 2009 Federal Court of Auditors' report criticised unnecessary expenses of €168 million.[593]

Mücke & Fledermaus (1990s – 2013)[594]

Two unarmed UAV types were part of the KZO family: the electronic support and counteraction drones Mücke ('mosquito') and Fledermaus ('bat'). In 1990, the Bundeswehr made a request for a UAV able to jam enemy communications. This led to the development of the 'electronic counteraction drone' Mücke, a variant of KZO, equipped with jamming systems. The Heer's requirements varied substantially over the years, from three systems with 130 air vehicles each in 1990 to eight systems with 12 vehicles in 1995; then the requirement shrunk to six systems. Other sources report a

[590] Bundesrechnungshof, "Bemerkungen 2009 zur Haushalts- und Wirtschaftsführung des Bundes." p.156.
[591] Heinrich Fischer, "Die Artillerietruppe im Heer der Zukunft " *Österreichische Miltärische Zeitschrift* 2004.
[592] "Taifun im Sturzflug," *Spiegel*, 20 May 1996.
[593] Bundesrechnungshof, "Bemerkungen 2009 zur Haushalts- und Wirtschaftsführung des Bundes." p.156.
[594] Data gathered from the following sources: STN ATLAS ELEKTRONIK, "FT2398 ESM Drohnensensorik FLEDERMAUS. Zusammenfassung der Studie/Ausblick " (2002). "Unterrichtung durch den Bundesrechnungshof 15/60," ed. Deutscher Bundestag (Berlin: 2002). pp.200/01 "Fledermaus adds ESM capability to UAVs," *International Defence Review* (2001). (ed.), *Jane's unmanned aerial vehicles and targets*. p.63. Joachim Baeker, "Unmanned Air Vehicles for the Army - Future Concepts," (1999).

requirement for 100 air vehicles in 1995.[595] The Fledermaus ('bat') was conceived in 2000, as KZO variant equipped with an electronic support measures (ESM) payload, supposed to include "detection and localization of hostile radio, radar, and jammer emitters."[596]

Neither of the two systems entered use with the Bundeswehr, and mention of the projects faded in the mid-2000s. A highly critical internal Bundeswehr document from 2002 stated that Fledermaus did "not fulfil the requirements for a long-range signal intelligence, surveillance and reconnaissance". The project was cancelled – de facto in 2003, officially in 2013. The cancellation document assessed that the "capabilities gap remains".[597] In sum, the KZO drone family was a disastrous programme, dragging on over more than a decade and causing hundreds of millions of sunk costs. The one drone which eventually emanated from the project, KZO, entered service a decade late and at considerably higher costs than estimated.

1.2.2. DAR – 'Drohne Anti-Radar' (1989 - 1992)[598]

In 1989, the Luftwaffe signed a contract for the development of an anti-radar drone, DAR, fitted with explosives and designed to combat enemy air defences. DAR was supposed to fly along a pre-programmed path with a reach of several hundred kilometres. Once a target was identified, the drone would nose-dive, destroying the enemy radar upon impact, making DAR a type of loitering munition. Two prototypes were produced, with a wing-span of 2m, a take-off mass of 110kg and a maximum endurance of three hours.

[595] "Unterrichtung durch den Bundesrechnungshof 15/60." p.201.
[596] "Fledermaus adds ESM capability to UAVs."
[597] Projektteam Umklappstrategie CPM, "Umklappentscheidung für Geräteausstattung ESM - Drohne FLEDERMAUS," ed. Bundesministerium der Verteidigung (2013).
[598] Data from: Joachim Nagel, "Die Drohne Anti-Radar (DAR)," *Wehrtechnik* 1990. "Anti-Radar UAVS set for 1990s," *Jane's Defence Weekly* (1988). "Dornes Planned," *International Defense Review* (1991). "Dornier DAR" in: (ed.), *Jane's unmanned aerial vehicles and targets*. "Unmanned Aerial Vehicles-Part 1: European Programs."

Germany had planned to procure 4000plus DAR drones.[599] The system was understood as "baseline air vehicle" on to which could be grafted "additional capabilities such as anti-tank performance and VHF jamming".[600] DAR equally became a casualty of the German post-Cold War defence budget overhaul of 1992.[601]

DAR achieved late success when the project was taken over by the Israeli IAI which went on to produce *Harpy*, a system "virtually identical" to DAR[602] - and highly successful, currently in use with Azerbaijan, China, Israel, South Korea, and Turkey among others.

1.2.3. EuroHawk (2000 – 2013)

The *EuroHawk* is the Bundeswehr's most recent, and most costly, failed UAV project. It attracted considerable attention. The programme began in December 1999 with plans to procure a HALE UAV to replace the out-of-date Brequet Atlantic manned SIGINT plane.[603] As a European HALE development was considered unlikely to yield results in the medium term, negotiations with the US began in 2000. EuroHawk was supposed to enter service with the Luftwaffe in 2012.

EuroHawk was conceived as block 20 variant of Northrop Grumman's GlobalHawk. The airframe would serve as a platform for German (Cassidian-manufactured) SIGINT equipment. The GlobalHawk's span width of 40m was larger than that of most commercial airliners and its endurance of c.35h unprecedented – in one flight, EuroHawk would have

[599] "The UAV goes to war," *Jane's Defence Weekly* (1990).
[600] "Dornes Planned."
[601] "Germany's Air Force post-unification restructuring," *International Defence Review* (1992).
[602] John G. Roos, ""Harpy" Antiradiation Attack Drone Again Seeks Elusive Pentagon Champion," *Armed Forces Journal International* (1990).
[603] "Brief an Staatssekretär Stützle, Bundesverteidigungsministerium, 13 Dezember," (1999).

been able to monitor the complete German territory.[604] Negotiations lasted for 13 years. Bundeswehr officials visited US airbases on several occasions; in 2003, a GlobalHawk underwent testing in Germany.[605] In July 2011, the EuroHawk demonstrator crossed the Atlantic and completed several test flights over German territory. However, as documents reveal,[606] from early on in the project, there had been an array of problems, and delays were caused by the use of all available GlobalHawks in US military engagements of the time.[607]

Eventually, the German side cancelled the programme in May 2013 citing significant barriers to certificating the UAV for flights in civilian airspace as the main reason for the decision. These difficulties were reportedly caused at least in part by Northrop Grumman's objection to sharing details of the construction plans with the German authorities.[608] The cancellation cost about half a billion Euro and caused enormous media attention and political turmoil in Germany.[609] EuroHawk had been presented as milestone of German and European UAV SIGINT development,[610] all the while public opinion in Germany had already turned against UAVs influenced by the US drone use in Pakistan (see below), and the cancellation came amidst heated debates about procurement of armed UAVs for the Bundeswehr.

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[604] Matthias Monroy, "Studie analysiert die Funktionsweise des Spionagesystems ISIS, das EADS für die Bundeswehr baut," in *Netzpolitik.org* (2013).
[605] Siegesmund von Ilsemann, "Flug des Habichts," *Spiegel*, 20 October 2003.
[606] ZEIT has gathered an array of documents relating to the EuroHawk, accessible at *Drohnen-Dokumente*, (2013 [cited 10 August 2014); available from http://www.zeit.de/serie/drohnen-dokumente.
[607] BWB L34, "Ergebnisvermerk betreff Unterarbeitsgruppe Angebotsbewertung SLWÜA/EUROHAWK," (2003).
[608] "Euro Hawk, Drohnenhersteller widerspricht de Maizière," *ZEIT*, 22 May 2013.
[609] Ulrike Franke, "Why the enormous interest in the mothballed Euro Hawk drone deal?," in *Politics In Spires* (2013).
[610] Thomas Horlohe, "Luftwaffe ohne Pilotedn? Wie Drohnen die Luftkriegfuehrung veraendern," *Streitkraefte und Strategien NDR* (2011). Frost & Sullivan, "Study analysing the current activities in the field of UAV." p.15.

Whether the Luftwaffe needed the EuroHawk in earnest has been a point of contention ever since. A detailed newspaper investigation painted the picture of Luftwaffe decision-makers fascinated by drone technology, wanting to acquire it no matter what: "advantages are being emphasised, disadvantages played down. Crucial problems are depicted as being somehow solvable or are being deferred to the future".[611] A 2002 joint Bundeswehr and industry study suggested that a business jet could have fulfilled most of the requirements.[612]

Despite the problems with the EuroHawk, Germany is one of 15 NATO countries that are funding the acquisition of five GlobalHawk systems for NATO, to be based in Sicily, Italy.

1.3. UAVs in the Bundeswehr (as of 2017)

The Bundeswehr has seven UAV types in use as of 2017, and over 600 drone vehicles. All systems are Intelligence, Surveillance, and Reconnaissance systems (ISR). The majority (five) are in use with the Army, Navy and Luftwaffe have one system each. Two systems – DJI Phantom and Black Hornet – have only been introduced in 2017 and will not be discussed here.

[611] Cf. Kai Biermann, "Drohnen-Dokumente Teil 1: Ein Traum von einer Drohne," *ZEIT*, 21 August 2013, Kai Biermann; Carsten Luther; Yassin Musharbash; Thomas Wiegold, "Drohnen-Dokumente Teil 2: Die fremde Drohne," *ZEIT*, 2 September 2013, Philip Faigle, "Drohnen-Dokumente Teil 3: Der Absturz des Eurohawk," *Zeit*, 23 August 2013.

[612] Arbeitsgruppe Systemkonzeptstudie, "Weiträumige Lufgestützte Überwachung und Aufklärung. Ergebnissbericht Phase 1," (Wahn: 2002). p.5.

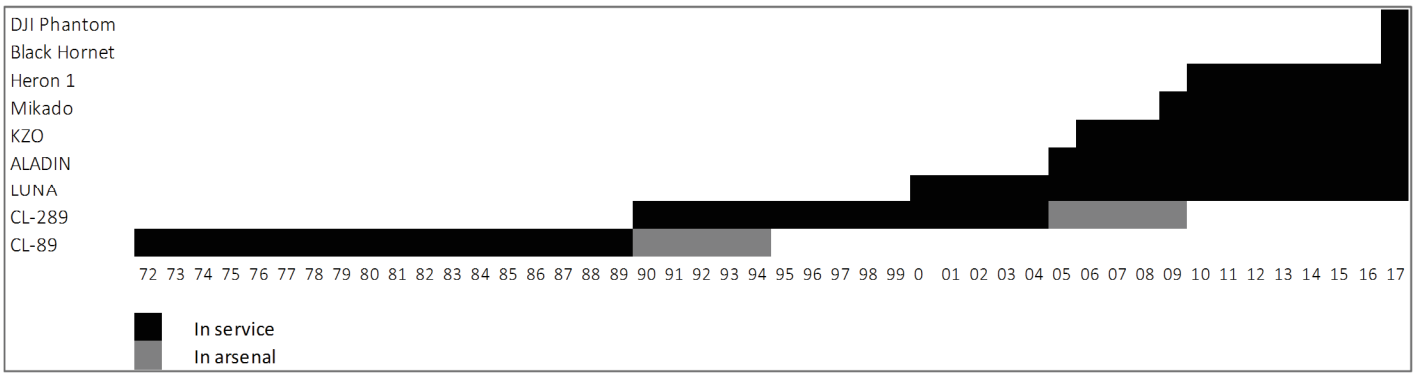


Illustration V.1. Timeline Bundeswehr UAVs

1.3.1. LUNA (2000 -)

With the introduction of LUNA in 2000, the Bundeswehr's first real-time reconnaissance drone, Germany entered the era of modern UAVs. LUNA was a 1.4m long, fixed-wing aircraft with a wing span of 4m and a maximum take-off weight of 40kg. Its payload consisted of video, still image, and infrared cameras. It could be used for reconnaissance in a radius of 50 – 100km and target acquisition.

The project was born out of a Bundeswehr competitive bidding won by EMT Penzberg in 1997. This was the first major drone contract for the south-German manufacturer which went on to become the most important player on the German military drone market. Development was fast; the first eight LUNAs were experimentally fielded three years later by KFOR's German-led Brigade South.[613] During the two-month long operation, LUNAs flew 175 reconnaissance missions. Plans existed to field LUNAs in Iraq in 2003 in support of UN weapon inspectors, a plan that did not come to fruition as the US invaded.[614]

The system's development has been described as "extraordinary successful".[615] It helped that LUNA was developed when major technological advances in crucial drone

[613] "Kosovo testing ground for Luna unmanned air vehicles," *Jane's Defence Weekly* (2001).
[614] Susanne Koelbl, "Deutsche Späher bei Saddam," *Spiegel*, 3 February 2003.
[615] Frank Wasgindt, "LUNA - Eine Erfolgsgeschichte " *Strategie & Technik* Oktober 2007 (2007). p.28.

technologies such as sensors, data storing, and GPS were made. Since its first introduction, LUNA has been upgraded several times. Upgrades included the introduction of better radars, a new landing system as well as a relays capability which allows the UAV to be used in valleys such as in Afghanistan.[616] The Bundeswehr has currently c.80 LUNA air vehicles.

1.3.2. KZO (2005 -)

KZO – 'Small target-locating drone' – is slightly bigger than LUNA but considerably heavier. The UAV is 3,4m long with a wing-span of 2,3m (compared to LUNA's 1,4m/4m). It weights 170kg, over 100kg more than LUNA. It is launched with the help of a rocket booster fixed on a truck, and lands with a parachute. KZO's payload first consisted of infrared sensors; later a real-time camera was added. It has an endurance of up to five hours. Its flight path is pre-programmed but can be altered during flight if necessary.

KZO was introduced into the Bundeswehr in late 2005/early 2006 – 26 years after its conception. Its development was plagued by problems, changes in designs, and the eventual abandonment of the aforementioned ambitious KZO 'drone family' project. Conceived to become Germany's first modern reconnaissance UAV, it was eventually overtaken by LUNA. The project began in 1979 when the Bundeswehr outlined the requirements for a UAV for the artillery, asking, most notably, for real-time capabilities.[617] A French-German Joint venture built the prototype which made its first flights in September 1994. The development of the final system however took longer and was significantly more expensive than planned. By the time series production started in 2000,

[616] Ibid.
[617] Georg Neuhaus, "Ein Stueck vom Himmel fuer das Heer - Sachstand und Perspektiven zu UAS des Heeres," *Wehrtechnischer Report*, no. 7/2011 (2011). p.47.

France had left the cooperation. The French audit court criticized this decision as having come too late, arguing the UAV had lost its appeal with the end of the Cold War.[618] KZO was indeed a Cold War legacy. Originally conceived for battlefield observation in the GDR, its systems were designed for a central-European climate,[619] which later proved problematic in Afghanistan. The German audit court and parliament's budget committee also criticised the project harshly and suggested procuring LUNA instead.[620]

KZO was introduced in 2006 and immediately experimentally fielded in Afghanistan, but only used operationally from 2009 onwards. Plans to combine KZO with loitering munition had existed for several years. The system, called WABEP would have combined KZO and Harop (Israeli-built loitering munition).[621] This project would have effectively turned KZO into an armed drone without the need to call it one, but the idea was cancelled in 2014. Today, the BW has 12 KZO systems with c.60 aircraft. KZO will be decommissioned in 2018.

1.3.3. ALADIN (2005 -)

ALADIN, short for 'Airborne reconnaissance drone for close area imaging' was for several years the Army's smallest UAVs. It was officially introduced in 2005, after having been field tested in Afghanistan two years earlier.[622] ALADIN is a fixed-wing reconnaissance UAV, 1,5m long with a span width of 1.46m and take-off weight of less than 4kg. The complete drone system, including the ground station can be transported in a backpack and

[618] "Unterrichtung durch den Bundesrechnungshof 14/4226," ed. Deutscher Bundestag (Berlin: 2000). p.187.
[619] Neuhaus, "Ein Stueck vom Himmel fuer das Heer - Sachstand und Perspektiven zu UAS des Heeres." p.47.
[620] "Beschlussempfehlung und Bericht des Haushaltsausschusses. 14/6521," ed. Deutscher Bundestag (2001).; "Unterrichtung durch den Bundesrechnungshof 14/4226."
[621] Tamir Eshel, "Israeli, German UAVs Network to Form an Integrated Reconnaissance and Strike Asset," *Defense Update*, 5 September 2011.
[622] Wolfgang Schörner, "EMT übergibt Bundeswehr die Mini-Drohne "Aladin"," *Merkur online*, 20 October 2005. Henry S. Kenyon, "Silent Eyes Guard Peacekeepers," *Signal* 2004.

assembled and launched by hand by a single operator. It has an endurance of up to one hour and a radius of 15km. It operates at low altitude (50–150m). ALADIN has been developed by EMT in less than three years.[623]

ALADIN's payload consists alternately of day-light or night-vision cameras that deliver real-time imagery to the ground station carried by the troops. It is developed for close reconnaissance including combat reconnaissance. ALADIN's flight path is pre-programmed along GPS-points, but can be altered manually during flight. ALADIN can be used as spotter for the light armoured tank Fennek.[624]

The small UAV is also in use with the Federal Police and its special operations unit GSG9.[625] The Bundeswehr has currently over 200 ALADIN, which have been used in Afghanistan, as well as by German peacekeeping troops in Kosovo. In Kosovo, ALADIN is popular as it does not require a cleared airspace and is allowed to fly over inhabited areas because of its low weight.[626]

1.3.4. MIKADO (2009 -)

MIKADO, 'Micro local area reconnaissance drone', was the Bundeswehr's only vertical take-off system (in 2017, the VTOL system DJI Phantom was introduced). A quadcopter with a diameter of 1m, MIKADO was procured to satisfy a 2004 Bundeswehr requirement that called for a system able to locate and identify single individuals, vehicles, and other objects in real time. The AR100 system by German producer AirRobot was chosen. It has

[623] "News Release: EMT wins Competition with its ALADIN MAV," *EMT Penzberg*, February 2002.
[624] "Aufklärungsbataillon 8 stellt Fennek und Aladin am Messestand des Bundesministeriums der Verteidigung zur „Heim und Handwerk" vor," *www.deutschesheer.de*, 12 December 2012.
[625] "Antwort der Bundesregierung auf Kleine Anfrage. Nutzung des deutschen Luftraums durch Drohnen. 16/13609," ed. Deutscher Bundestag (2009). p.1.; Markus Becker, "Drohnenkrieg: Fliegende Killer schrumpfen auf Kleinformat," *SpiegelOnline*, 21 October 2011.
[626] Interview with anonymous, 19 February 2014.

day-light and twilight cameras that send real-time imagery to the hand-held control station. Because of its electric motor, MIKADO was quiet and difficult to detect. As a rotor system, it could hover. First sent to Afghanistan in late 2009, the system revealed several flaws, mainly related to the Afghan climate. A modified version was developed, called AR 100-B or MIKADO, deployed to Afghanistan in March 2011, as well as to Kosovo.[627]

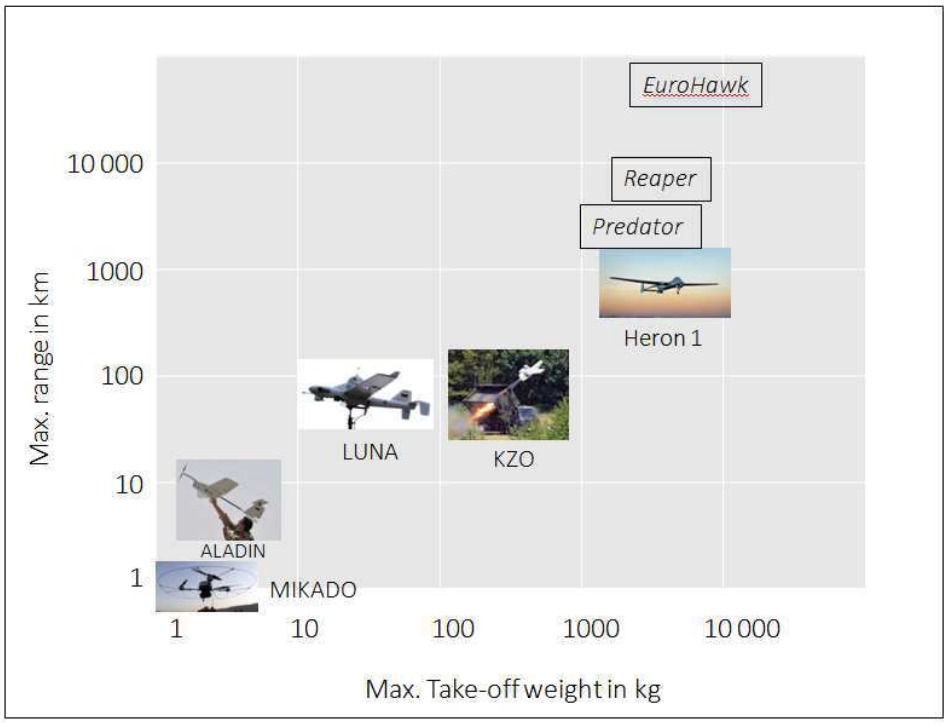
1.3.5. Heron 1 (2010 -)

Heron 1 was an Israeli system, the first UAV out of IAI's Heron series. It was Germany's only MALE UAV and the only UAV operated by the Luftwaffe. The 8.5m long, fixed-wing aircraft weighed 1.2tonnes, eight times as much as the largest Heer UAV. Its payload consisted of several cameras for still pictures, full motion videos, and infrared imagery, and a Synthetic Aperture Radar (SAR) with ground moving target indication. While the other systems belonged to the Bundeswehr, Heron was leased in 2009 to fill an urgent operational requirement for Afghanistan. Three vehicles and two control stations were deployed to the country in spring 2010, to provide up to 480 hours of ISR per month.

Initially, the Luftwaffe wanted another system, namely the US Predator or Reaper.[628] It can be speculated that the Luftwaffe viewed favourably the fact that the Predator/Reaper could be armed if the decision to do so was taken at a later point. Possibly, however, it was this fact which in the end tipped the decision towards the Heron – the government might have feared bad press. Moreover, procurement of the American system would have taken longer than the leasing agreement with Israel.[629]

[627] Steffen Maluche, "Mein Beruf: Der Aufklärer," *Bundeswehr.de* 2013.
[628] Otfried Nassauer, "Aufbruch in eine neue Ära der Kriegsführung? – Bundeswehr will bewaffnete Drohnen kaufen," (2012).
[629] Interview with employee of German Office of Procurement, 2014.

Heron is an international success, about a dozen countries are reported to have procured the UAV. For Germany, it was supposed to only be an interims solution to be eventually replaced by a European drone. The lease for Heron has been extended multiple times and Heron remains in use as of 2017, in Afghanistan and, from November 2016 onwards, in Mali.



Endurance:

MIKADO: 30 min
ALADIN: 30-60 min
LUNA: 6h
KZO: >4h
Heron 1: >24h
Predator: >24hours, less if fully loaded
Reaper: >24hours, less if fully loaded
EuroHawk: 32h

Illustration V.2. Comparison UAV Systems
Source: Own diagram, based partly on Petermann (2011), p.35

Bundeswehr UAVs as of 2017				
Name	**LUNA** **L**uftgestützte **U**nbemannte **N**ahaufklärungs-**A**usstattung, 'Airborne unmanned close reconnaissance system'	**ALADIN** **A**bbildende **l**uftgestützte **A**ufklärungs**d**rohne **i**m **N**ächstbereich, 'Airborne reconnaissance drone for close area imaging'	**KZO** **K**leindrohne für **Z**iel**o**rtung, 'Small target-locating drone'	**Mikado** Mikroaufklärungsdrohne für den Ortsbereich, 'Micro local area reconnaissance drone'
Manufacturer	EMT Penzberg	EMT Penzberg	Rheinmetall/ Cassidian	Air Robot
Type	Fixed-wing tactical UAV	Fixed-wing Mini-UAV	Fixed-wing tactical UAV	Electric, vertical take-off Micro-UAV
Tasks	Target acquisition, reconnaissance	Close (combat) reconnaissance	Reconnaissance and battle damage assessment	Close reconnaissance, particularly in urban terrain
Current payload	Video, still image and infrared camera	Daylight and night vision camera (alternately)	Infrared-camera	Daylight- and Twilight-camera
Introduced	2000	2005	2006	2009
Used by	*Heer*	*Heer*	*Heer*	*Heer*
Numbers in use (2017)	85	290 (145 systems à 2 vehicles)	44	145
Military operations	Kosovo, Macedo-nia, Afghanistan	Kosovo, Afghanistan	Afghanistan	Afghanistan, Kosovo
Dimensions				
Wing Span	4,17m	1,46m	3,4m	Diameter: 1m
Length	1,36m	1,53m	2,3m	-
Height	0,9m	0,36m	0,9m	-
Max. Weight	40kg	c.3,2kg	c.170kg	c.1,3kg
Performance				
Speed	70 – 160km/h	45 – 70km/h	120 -210km/h	40km/h
Endurance	c. 6h	30-60min/5 km	c.3,5 -5h	30min/500m
Ceiling	>5000m		>2000m	150 – 1000m
Range	c. 100km	5-15km	>100km	>500m
Armament	none	none	none	none
Planned Retirement	2017/20		2018	
Other	In use by Pakistani Navy	Used with *Fennek* light tank system		

Bundeswehr UAVs as of 2017 (continuation)			
Name	**Heron 1**	**DJI Phantom**	**Black Hornet**
Manufacturer	IAI (Israel) & Rheinmetall	DJI (China)	FLIR Systems (prev.Prox Dynamics) (Norway)
Type	Fixed-wing MALE UAV	Commercial vertical take-off UAV	Nano vertical take-off UAV
Tasks	Operational ISR, target acquisition	Sea-based reconnaissance	Personal-level reconnaissance
Current payload	Still picture and full motion video (day light and infrared); SAR		Daylight and Infrared-camera
Introduced	2010	2017	2017
Used by	*Luftwaffe*	*Marine*	*Heer*
Numbers in use	6 (leased)	6 air vehicles	10 systems à 3 vehicles
Military operations	Afghanistan	Operation Sophia in the Mediterranean	
Dimensions			
Wing Span	16,6m		12cm rotor
Length	8,5m	35cm	10cm
Height	2,28m	22cm	
Max. Weight	1,2t	1,4kg	18gr
Performance			
Speed	200km/h	70km/h	18km/h
Endurance	>24h	25min	25min
Ceiling	max. 10km		
Range	~400km	3,5km	1,5km
Armament	none	none	none
Planned Retirement	Lease continuously renewed		
Other	Can start and land autonomously	Commercially available system	

2. The German drone debate

"It is difficult to have an objective debate about the military worth of remotely piloted vehicles in Germany."

Generalleutnant Karl Müllner, Inspector of the Air Force [630]

2.1. The German media's drone coverage

Drones made their first appearance in the German media in the mid-2000s when they began to be mentioned sporadically in the context of Israel's use of armed drones in Gaza in 2005 and in Lebanon in 2006.[631] New US drone developments were also reported on.[632] Only on very rare occasions however did reports feature information on German drones. Whilst Bundeswehr circles agreed already in 2007 that "UVs have become an indispensable asset in operations",[633] public interest in and knowledge of the issue remained low, a fact reflected in the media's treatment of the issue: in 2001, the term 'drone' war still put in inverted commas, and many journalists felt the need to repeatedly explain what UAVs were.[634]

Media coverage on drones started to increase when US missile strikes carried out via UAVs in Pakistan became a topic of discussion. At first, there was no particular interest in the technology itself. Rather, the media reported on insurgents being killed in "US-

[630] Quoted in Daniel-Dylan Boehmer and Thorsten Jungholt, "Der ferngesteuerte Krieg. Sind Drohnen böse?," *Welt*, 4 February 2015.
[631] "Gaza: Israel holt zum Militärschlag aus," *SpiegelOnline*, 17 July 2005. "Libanon: Israel fliegt neue Luftangriffe," *SpiegelOnline*, 31 July 2006. "Israelisches Bombardement: Mutter und sechs Kinder sterben bei Luftangriff," 29 July 2006.
[632] "US-Armee: Pentagon lässt neuen Phantomflieger bauen," *SpiegelOnline*, 24 August 2004.
[633] Wolfgang Schneiderhan, "UV's - an indispensable asset in operations," *NATO's nations and partners for peace* 52, no. 1 (2007). p.91.
[634] "Amerika verliehrt abermals 'Drohne'," *Frankfurter Allgemeine Zeitung*, 12 September 2001.

attacks", "air attacks", or "missile attacks".[635] But the more the international drone debate gained momentum, the more drones began to appear in German news – and made their way from being mentioned within an article to becoming the main story. While in 2008, insurgents were killed in "US air attacks", by 2010 they were hit by "drone attacks".[636] The terms 'drones', 'Predator', and 'Reaper' entered the general vocabulary.

By 2010, drone technology had become a topic of public interest in Germany in its own right. In mid-2012, then-Defence Minister Thomas de Maizière publicly discussed plans to procure armed UAVs, backed by high-level Bundeswehr officials.[637] The negative response from the public and political opposition caused the question to quickly be adjourned until the following legislative period, but drones had captured a place in the public debate. UAVs were ultimately catapulted into the lime light in May 2013 when the MoD had to cancel the Bundeswehr's EuroHawk project after having invested over half a billion Euros, causing a public uproar.

[635] "Pakistans Qaida-Chef bei US-Angriff getötet," *SpiegelOnline*, 9 January 2009. "Viele Tote bei mutmaßlichem US-Raketenangriff auf Qaida-Versteck," *SpiegelOnline*, 14 February 2009. "Pakistan: Bin Ladens Sohn angeblich durch US-Raketenangriff getötet," *SpiegelOnline*, 23 July 2009. "Militärschlag in Pakistan: Raketen töten mutmaßliche Extremisten," *SpiegelOnline*, 16 March 2008. "Raketenangriff: US-Angriff tötet Pakistaner," *Süddeutsche Zeitung*, 3 November 2008. "Dutzende Tote bei US-Angriffen," *Nürnberger Nachrichten*, 3 November 2008. "Gefechte im Grenzgebiet: Pakistanische Soldaten sterben bei US-Luftangriff," *SpiegelOnline*, 12 June 2008.

[636] "Pakistan: Mindestens vier Tote bei US-Drohnenangriff," *SpiegelOnline*, 10 January 2010.

[637] Thorsten and Meyer Jungholt, Simone, "De Maizière wirbt für Einsatz bewaffneter Drohnen," *Welt*, 3 August 2012.

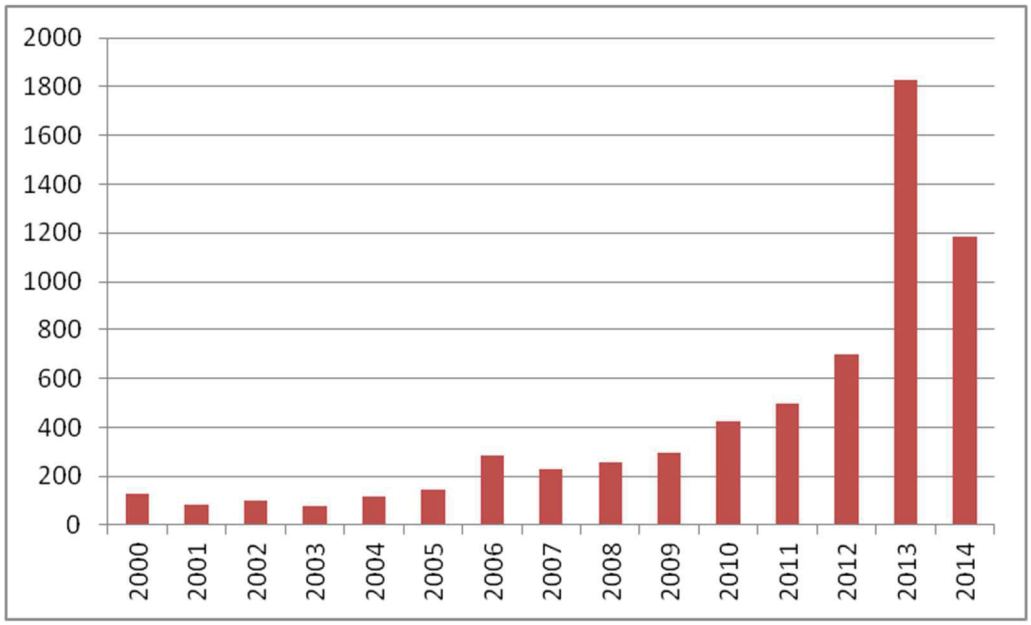


Illustration V.3. German news articles on drones 2000-2014
Source: Own illustration, data from Faktiva[638]

From 2010 onwards, drones received full news coverage,[639] with even minor details getting extensive exposure. It is striking how suddenly, and, once on the map, how quickly the issue of drones captured public imagination. News stories were 'dronified': an article discussing the 2012 US military budget was entitled "USA wants to enlarge drone fleet", although drones were only a minor aspect of the budget changes and the article. A piece discussing the military campaign in Libya in 2011 used the loss of a drone as a peg; an article about international support to fight Daesh in Iraq was entitled "Iran supports Iraqi military with drones" – the articles mainly discussed other issues.[640] "'Drohnen are worth

[638] Search terms: Drohne, UAV (excluded: Biene, Bienenstock, Imker, Honig) Newspapers: BILD, FAZ, Fokus, Handelsblatt, Spiegel, Spiegel Online, Süddeutsche, Tagesspiegel, TAZ, Welt, Zeit.
[639] This section's examples will be drawn predominantly from *Spiegel Online (SPON)*, Germany's largest and most influential news website, the online platform of the renowned weekly *Der Spiegel,* albeit with a more tabloid character.
[640] "Krieg gegen Gaddafi: Nato verliert Drohne über Libyen," *SpiegelOnline*, 21 June 2011. "Kampf gegen ISIS-Truppen im Irak: Iran unterstützt irakisches Militär mit Drohnen," *SpiegelOnline*, 26 June 2014.

mentioning; there is something exciting about them that attracts attention," Sabine Selchow noted in a German media analysis.[641]

By the 2010s, drones had clearly become a topic of public interest. But the language fluctuated between hype and hysteria. On the one hand, the unmanned technology clearly fascinated journalists. Numerous articles detailing new unmanned developments were published, including about developments for which it was unclear when, if ever, they would be used.[642] *SPON* featured a 3D view model of the Reaper UAV, showing and detailing all its technical gadgets (including missiles and bombs), as well as a list of "the most important drone types" which includes detailed technical specifications.[643] These technology-focused articles employed an enthusiastic tone: UAVs were portrayed as "super-birds" or "super-drones", and a journalist proclaimed: "the technical data alone is formidable".[644] "'Drohne' stands for hyper-progress". Sabine Selchow notes.[645]

Yet, this positive, high-tech view of drones pertained almost exclusively to US developments, while German unmanned technology was neglected. The "most important drone types" were all American. There was no lack of German drones, yet, to portray Bundeswehr weapons in the enthusiastic way US weapons were described, was clearly

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[641] Selchow, "The Drones of Others: An Insight into the Imagination of UAVs in Germany." p.67.
[642] "Spionagedrohne: US-Armee schickt Superspäher nach Afghanistan," *SpiegelOnline*, 1 January 2012, ""Firebird": US-Rüstungskonzern enthüllt neuen Spionageflieger," *SpiegelOnline*, 10 May 2011, Markus Becker, "Stealth-Technik: US-Militär lässt Tarnkappen-Kampfdrohne fliegen," *SpiegelOnline*, 7 February 2011, "Wasserstoff-Flieger: Boeing präsentiert Ökodrohne," *SpiegelOnline*, 15 July 2010, Markus Becker, "Erfolgreicher Test: US-Militär lässt Hyperschall-Geschoss fliegen," *SpiegelOnline*, 28 May 2010. "Winzige Spionagedrohne: Lauschangriff mit Roboterkolibri," *SpiegelOnline*, 18 February 2011, "Hightech-Flieger: Pentagon plant neue Hyperschall-Drohne," *SpiegelOnline*, 12 March 2008.
[643] *Der Sensenmann*, ([cited 10 June 2014]); available from http://www.spiegel.de/flash/flash-27187.html. *Drohnen. Alle Artikel und Hintergründe*, ([cited 10 June 2014]); available from http://www.spiegel.de/thema/drohnen/
[644] "Aufklärungsdrohne: Luftwaffe präsentiert neuen Supervogel," *SpiegelOnline*, 11 October 2011, "US Airforce testet neue Superdrohne," *SpiegelOnline*, 3 January 2011, Anatol Johansen, "Superdrohnen entscheiden die Kriege der Zukunft," 11 September 2011.
[645] Selchow, "The Drones of Others: An Insight into the Imagination of UAVs in Germany." p.64.

considered a journalistic no-go. In fact, the press even reported considerably less on actual German UAV *use* than US *developments*. An avid news reader in the early 2010s would have had no problem naming several US drones but would probably not have known whether, or what kind of UAVs the Bundeswehr employed. The introduction of new German UAV systems to the Afghan theatre got, at best, a few lines in the press: when the KZO was deployed in 2009, *SPON* deprecatingly headlined "Bundeswehr uses multi-million Euro mini-drone" and described the system in the header as "extremely accident-prone".[646] Hence, on the one hand, drones – at least those used by the US military – were portrayed as fascinating high-tech gadgets. However, on the other hand, drones were portrayed as dangerous, futuristic machines. References to Sci-Fi Hollywood movies such as *Terminator* or *IRobot* (both of which feature robots trying to take over the world) were common.[647] A heavily biased language was used; "Robot-killer", "flying killer", and "killer drone" were just some of the names repeatedly used to describe drones.[648] The stealthy US X-47B was a "killer with invisibility cloak", the Gray Eagle a "silent killer".[649] The use of such terms was so widespread that whereas until 2010 the term 'killer robot' was reserved for discussions of the *Terminator* movies, from 2010 onwards, the word appeared predominantly as a drone synonym. Whether this coverage only mirrored public concerns or helped to cause it is impossible to reconstruct. A German particularity is that the term 'drone' itself may have contributed to the fear-inducing

[646] Alexander Szandar, "Afghanistan: Bundeswehr setzt millionenteure Mini-Drohnen ein," *SpiegelOnline*, 8 August 2009.
[647] HR2, "Unbemannt - unbemerkt - unaufhaltsam - Die Drohne ist über uns," (2012).
[648] Matthias Gebauer, "Drohnenkrieg in Afghanistan: Nato stationiert leise Killer im Bundeswehrgebiet," *SpiegelOnline*, 2 December 2011, Hasnain Kazim, "Drohnenopfer in Pakistan: Feldzug gegen die Roboter-Killer," *SpiegelOnline*, 30 November 2010, Becker, "Drohnenkrieg: Fliegende Killer schrumpfen auf Kleinformat, Yassin Musharbash, "Schattenkrieg des Friedensfürsten," *SpiegelOnline*, 9 March 2010.; "Abhörflugzeug: Amerikas Kampfdrohne geht auf Handy-Jagd," *SpiegelOnline*, 4 May 2008.
[649] "X-47B: Killer mit Tarnkappe," *SpiegelOnline*, 7 February 2011. Gebauer, "Drohnenkrieg in Afghanistan: Nato stationiert leise Killer im Bundeswehrgebiet."

image of drones: linguistically, the German term 'Drohne' (drone) and 'drohen' (to threaten, menace) are close.

Interestingly, both types of articles – those focusing on the high-tech narrative (hype) and those emphasising the deadly aspects of drone warfare (hysteria) – employed the Unmanned Revolution narrative. The *Berliner Zeitung* proclaimed a "revolution in warfare", and the leftist *Neues Deutschland* a "robot revolution on the battlefield".[650] *n-tv* believed in a "revolution in the sky".[651] Peter W. Singer was regularly quoted. In fact, the role Singer played in the German debate is astounding. A 2013 radio report describes him as "drone pope"; countless newspapers, film-, and radio stations interview him, several of his articles were published in German, and numerous articles based their analysis exclusively on Singer's work.[652] Unsurprising, those texts employed the 'revolutionary killer robots' narrative without fail.

2.2. German drone literature

Three trends in the German drone literature[653] can be identified: (1) a focus on legal and philosophical topics (ethics and morality rather than military/strategic), (2) little (but some) original work, and (3) a lack of Germany-focused work.

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[650] Bettina Vestring, "Leitartikel zur Bundeswehr-Drohne. Revolution der Kriegsführung," *Berliner Zeitung*, 2 August 2012. Kerkow, "Die Roboter-Revolution auf dem Schlachtfeld."

[651] *Bilderserie. Die Revolution am Himmel, Schöne neue Welt der Drohnen*, ([cited 1 April 2016]); available from http://www.n-tv.de/mediathek/bilderserien/politik/Schoene-neue-Welt-der-Drohnen-article7097581.html.

[652] See Bernhard, "Tiefenblick, Zukunft der Kriege (1/3), Auf dem Weg zur unbemannten Luftwaffe." "Drohneneinsätze: 'Sie nennen es Kriegsporno'," *SpiegelOnline*, 11 March 2010. Gunars Reichenbachs, "Roboter führen Kriege der Zukunft," *NWZ Online*, 24 June 2013. Singer, "Die Zukunft ist schon da." Peter W. Singer, "Schlachtfelder der Zukunft " *Süddeutsche Zeitung*, 4 February 2011.

[653] This section aims at identifying the idiosyncrasies of the German literature and thus highlights selected publications. 'German literature' is defined here as the work of German authors published in German.

The majority of German (academic) drone literature discusses legal and moral/ethical issues regarding armed drones and drone warfare as well as questions of arms control. Examples are Roman Schmidt-Radefeldt and Christine Meissler's edited volume *Automatisierung und Digitalisierung des Krieges ('Automatisation and digitalisation of war'),* Robert Frau's *Drohnen und das Recht ('Drones and the law'),* several publications by the German thinktank *SWP*[654] and journal articles.[655] These works usually focus on armed drones and their use in warfare.

The German drone literature has been influenced significantly by the English-speaking literature and lagged behind it. The topic gained momentum later than in the English-speaking world and matters relating to the military were generally of less interest to public and academia. Accordingly, the majority of edited volumes on drones include articles written by English-speaking authors: Schmidt-Radefeldt & Meissler's volume includes an essay by Peter W. Singer and almost half of the authors in Peter Strutynski's critical *Töten per Fernbedienung* are not German. Several well-known drone books have been translated for the German market, including Medea Benjamin's *Drone Warfare* ('Drohnenkrieg - Tod aus heiterem Himmel'). Surprisingly, Peter W. Singer's *Wired for War* has to date not been translated.

The presence of English-speaking authors is not surprising, yet, it is noticeable how little of the work focused on Germany's drones. Few historical accounts of German drone use exist. Whether UAVs could play any kind of role in Germany – in particularly in a military

[654] Wolfgang Richter, "Rüstungskontrolle für Kampfdrohnen," *SWP Aktuell*, no. 29 (2013), Wolfgang Richter, "Kampfdrohnen. Völkerrecht und militärischer Nutzen," *SWP Aktuell*, no. 28 (2013). Rudolf and Schaller, "Targeted Killing: zur völkerrechtlichen, ethischen und strategischen Problematik gezielter Tötens in der Terrorismus- und Aufstandsbekämpfung."

[655] See Markus Löffelmann, "Rechtfertigung gezielter Tötungen durch Kampfdrohnen?," *Juristische Rundschau* 11 (2013).

context – is rarely asked.[656] As shown above, this lack of interest cannot be explained by Germany having had no military interest in the technology. But only with the discussion on the armed drones' procurement, and the EuroHawk, a few articles were published which specifically looked at Germany.[657] A notable, early exception to this is the 2003 SWP study by Sascha Lange, one of the first German researchers to show interest in drones. Lange discusses possible missions for German UAVs, presenting two scenarios, peacekeeping and 'robust military operations', and details what UAVs Germany would need for either mission.[658] Thomas Wiegold and Kai Biermann's *Drohnen* (2015) also provide some details on German UAV use.[659] Still, German authors focus rather on the US use of drones – or the German participation in the US 'drone wars', through Ramstein air base.[660] A truly original German publication is Hans-Arthur Marsiske's 2012 edited volume *Kriegsmaschinen, Roboter im Militäreinsatz* ('War machines, robots in military operations').[661] The slightly misnamed[662] book includes short stories, email conversations, academic articles, and essays which form an original collage. *Kriegsmaschinen* features the work of journalists, science fiction authors, roboticists as well as academics. It discusses the link between robotic and sciences fiction in film, theatre, and literature, making the connection from *Frankenstein* to the *Terminator*, and linking the Predator to the 1921

[656] An exception is Thiele, "Veränderung in Sicht? Zur Bedeutung von Drohnen für die deutsche Aussen- und Sicherheitspolitik."
[657] Luehr Henken, "Kampfdrohnen als zentraler Bestandteil der 'Neuausrichtung der Bundeswehr'," in *Töten per Fernbedienung: Kampfdrohnen im weltweiten Schattenkrieg*, ed. Peter Strutynski (Wien: ProMedia, 2013).
[658] Lange, "Flugroboter statt bemannter Militärflugzeuge?."
[659] Kai Biermann and Thomas Wiegold, *Drohnen. Chancen und Gefahren einer neuen Technik* (Berlin: Ch. Links Verlag, 2015).
[660] Christian Fuchs and John Goetz, *Geheimer Krieg* (Rowohlt, 2013).
[661] Hans-Arthur (ed.) Marsiske, *Kriegsmaschinen. Roboter im Militäreinsatz* (Hannover: Heise Verlag, 2012).
[662] As Marsiske notes "what is largely lacking in this book is the military view on the topic". Ibid. p.3.

silent film *L'Uomo Meccanico*. The book featured on the Bundestag's recommended reading list on drones.[663]

2.3. Political debate

The political debate on drone in Germany has been extensive and involved many actors, beyond the political parties, including even the church.

2.3.1. Political parties

31 January 2013 was an important date for the political drone debate, as the Bundestag discussed plans for procurement of armed UAVs. The parties set forth their position on armed drones procurement but also took the opportunity to discuss the unmanned technology in more general terms. The following is an overview of the positions expressed during the debate, complemented by additional information from other occasions.

The Christian Democrats, CDU/CSU, in government since 2005, were in favour of both surveillance and acquiring armed drones. Then-CDU Defence Minister Thomas de Maizière (2011-2013) was an outspoken proponent of the procurement of armed drones. He argued that "deploying an unmanned drone instead of a manned aircraft serves the security of our soldiers."[664] In the Bundestag he emphasised that it was crucial for Germany to invest in this 'technology of the future': "We cannot say 'we'll keep the stagecoach' while all others are developing the railway".[665] De Maizière refuted criticism of drones from a legal perspective, arguing that drones follow the same rules as any other military platform or weapon. While he and his government colleagues tried to avoid

[663] "Literaturtipp: Drohnen im Kampfeinsatz. Literaturauswahl 2007 - 2013," *Bibliothek Deutscher Bundestag*. p.3.
[664] Jungholt, "De Maizière wirbt für Einsatz bewaffneter Drohnen."
[665] "Stenografischer Bericht, 219. Sitzung, 31. Januar 2013," ed. Deutscher Bundestag (Berlin: 2013). p.27124.

directly criticising the US use of drones, he refuted claims that Germany would follow the US-lead, refuting technological determinism: "you cannot conclude from other states' operations that this is how the instrument has to be used. For our use of drones, our law and constitution applies." [666] He contradicted the often-made claim that UAVs would lower the threshold for attacks and that drone operators were emotionally removed from the battlefield.[667] CDU has kept this stance since, with Defence Minister Ursula von der Leyen (2013 -2017) equally pushing for armed drone procurement.

The Social-Democrats, SPD, in government 2005-2009 and 2013-2017, adopted an ambivalent stance regarding drones. When *Europäische Sicherheit & Technik* asked all political parties about their view regarding armed drones procurement, the SPD's line was "no simple yes/no".[668] In the Bundestag, SPD members argued that there was no urgency to procure armed UAVs, as they saw no capability gap. Rainer Arnold, chair of the defence committee stated that "of course, using drones changes something – […] [but the government] tries to make us believe that a drone is only an aircraft without a pilot."[669] How military operations are changed by drones, however, he did not explain. The party's executive committee later announced that it opposed the procurement of armed drones.[670] Yet, five months after that the SPD signed a coalition agreement which aimed "to advance European development of unmanned aerial vehicles," and specifically allowed procurement of an armed system."[671] However, when the government went to finalise the procurement decision before the end of its term in June 2017, the SPD withdrew its

[666] Ibid. p.27124.
[667] Ibid. p.27124.
[668] Henning Bartels, "Bewaffnete Drohnen für die Bundeswehr?," *Europäische Sicherheit & Technik*, no. April (2013).
[669] "Stenografischer Bericht, 219. Sitzung, 31. Januar 2013." p.27116.
[670] Christine Kroke, "Beschluss des SPD-Parteivorstandes. Nein zu Kampfdrohnen," *SPD.de*, 11 June 2013.
[671] "Deutschlands Zukunft gestalten. Koalitionsvertrag zwischen CDU, CSU und SPD," (2013). p.124.

support, arguing that there had not been a sufficient public debate and that while it had agreed to procure drones *able to carry weapons* ('bewaffnungsfähig') it could not agree to procurement of *actually armed* drones.[672]

The liberal party FDP, CDU/CSU's coalition partner 2009-2013 but outside parliament 2013-2017, has not been particularly involved in the drone debate. In the Bundestag discussion, MP Elke Hoff criticised the confounding of CIA UAV use for targeted killings and future Bundeswehr UAV use. "This is all a tangled mass which must create the impression in the population that we are in favour of a weapon system without sensible explanations and under completely unclear conditions."[673]

The Greens, a party with roots in the German peace movement have struggled with their stance on military questions in general, and the debate on drones specifically exposed differences within the party. In the 2013 Bundestag debate, Agnes Brugger, member of the defence committee for the Green party argued that the use of armed drones would contribute to the escalation of conflicts, opposing any procurement plans.[674] Brugger's passionate speech notwithstanding, a Green MP dismissed his party's official stance as "ideologically motivated" and spoke positively of drones.[675]

The left-wing, anti-militaristic LINKE has been highly critical of drones and German procurement plans. The LINKE asked for an international ban on the production, procurement, and use of armed UAVs and many MPs opposed even military surveillance UAVs. MP Andrej Hunko argued that the existence of armed drones lowered the threshold

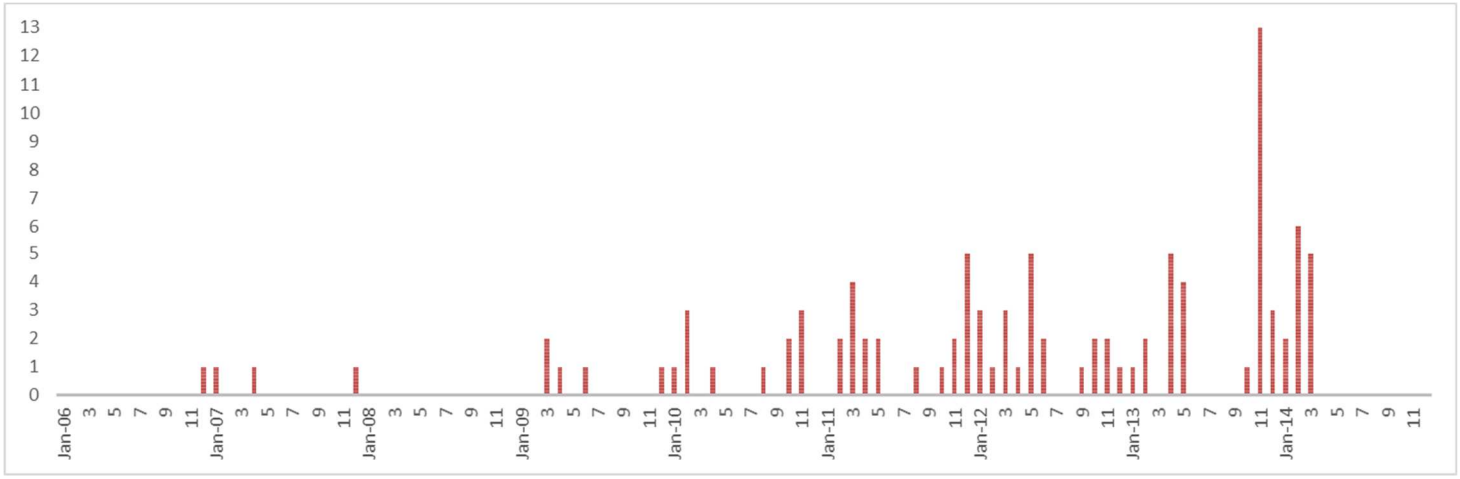
[672] Christian Thiels, "SPD stoppt von der Leyens Drohnenprojekt," *Tagesschau*, 27 June 2017.
[673] "Stenografischer Bericht, 219. Sitzung, 31. Januar 2013." p.27112.
[674] Ibid. p.27113/4
[675] The interview was conducted in Berlin in March 2014.

to go to war since "other means are not even considered anymore".[676] Inge Höger described a world in which soldiers would "casually, from the home office, bomb a few targets".[677] Both repeatedly used the terms "killer drones", "killer weapons", and "murder weapons". LINKE MPs have played a crucial role in the German drone debate, by using minor interpellations as "investigative parliamentarianism".[678] The majority of all questions and interpellations on drones have been submitted by the LINKE.

The issue of drones in both the political realm and public began to gain momentum when US drone strikes in Pakistan started to be discussed internationally, beginning in 2008/9. Plans to procure armed drones (2012) and the cancellation of the EuroHawk deal (2013) further increased interest. This can well be illustrated by Bundestag discussions, minor interpellations, written questions, and questions posed to the government pertaining to drones during the three legislative periods since October 2005.[679] This late interest in UAVs, particularly from the political realm is surprising given the earlier use of drones by the Bundeswehr, including in Afghanistan, and the fact that the procurement of armed drones had, as shown above, been discussed long before.

[676] "Stenografischer Bericht, 219. Sitzung, 31. Januar 2013." p.27108.
[677] Ibid. p.27119.
[678] Interview Matthias Monroy, March 2014.
[679] The analysis of Bundestag interest in drones covers only this time period because before that the issue was virtually non-existent.

Illustration V.4. Number of minor interpellations/questions/ written question pertaining to drones
Own illustration



The US use of armed UAVs had a crucial impact on the German public debate. The media concentrated almost exclusively on the US, and the political realm did little better. Of a total of 102 questions and interpellations relevant to UAVs, 40 discussed US drone use. Three quarters of those pertained to the US targeted killings outside official warzones; the others discussed the stationing and testing of US drones over German territory.

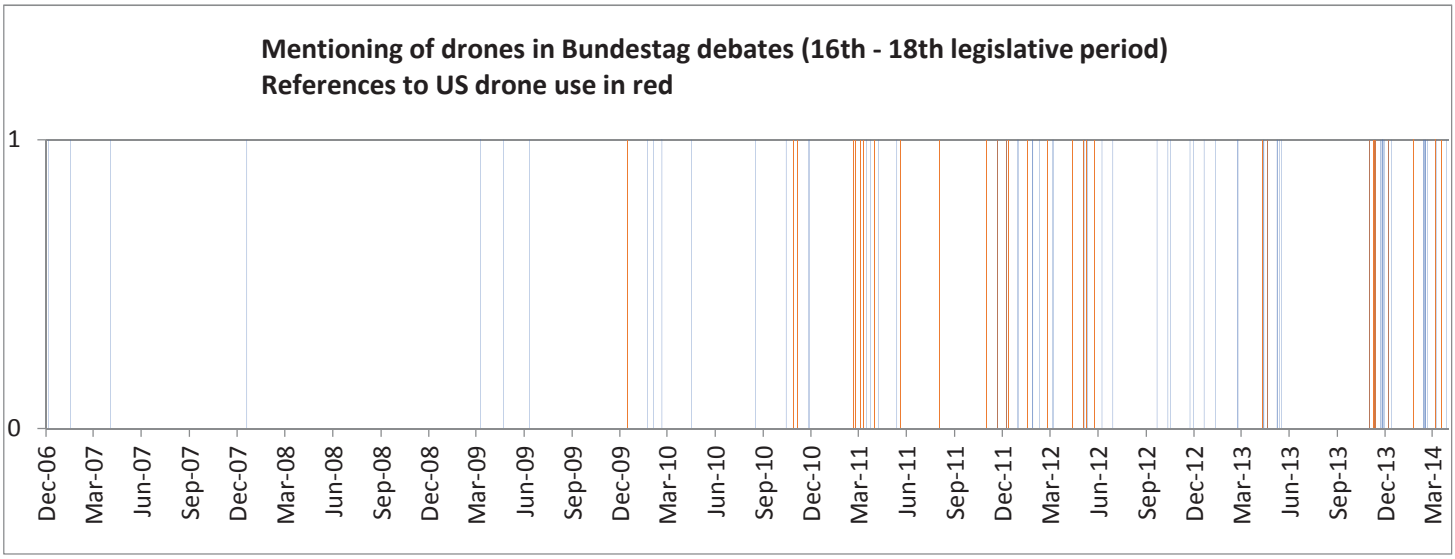


Illustration V.5. Bundestag Debates. Own illustration.

The impact of the US use of drones on the debate was so important that CDU and SPD, in their 2013 coalition agreement, felt it necessary to "categorically oppose extra-legal killings with drones," distancing themselves from the (US) use of UAVs for targeted killings (without, however, explicitly naming the US). The impact of the US drone use made an objective debate about drones in Germany largely impossible. A journalist complained in 2014 that in Germany "the drone has become such an anxiety-inducing symbol of the cowardly American way to kill, that many Germans are no longer able to even consider fact-based arguments. It's spooky".[680]

2.3.2. Advocacy groups

The German drone debate has motivated the formation and work of multiple interest groups and revived the German peace movement which has its roots in the Cold War. The publication *Töten per Fernbedienung* (*Killing by Remote Control: Combat Drones in the Global Shadow War*) edited by activist Peter Strutynski is a good example of the peace movement's discussion of drones. Its authors unanimously condemn the use of (combat) drones. The authors primarily have a left-wing political background, or are known peace-activists. The message is clear: "mass murder by US-drones".[681]

In early 2013, the *Drohnenkampagne* ('campaign against the establishment of drone technology for war, surveillance, and oppression') was founded in the context of the government's armed drones' procurement plans. The campaign was a loose coalition of several organisations and individuals, (including executive committees of both LINKE and Greens) who rallied behind the appeal to "oppose combat drones because their deployment lowers the threshold to armed aggression even further; entails "targeted"

[680] Jochen Bittner per Email, 8 July 2014.
[681] Strutynski, *Toeten per Fernbedienung. Kampfdrohnen im weltweiten Schattenkrieg*.

killing of people within and outside warzones – without indictment, trial and conviction; terrorizes the population of the targeted territory by threatening life and limb; encourages the development of autonomous killer robots, thereby making more horrifying wars likely; initiates a new round in the arms race."[682] The campaign regularly employed the Unmanned Revolution narrative: "Through the procurement and use of combat drones, the military – and the Bundeswehr – is marking the start of a new chapter in warfare. [...] The drone wars are initiating a paradigm change."[683]

"Informationsstelle Militarisierung" (IMI, 'information unit militarisation') is a non-profit organisation that, since the mid-1990s, has worked on issues relating to peace politics. IMI considers drones "a devastating weapon. The technology carries risks and dangers for individuals as well as the society as a whole. It is a technology whose potential risks and consequences in particular with regard to ethical, political, societal, and legal aspects are not foreseeable."[684] IMI has become so prominent that in June 2014, a spokesperson was invited to speak at a hearing of the Bundestag's defence committee on drones.[685]

Both IMI and Drohnenkampagne focus on armed drones. Their main concern is the US use of UAVs and the danger of this behaviour being adopted by Germany and other states. Surveillance drones are considered a preliminary stage to armed drones. Christoph Marischk, IMI spokesperson and Drohnenkampagne member, argued: "The blurred

[682] "Appeal: "No Combat Drones!"," *drohnenkampagne.de* 2013.
[683] Drohenkampagne, *5-Minuten-Info* ([cited 20 June 2014]); available from https://drohnen-kampagne.de/5-minuten-info/.
[684] "FAQ 1. Wozu dient das »FAQ – Drohnen-Kriege«?," ed. Informationsstelle Militarisierung.
[685] "Verteidigungsausschuss Mitteilung 5. Juni 2014," ed. Bundestag Verteidigungsausschuss (Berlin: 2014).

borders between surveillance and combat drones […] are a reason why the [Drohnenkampagne] is also directed against surveillance drones."[686]

The German military pastoral care – a community of several hundred catholic and protestant priests and pastors in charge of all Bundeswehr members – also took part in the debate, a testimony to the heatedness of the debate.[687] In February 2013, the military Bishop wrote a letter which, while not overtly arguing against armed drones, was critical of procurement plans and called for more debate.[688] Church members without affiliation with the military pastoral care have taken a clearer stance; Ludwig Schick, chairman of the 'Commission World Church' argued vehemently against German use of armed UAVs,[689] as did the German branch of the international catholic peace movement Pax Christi.[690]

2.4. Bundeswehr and MoD in the eye of the storm

The actor strikingly absent from the debate was the one most affected by it: the Bundeswehr. The German military generally preferred a low profile, rarely engaging in public debates. Initially, Bundeswehr and MoD tried to avoid the drone discussion completely,[691] and was unwilling to even confirm factual information, such as whether Heron pilots were training in Israel, out of fear of negative reactions.[692] Then-Defence

[686] Verteidigungsausschuss, *Stellungnahme für die öffentliche Anhörung Christoph Marischka*, 30 June 2014.
[687] Josef König, "Unbemannte bewaffnete Luftfahrzeuge," *Katholische Militärseelsorge* 2013.
[688] "Gemeinsame Erklärung, 5 Februar," ed. Katholische Militärseelsorge and Justitia et Pax (2013).
[689] "De Maizière plant deutsch-französische Kampfdrohne," *Welt*, 26 January 2013.
[690] Florian Gathmann et al., "Deutschlands Drohnenpläne: Merkel rüstet auf," *SpiegelOnline* 25 January 2013. "Kampf-Drohnen kategorisch abgelehnt," *Pax Christi* 2014.
[691] "The Ministry of Defence prefers not to talk about robots in public, in particular not about armed ones" Hans-Arthur Marsiske noted. Rafael Capurro; Hans-Arthur Marsiske, "Der Moment des Triumphs. E-Mail-Dialog über ein Bild," in *Kriegsmaschinen. Roboter im Militäreinsatz*, ed. Hans-Arthur Marsiske (Hannover: Heise Zeitschriftenverlag, 2012). p.26.
[692] "Bundeswehr in Israel," *Financial Times Deutschland*, 4 March 2010.

Minister von der Leyen, while on a visit in Afghanistan so actively avoided being photographed near Bundeswehr drones that this behaviour became a news item.[693]

In particular on armed drones, Bundeswehr and MoD tried to avoid sticking out their necks. In at least two instances, this had had tangible career implications for personnel. In 2012, Ulf Häussler, advisor in the political unit of the Ministry of Defence wrote an FAZ commentary on the legal aspects of armed drones and their use for targeted killings. His verdict: "[armed] drones are not forbidden".[694] Despite the usual disclaimer that the author's views were his own, the article quickly became a topic of discussion at the highest level and was discussed four days later at a staff meeting with the Defence Minister.[695] Häussler was soon transferred into a less exposed position. In a personal conversation he said the article had 'largely destroyed' his MoD career.[696] In 2011, a Heron operator was asked to speak at an Unmanned Vehicle forum. Having recently come back from deployment to Afghanistan, he shared his experiences with the audience and argued in favour of arming the Bundeswehr drones. "Already while I was doing my presentation, someone came up to me at the desk and said: 'if there are questions on armament, don't answer.' […] After that, I was almost put on leave".[697]

These two instances show how little strategic coordination there has been within the MoD or Bundeswehr – after all, the military at the same time argued in favour of armed drones. Already in 2001, the MoD commissioned a 'study on the usefulness of unmanned attack

[693] Bela Anda, "Ursula von der Leyen in Afghanistan. So drückt sich die Ministerin vor der Drohne," *BILD*, 23 December 2013.
[694] Ulf Haeussler, "Drohnen sind nicht verboten," *Frankfurter Allgemeine Zeitung*, 31 October 2012.
[695] Reinhard Müller, "An der Drohne hängt doch alles," *Frankfurter Allgemeine Zeitung*, 1 June 2013.
[696] Private conversation, January 2014, Berlin.
[697] Interview with anonymous, 2014.

aircrafts'.[698] The 2012 Bundeswehr's 'line of argumentation UAS' states: "experiences show that a persistent, armed over-watch in today's and future scenarios of engagement are needed imperatively as protection for sudden grave situational changes".[699] Hence, while some Bundeswehr officials openly argued in favour of armed UAVs, other MoD employees were being told off for publicly discussing this possibility.

The reason for this behaviour most likely lies in the fact that the Bundeswehr was acutely aware that the topic meant trouble. "The topic is emotionally charged", a MoD publication noted.[700] The Bundeswehr wanted to avoid being associated with US drone usage. Under the heading "bad public image", a Bundeswehr document explained: "the operations of the US armed forces cannot be compared to German operation principles. Weapons are neutral, [the Bundeswehr] receives its rules from the parliament (RoEs) which are being followed".[701] Over time, the Bundeswehr's reticence to engage in the debate has somewhat weakened with the end of German combat operations in Afghanistan, and an increase in the public's interest in security and defence.

The Bundeswehr's limited engagement in the drone debate, most likely aimed at calming the waters, however contributed to tilting the debate towards drone opponents. That the Bundeswehr has not taken a clear stance on an issue most important to them also caused anger and frustration among many of its members, in particularly those working with

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[698] "Antwort der Bundesregierung auf Kleine Anfrage, Einfuhrung und Bedeutung unbemannter militaerischer Fahrzeuge und Luftfahrzeuge 16/12193," ed. Deutscher Bundestag (Berlin: 2009). p.3-5.
[699] "Argumentationslinien zum Thema: Unbemannte Luftfahrzeugsysteme/Unmanned Aerial Systems (UAS)," ed. BMVg (2012). p.8. Also see "Befehlshaber der Bundeswehr in Afghanistan fordert bewaffnete Drohnen," *Süddeutsche Zeitung*, 23 October 2013.
[700] "Argumentationslinien zum Thema: Unbemannte Luftfahrzeugsysteme/Unmanned Aerial Systems (UAS)." p.52.
[701] "Argumentationspunkte Einsatzunterschiede von Bewaffnung UAS vs. bemannte Lfz Kdo Lw 2 II a," (2014).

UAVs. In interviews with Bundeswehr personnel the sentiment of being misunderstood was expressed often. Bundeswehr personnel showed an immense willingness to provide information, with interviewees taking hours to answer questions, and a request for information being answered with "THANK YOU for asking!"

2.5. Conclusion – A drone debate between hype and hysteria

Drones were a big topic of discussion in Germany, which is particularly noteworthy as articles on military topics are a rare feature of the German debate. The media's coverage of drones oscillated between fascination with drone technology and a hysterical coverage of 'killer robots'. The Unmanned Revolution narrative was ubiquitous in the media, with various articles announcing a "*Drohnen Revolution*",[702] and others portraying drones as Terminator's younger brothers. Overall the German public discussion was dominated by drone opponents. Drone supporters were hidden in the trade press. Hence, the German discussion on drones took place in two parallel universes. On the one hand, there was the public debate dominated by the technology's opponents and infused with criticism of the US's use of drones. On the other hand, the majority of military actors agreed on the usefulness of drones a long time ago and internally discussed the how rather than the why of armed drone procurement.

The impact of the US use of armed UAVs outside official battlespace on the German debate cannot be overemphasised. From its very beginning, the German debate on drones was linked to the debate about US missile strikes carried out via drones in Pakistan and elsewhere. The fact that the German public heard about drones for the first time in the context of potentially illegal drone strikes in Pakistan was central as it meant that

[702] Vestring, "Leitartikel zur Bundeswehr-Drohne. Revolution der Kriegsführung."

everything related to UAVs in Germany was seen through this prism. The framework for analysis was set: drones were seen as reprehensible weapons that seduce politicians to carry out targeted killings, terrorising populations and causing large civilian casualties. In the public mind, drones are hence always associated with illegal targeted killings, and always armed. As a Bundeswehr officer phrased it: the discussion on drones had been "poisoned" by the focus on Pakistan.[703] The same is true for the political debate, perfectly epitomised by a 2013 parliamentary exchange: "Hans-Peter Bartels (SPD): 'I ask you, Mr. Minister to slow down and first find answers to these questions […]! What is the stance of the federal government on the US American use of combat UAVs in Pakistan and elsewhere?' Interjection from Elke Hoff (FDP): 'What does this have to do with [our] procurement [plans], for God's sake?!'".[704] The technology had come to be equated with its illegal and improper use. This association caused the debate to be emotionally loaded. Last, there was surprisingly little debate on German drone use, and ISR drones in general. Important questions on German UAVs were not discussed as it was overshadowed by the discussion on US targeted killings.

3. German UAV use in Afghanistan 2003 – 2014

3.1. The Afghanistan mission

Three months after 9/11, on 22 December 2001, the Bundestag decided that the Bundeswehr would take part in the International Security Assistance Force ISAF in Afghanistan. The first of the 1200 German soldiers arrived in Afghanistan in January 2002. The troops were initially sent to Kabul and surroundings, and later to the northern towns

[703] Interview January 2014.
[704] Ulrike Franke, "The Flawed German Debate on Armed Drone Acquisition: "What Does This Have to Do with Our Procurement Plans, for God's Sake?"," in *ISN ETH Zürich* (2014).

of Kunduz and Faizabad. From June 2006 onwards, Germany became the lead nation of ISAF's 'Regional Command North'. Germany was the third largest troop contributor after the US and the UK and deployed, at the height of its engagement in 2011, over 5000 soldiers to Afghanistan. The ISAF mandate – and the period covered by this analysis – ended on 31 December 2014. Up to 850 Bundeswehr soldiers remained in Afghanistan after that date to contribute to the follow-on operation 'Resolute Support'.

The thirteen-year long mission has been the most ambitious German military endeavour since the foundation of the Federal Republic in 1949. Six defence ministers came and went, four governments, and a total of about 100 000 Bundeswehr soldiers eventually served in Afghanistan. 55 soldiers were killed. The mission had a profound influence on the German view of military force and its role in the world. The impact of the mission on the Bundeswehr was crucial. "A new Bundeswehr has emerged. One that has learnt to participate in international missions. It has learnt a lot."[705]

German forces predominantly operated in the comparatively peaceful northern part of Afghanistan after taking control of Regional Command North (RCN). The troops were in charge of an area of 163 000km^2 (the size of England and Wales combined) with a population of 6.7 million. The area comprised Kunduz (300 000 inhabitants) and Mazar-e-Sharif (375 000), the site of the main German base. The terrain in the RCN is roughly half mountainous and half plains, with hot summers and harsh winters.

[705] Jonathan Schnitt, *Foxtrott 4: sechs Monate mit deutschen Soldaten in Afghanistan* (C. Bertelsmann Verlag, 2012). p.204.

3.2. German drones in Afghanistan

German UAVs in Afghanistan					
	LUNA	**ALADIN**	**KZO**	**Heron**	**MIKADO**
Introduced in AFG	2003	2005	2009	2010	2011
Used in Afghanistan by	***Heer***: *Heeresaufklärungs-truppe* (Hat) (Army Reconnaissance)	***Heer***: Hat *Infanterietruppe* (Infantry)	***Heer***: Hat *Artillerietruppe* (Artillery)	***Luftwaffe:*** *Taktisches Luftwaffen-geschwader 51 „Immelmann"*	***Heer***: Hat Infantry
Maximum used in AFG at any one time	n/a	n/a	1 "Zug" – 5 vehicles	3	40
Number of sorties flown (some numbers are for all areas of operation, including Kosovo, so Afghanistan numbers will be lower)	2003: 213 2004: 504 2005: 542 2006: 406 2007: 502 2008: 533 2009: 651 2010: 473 2011: 288 2012: 213 **Total: 4325 (6700 sorties until 2015)[a]**	2006: 188 2007: 207 2008: 405 2009: 307 2010: 173 2011: 146 2012: 174 **Total: 1600**	2009: 162 2010: 293 2011: 316 2012: 248 **Total: 1019**	2010: 229 2011: 437 2012: 430 **Total: 1096**	2011: 1204 2012: 381 **Total:1585**
Hours of flight (some numbers are for all areas of operation, so Afghanistan numbers will be lower)	2003: 580 h 2004: 1400 h 2005: 1600 h 2006: 1200 h 2007: 1500 h 2008: 1600 h 2009: 1800 h 2010: 1500 h 2011: 900 h 2012: 800 h **Total: 12880 h**	2006: 45 h 2007: 49 h 2008: 98 h 2009: 85 h 2010: 49 h 2011: 43 h 2012: 52 h **Total: 421 h**	2009: 600 h 2010: 900 h 2011: 950 h 2012: 750 h **Total: 3200 h**	2010: 2413 h 2011: 4736 h 2012: 5238 h **Total: 12387 h**	2011: 320 h 2012: 93 h **Total: 413 h**
Average flight- duration per sortie	2,9 h	0,3 h	3,1 h	11 h	0,3h
Numbers lost in Afghanistan in total[b]	40[c]	5[d]	2	2 (replaced)	
Numbers lost in total (incl. training & other ops)	52	30	18	2	4
Maintenance & operations costs [e]	6 063 €/h	4 596 €/h	13 979 €/h	8 675 €/h	519 €/h

When the Bundeswehr first arrived in Afghanistan it did not bring any UAVs, as it barely had any. The only unmanned system in use was CL-289 which was not deployed as its capabilities were of little use in Afghanistan. The first Bundeswehr UAV to be used in Afghanistan was LUNA, deployed from 2003 onwards. ALADIN and KZO followed in 2005 and 2009. The Luftwaffe began leasing three Heron I in 2010. The latest addition to the unmanned fleet in Afghanistan was the MIKADO micro-UAV in 2011. Throughout most of its Afghanistan mission, UAVs were the only German air-borne reconnaissance systems, only between 2007 and 2010, three Recce-Tornados were deployed.

3.2.1. The beginning – LUNA, the Bundeswehr's unmanned workhorse

Initially, LUNA was planned to be deployed to Afghanistan for one year only,[706] but, quickly proving its value, remained there for the full length of the operation and beyond. LUNA was used by Army Reconnaissance, first in Kabul, later in the RC North. It became the Bundeswehr's unmanned workhorse, flying around 500 sorties per year, accumulating more than 12 000 flight hours. These number only began to decrease with the introduction of Heron in 2011.

A mobile LUNA team consisted of seven soldiers in charge of launching, piloting, and recovering the system, and data analysis. LUNA has been developed for reconnaissance to a radius of 50–100km and for target acquisition. While it was regularly used in these capacities, LUNA proved most valuable when helping troops in trouble, such as when a Bundeswehr patrol was hit by an IED. Within minutes, LUNA was deployed from the base to monitor the situation, oversee the rescue operation and to accompany the troop back to base. LUNA was also used for regular patrol flights around the base. LUNA operators

[706] "Next drone mission to Kabul hangs in balance," *Jane's Defence Weekly* (2004).

became quickly creative with their system, using it for intimidation – flying it low over suspected enemy posts during the night "to simply let them know that we are there and watching".[707]

The majority of Bundeswehr soldier interviewed spoke fondly of LUNA, yet there were also problems. For one, its flight time was limited to around three hours, which at times was too short to provide support to troops on the ground. LUNA could only help out troops in contact, when these situations happened close enough to a base, or when a mobile team could be send out in time to cover the situation. The Army is planning procurement of a more powerful follow-up version, LUNA NG (Next Generation) which may alleviate some of these concerns. LUNA stayed in Afghanistan after the end of combat operations in late 2014, to support the follow-up mission.[708]

3.2.2. Looking over the next hill - ALADIN

ALADIN was introduced in 2005, to close a skills gap and allow soldiers an over-the-hill view. ALADIN was used by Army reconnaissance and the infantry. In a typical reconnaissance mission, a soldier carried the ALADIN vehicle and ground control station in a backpack. At the best vantage point, ALADIN was assembled and launched by hand. The vehicle reconnoitred the area for up to 45 minutes at an altitude of 20–200m above ground and monitors an area of up to 5km range, holding an uninterrupted connection to the line-of-sight radio link. ALADIN was often used during night missions as, thanks to its electric engine, ALADIN's signatures were low and the vehicle could fly largely undetected, relying on its night-vision cameras.

[707] Interview anonymous, April 2014.
[708] Information provided by the *Heer*, February 2014.

Throughout the mission, ALADIN provided good over-the-hill reconnaissance and came to be valued highly. The number of missions varied between 150 and 400 per year, with the variation mainly due to the number of patrols being sent out. One main concern with ALADIN was adverse weather: because of its low weight, the system could often not be deployed, particularly in strong winds.

3.2.3. KZO – A Cold War system in Afghanistan

From July 2009 onwards, the German unmanned capability in Afghanistan received additional support from KZO, used by the Army Reconnaissance.[709] Even though the Bundeswehr had up to 60 KZO vehicles, only five vehicles, with one ground control station and launcher were, at any time, deployed to Afghanistan, mainly because of problems with replacement parts.[710]. Because of their low numbers, the system was only used in the Kunduz area.[711] An officer told me in an interview that he felt that among the artillery officials, there was a clear "wish to get KZO to Afghanistan, no matter what", despite the fact that there were not enough systems for use and training.[712]

KZO still accumulated over 1000 sorties and 3200 hours of operation in Afghanistan. KZO was use predominantly during night-time as it carried an infrared, but no daylight camera (added later). This meant that KZOs was not used for combat reconnaissance as night battles were rare. A typical KZO mission in Afghanistan would send the UAV over the areas where Bundeswehr troops were stationed. Following a pre-programmed flight path, the UAV would reconnoitre the area, monitoring potential threats. For a typical KZO mission,

[709] Georg Kubis, "Das fliegende Auge: KZO im Einsatz über Afghanistan," *Hardthöhenkurier*, March 2011.
[710] Detlef Keller, "Die Drohnen des Heeres im Einsatz," *Strategie & Technik* (2011). p.20.
[711] Information as provided by the *Heer*. Email from March 2014.
[712] Interview with Army officer who wishes to remain anonymous.

three soldiers were needed: the pilot who controls the drone, an imagery analyst, and the commander overseeing the mission.[713]

Before the system was deployed, the media reported problems and crashes.[714] KZO, designed for use in Eastern Europe, struggled with the Afghan climate and had to be modified. The system was furthermore criticised by soldiers for being difficult to handle, and needing replacement parts often – which were difficult to procure. Other problems concerned the quality of the images, negatively affected by the vibration of the aircraft and the fast wear-out of parts. This combined with the limited number of aircraft available led to a situation in which few training flights could be done.

KZO did not create much added value in Afghanistan, particularly when compared to LUNA, while being considerably more expensive to operate (13 979 €/h compared to 6 063 €/h). In fact, KZO has the highest costs of operation of all German UAVs, including the larger and more powerful Heron 1. Its technical limitations – cumbersome, only infrared camera for most of the time – made it less valuable to the mission. Overall, KZO was a system from another era, sent into a 21st century war. Unsurprisingly, KZO was the first UAV to be withdrawn from Afghanistan in late 2012 and is planned to retire in 2018. A soldier from the Heer summarised the KZO development and use in one word: a "fiasco".[715]

3.2.4. Strategic-level reconnaissance – Heron 1 in Afghanistan

While the existing unmanned systems, particularly LUNA and ALADIN, provided good tactical support for the troops on the ground, additional, strategic-level ISR capability was

[713] Bundeswehr tv, "Aufklärer mit Airbag - KZO über Afghanistan," (2012).
[714] "Absturz vor dem Einsatz," *Spiegel*, 3 September 2007.
[715] Interview with anonymous, February 2014. ("KZO war ein Trauerspiel").

needed to guard ground troops during longer operations and to provide long-time, beyond-line-of-sight reconnaissance. The six (manned) reconnaissance 'Recce'-Tornados in Afghanistan could not perfectly fill this strategic-level reconnaissance role, and availability of strategic-level UAV from allied forces was limited.[716]

The Israeli-built Heron 1 was procured as an urgent operational requirement and declared fully operational in May 2010 (although it only flew line-of-sight operations in the first seven months). Heron was the first and as of 2017, only, Luftwaffe aircraft. Heron was remotely piloted by Luftwaffe pilots based at Camp Marmal, in Mazar-e-Sharif. A crew consisted of a pilot, tactical operator, and mission commander. Six crews were usually stationed in Afghanistan at the same time. A crew was sent to Afghanistan thrice a year for six to eight weeks. Further personnel, including civilian contractors, were in charge of the aircraft.[717] Missions lasted for up to 27 hours, in Afghanistan the average was 23 hours, with crews rotating every four hours.[718] The Heron was used extensively; between 2010 and 2013, the UAV completed more than 1000 sorties, flew for over 12 000 hours, and monitored the complete Regional Command North.

Operators and commanders identified three main uses of the Heron system: most importantly, Heron accompanied moving Army patrols. In fact, in the last years, no patrol was out without being accompanied by a Heron.[719] Heron was send out 24 hours before patrols, to check whether routes were trafficable – for instance after flood rains. Most importantly, Heron flew ahead of patrols to check for anything out of the ordinary: "if we

[716] Michael Krah, "UAS Heron 1 Einsatz in Afghanistan," *Strategie & Technik*, no. Februar (2011). p.37.
[717] Cassidian contractors are on site to ensure maintenance of the aircraft, and handled half of the take-offs and landings.
[718] Interview with anonymous, April 2014.
[719] Confirmed in interviews with several *Luftwaffe* and *Heer* officials, January to March 2014.

see no one around at usually busy places, if no children are playing outside, we get suspicious and look closer for clues for an imminent attack or hidden IEDs – spots on the ground indicating recently churned soil, abandoned cars etc."[720] Searching for IEDs was one of Heron's most important roles. IEDs could be detected by day-light camera, detecting changes in colour of the soil, infrared cameras indicated changes in soil temperature as recently planted IED appeared warmer – in winter, these changes could be observed for several hours after the IED was planted.[721] When accompanying troops, the UAV's operators and commander on the ground were in constant radio contact to warn them of enemy movements but also to inform them about more mundane issues such as traffic jams. This continuous coverage was highly valued by the soldiers, an operator described: "We were accompanying a patrol. When night fell, they put up their camp. Over radio they asked to the Heron. We flew lower so that they could hear us. 'A great sound, now we can all go to sleep', they said."[722]

Second, because of its long endurance (up to 72 hours with two Heron in relay), Heron was used to continuously monitor strategically important points, such as bridges and Taliban headquarters or meeting places. In at least one instance, the Heron was used – much like the LUNA – to circle over Mazar-e-Sharif headquarters as information about a possible attack on the camp had been intercepted.[723]

Third, Heron was used in combat situations. Here, the real-time video feed that could be sent to several different locations, and the communication link between the commanders on the ground and the Heron operators were crucial. Heron could warn troops on the

[720] Statement by a Heron pilot, March 2014.
[721] Kai Biermann and Thomas Wiegold, ""Ich bin kein Computerspieler"," *ZEIT*, 9 January 2015.
[722] Ibid.
[723] Interview anonymous, March 2014.

ground of hidden insurgents or helped guide attacks. It was the use in these situations that made the Luftwaffe want an armed UAV – the Air Force Inspector Müllner repeatedly told the story of having been at the Heron control centre during a Taliban ambush: the Bundeswehr forces got out without serious problems, but "what if the situation had been more critical? We could only sit there and watch."[724]

When Heron was deployed to Afghanistan, six Recce-Tornados that had been stationed there were withdrawn. It is an open question whether the systems were complementary or whether the Heron replaced the Tornado. The Recces were faster and had a greater range, but provided stills that could only be analysed after landing – but which were of better quality. (In October 2009 the Recce equipment was upgraded so that Tornado could transmit batches of low-quality images in-flight.) Heron on the other hand delivered real-time full motion videos. In Afghanistan, surveillance was mainly needed to accompany Bundeswehr patrols on the ground and to find IEDs – both roles which could not be fulfilled well by the Recce Tornado. While the Tornados operated in the complete ISAF area of operation, Heron only flew in the RC North, which increased its availability and flexibility.

[724] Statement as told by a Luftwaffe officer during an interview in March 2014. Exact phrasing by the author.

Illustration V.6. Afghanistan, German theatre of operation
Source: Presentation by Lt Col (GS) Smekal, German Air Force Command

The use of the Heron was not without problems. The very first operational flight on 17 March 2010 ended badly: after landing, the vehicle rolled into a parked C-160 Transall and was destroyed – a public relations disaster, although IAI quickly delivered a replacement aircraft. Two more Heron had to be destroyed deliberately when recovery was impossible after "emergency landings".[725] According to the official inquiry into the second of these incidents, it was caused by a combination of signal loss and operator error.[726]

[725] "Antwort der Bundesregierung auf kleine Anfrage. Änderung des Luftverkehrsgesetzes zum Drohnen-Einsatz. 17/8693," ed. Deutscher Bundestag (2012). p.16.
[726] "Aktuelle Lage in den Einsatzgebieten der Bundeswehr ", *Bundeswehr.de* 2014. p.4.

Still, assessment of the Heron by Bundeswehr publications and soldiers, has been universally positive: "the use of the Heron 1 has significantly improved our situational overview and helps keeping our forces safe".[727] The quality of the surveillance equipment has been praised: "When the weather is good I can even make out the colour of shoes".[728] The costs of operation of the Heron have been estimated at a comparably low 8675€/h, lower than for the smaller and clearly less valuable KZO.

Many have praised the option of having the data gathered by the Heron distributed to many different analysts at the same time: "In Afghanistan [the data is received by] the operations headquarter in Kunduz and Mazar-e-Sharif; but it can also be watched in real-time in Germany. By using two additional mobile receivers, our international partners, such as the Swedish regional headquarter in Mazar-e-Sharif or the Norwegian headquarter in Maymneh, can equally be involved. [...] Thanks to an [additional] interface, the full motion video can also be received by forces on the ground on a laptop."[729] Although Heron was managed through ISAF Joint Command, meaning that it could be assigned to support other troops, it effectively only flew for German troops.[730] The Bundeswehr did however get support from other nations, in particular US assets, including armed UAVs.[731]

Initially, the stationing of the Heron crew in Mazar-e-Sharif was necessary because the aircraft was piloted by line-of-sight. But even after satellite capability was added, the

[727] "Immer und überall gegenwärtig - der Heron 1 im Einsatz (Letzter Teil)," *Luftwaffe.de*, 18 February 2011.
[728] Peter M., "Entscheidende Informationen," *Bundeswehr.de* (2010).
[729] "Immer und überall gegenwärtig - der Heron 1 im Einsatz (Fortsetzung)," *Luftwaffe.de*, 16 February 2011. A Heron operator however said, the data was never actually analysed in Germany.
[730] Interview with *Luftwaffe* officer March 2014.
[731] Sascha Brinkmann, Joachim Hoppe, and Wolfgang Schröder, *Feindkontakt: Gefechtsberichte aus Afghanistan* (Hamburg, Berlin, Bonn: E.S. Mittler 2013). p.116.

crews remained in theatre. The Bundeswehr emphasised that the deployment helped the operator not to lose contact with the mission.[732] Operators have seconded this, arguing the opportunity to meet the soldiers they are protecting in person was important.[733] The MoD has announced that if it were to acquire armed UAVs, it would station the operators in proximity to the troops they are serving.[734] Heron remained in Afghanistan, three more systems were sent to Mali in November 2016. Germany plans to procure its armed follow-up system, Heron TP.

3.2.5. A View into Afghan compounds – MIKADO

The small, vertical take-off MIKADO was introduced in March 2011 and immediately put to use. C.40 systems were in use in Afghanistan. In the first four months, MIKADO flew 269 sorties,[735] and in all of 2011 1204 (including use in Kosovo), more than three missions per day.[736] Like ALADIN, MIKADO was used by the Army reconnaissance and infantry. Because of its small size, one soldier could carry the system, including its ground station, in a rucksack; the system was ready to start in five minutes. The UAV was controlled from the ground by the soldier and its images seen and analysed directly by the troops – images could not be sent to headquarters. MIKADO had two typical uses. First, small reconnaissance patrols used the drone to look over the next hill. In this vein, MIKADO (and ALADIN), helped to decrease the risk for the soldiers and the number of soldiers to be sent out. Second, MIKADO accompanied patrols on food, in urban terrain. MIKADO was particularly suitable for this type of mission because it could fly at slow speed and hover

[732] Biermann and Wiegold, *Drohnen. Chancen und Gefahren einer neuen Technik*. p.116.
[733] Interview with *Luftwaffe* officer, February 2014.
[734] "Argumentationslinien zum Thema: Unbemannte Luftfahrzeugsysteme/Unmanned Aerial Systems (UAS)." p.39.
[735] Neuhaus, "Ein Stueck vom Himmel fuer das Heer - Sachstand und Perspektiven zu UAS des Heeres." p.47.
[736] Numbers provided to the author by the *Luftwaffe*.

over areas, and allowed soldiers to look over the omnipresent Afghan compound walls. MIKADO helped Bundeswehr soldiers to navigate through the streets of Kunduz.[737] Several Bundeswehr members furthermore underlined the psychological effect of MIKADO. When accompanying a squad or platoon through urban areas, the MIKADO would be perceived as an additional presence – "intimidating those who deserve it, while reassuring the others".[738]

3.3. Specific incidents

Two instances of the Bundeswehr's operations in Afghanistan were particularly critical; the 'Karfreitagsgefecht' (Battle of Good Friday) in April 2010, one of the deadliest attacks for the Bundeswehr, and 'Operation Halmazag' in October/November 2010, the first German offensive since WWII. The following studies the role played by drones in these events.

3.3.1. Karfreitagsgefecht

On 2 April 2010, in a routine operation, the first infantry paratrooper company from Kunduz was sent to protect an IED-sweep in Isa Khel, a village a few kilometres from base. The company was ambushed by 40 Taliban fighters. One Bundeswehr soldier was killed in the initial attack and two badly wounded. An hour into the fight, another two soldiers were killed when a 'Dingo' armoured vehicle hit an IED. Reinforcements were sent from Kunduz; US Medevacs recovered the wounded. US Air fighters flew 'show of force' manoeuvres, but air attacks were impossible because of the proximity of the attacker to the troops. The fight lasted for several hours. In parallel, the police station in Chahar Dara a few kilometres away was attacked by insurgents, most likely in an effort to cut off

[737] Interview with anonymous Army officer, March 2014.
[738] Interview with Army officer, March 2014.

reinforcement routes. By the time the fighting in Isa Khel stopped, three Bundeswehr soldiers had been killed, four were badly wounded and another four injured. In a tragic misunderstanding following the fight, six Afghan soldiers died in a friendly fire accident.[739] For the Bundeswehr, the Karfreitagsgefecht has been the deadliest fight in Afghanistan and the heaviest combat since WWII.

Drones did not play a glorious role in this attack. The first soldiers to be attacked by the insurgents were four soldiers that had been sent to recover a MIKADO drone that had been carried away by a gust of wind.[740] While the attack would probably have happened in any case, it underlined the dangers associated with drone recoveries. MIKADO was operated by the troops on the ground, the troops also had support from LUNA and KZO, piloted from camp. In the night before the attack, a drone, most likely KZO, had reconnoitred the area and possibly scared away an insurgent trying to place an IED.[741]

Official accounts mention the presence of the drones,[742] there is however no mention of how much they saw, who had access to their data and whether any decisions were taken on basis of that data. In fact, two different claims have been made. First, reports by soldiers argue that the UAV had apprehended the insurgents before the attack, but the information had been ignored:

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[739] Good accounts of the Karfreitagsgefecht can be found here: Andreas Trenzinger, "Isa Khel, Karfreitag 2010," in *Feindkontakt*, ed. Sascha Brinkmann, Joachim Hoppe, and Wolfgang Schroeder (Berlin: Mittler, 2013). Matthias Gebauer and Shoib Najafizada, "Taliban-Angriff auf die Bundeswehr: Blutiger Karfreitag in Camp Kunduz," *SpiegelOnline* 2 April 2010. "Statement des Generalinspekteurs der Bundeswehr, General Volker Wieker," *Bundeswehr.de* (2010). Boris Barchow, "Anschlag am Karfreitag: Ein Erlebnisbericht eines Soldaten," *Focus* 28 July 2010.

[740] On this incident see Trenzinger, "Isa Khel, Karfreitag 2010." p.24. Also see Martin Ahlers, Ludger Böhne, and Armin Dille, "Bundeswehr-Soldat spricht über Taliban-Angriff - 'Ich würde wieder nach Afghanistan gehen'," *Der Westen*, 22 April 2011.

[741] Trenzinger, "Isa Khel, Karfreitag 2010." p.22.

[742] In the official statement, only LUNA and KZO are mentioned. Reports by soldiers who were present however also mention the MIKADO. See "Statement des Generalinspekteurs der Bundeswehr, General Volker Wieker."

> "We've been told today that the leader of Provincial Reconstruction Team Kunduz has issued the order that we have to refrain from all accusations with regard to Good Friday and the three dead comrades. This clearly means: no one is allowed to criticize the leadership. That's typical. *In particular since the operators of LUNA, a reconnaissance drone which was in the air before and during the fight, said that they could see everything and that they had apprehended the Taliban before the attack happened, but the leadership just did not react. In addition, the recording from the flight have been confiscated and classified as 'top secret'."*[743]

Another account tells a similar story: "Supposedly our drones could see the insurgents approach. We did not know anything about this. I could of course wonder whether this would have changed anything."[744]

The second, contrary claim is that the drones were either not actually present during the fight because of weather-related problems: "the base in Kunduz had unmanned drones of the LUNA type […]. The Problem: because of a sandstorm Luna could not be used for half an hour before the attack".[745] Heron, while already in Afghanistan at the time, was not yet operational because of the aforementioned accident during its first flight.

Depending on whether the first or second account is true, drones did either play no role or had no positive impact. While drones would not have necessarily detected the IED that caused the most serious injuries, drones could have provided help during the battle. Armed forces Commissioner Königshaus argued that the presence of armed drones could have substantially improved the situation: "If we had had the capabilities not only to

[743] "Kriegstagebuch eines deutschen Soldaten in Afghanistan," *Nürnberger Nachrichten*, 25 October 2010. (emphasis added).
[744] Franz Feyder, "Die Lehren von Isa Khel - ein Jahr nach den schweren Gefechten am Karfreitag," *"Streitkräfte und Strategien" NDR* (2011).
[745] Matthias Gebauer and Shoib Najafizada, "Angriff auf deutsche Soldaten: Taliban attackieren Bundeswehr in Kunduz," *SpiegelOnline* 9 April 2010. Thorsten Jungholt, "Bundeswehr in Afghanistan bedingt einsatzbereit," *Welt*, 6 April 2010.

watch but to immediately intervene [i.e. with weapons], we could have prevented much harm".[746]

3.3.2. Operation Halmazag

Between 31 October and 4 November, 400 ISAF (mainly Bundeswehr) soldiers and 100 Afghan forces carried out Operation 'Halmazag' in the Kunduz region and in proximity of Isa Khel. The goal of the operation was to secure the area, disperse the Taliban forces and establish a new outpost. These aims were reached after four days of heavy fighting. The destroyed Dingo which had been left behind on Good Friday was recovered. Several soldiers were wounded, but no ISAF soldiers were killed. Operation Halmazag included some of the heaviest fighting of the German mission; the howitzer stationed in Kunduz was used; American F-15 and F-16 provided close air support.[747]

Operation Halmazag should be a perfect case study regarding the use of Bundeswehr drones in Afghanistan. While in most cases the Bundeswehr has only been reacting to attacks, this time they "took action against the Taliban, and did not let them take action against us".[748] Hence, the use of any equipment could be planned in advance. Furthermore, Halmazag took place in late 2010, a time when the majority of UAV types had been in Afghanistan for a while.

Yet, there is very little note of UAVs. Official accounts mentioned the use of UAVs on three of the five days. The only UAV mentioned by name in the official report and other sources

[746] Peer Uhlmann, "Wehrbeauftragter in Afghanistan: „Kosovo-Fehler nicht wiederholen"," *Radio Andernach*, 5 April 2013.
[747] Good sources on Operation Halmazag: Marco Seliger, "Der Sieg bei Isa Khel," *FAZ*, 15 April 2010. Presse- und Informationsstab BMVg, "Afghanistan: Informationen zur Operation Halmazag," *Bundeswehr.de* (2010). David Schraven, "Die erste Schlacht der Bundeswehr in Afghanistan," *WAZ*, 4 November 2012.
[748] Seliger, "Der Sieg bei Isa Khel."

was KZO which was used for damage assessment.[749] Two detailed descriptions of the operation, written by Bundeswehr paratroopers, mentioned drones only in passing.[750] Oberstleutnant von Blumröder, Task Force commander and the operation's chief planner referred to drones twice in his account, first when he was informed that a UAV has spotted fighters in a village, second, when he recalls being kept awake by the noise of a UAVs.[751] Johannes Clair, a paratrooper, wrote a book about Operation Halmazag, but on 400 pages, mentioned UAVs a total of six times. Asked about it, he noted "for absolutely every operation, every patrol and every mission outside the base we had a drone with us. […] That I did not mention them more can be explained by the fact that they did not play a central role for the actions".[752]

3.4. Conclusion – A better battlespace awareness

The Afghanistan mission was crucial for the Bundeswehr's UAV arsenal. All but two UAVs (LUNA and KZO) were procured specifically for the mission. Considering Germany's limited defence budget, it would not have invested as much and as fast in UAVs without the incentive of the operation.

The ISR UAVs were popular with the troops in Afghanistan. "There cannot be any discussion about surveillance UAVs… they are simply indispensable", an infantryman noted.[753] Without the continuous reconnaissance provided by UAVs, the situation in Afghanistan would have been more difficult. On the tactical level, drones offered an over-

[749] BMVg, "Afghanistan: Informationen zur Operation Halmazag." Cf. also Stefan Löwenstein, "Haubitzenfeuer auf Mörserstellungen," *FAZ Blog*, 4 November 2010.
[750] Christian von Blumroeder, "Operation Halmazag," in *Feindkontakt*, ed. Sascha Brinkmann, Joachim Hoppe, and Wolfgang Schroder (Berlin: Mittler, 2013).
[751] Ibid. p.87,90. Von Blumröder was not available for an interview.
[752] Email conversation with Johannes Clair.
[753] Quoted in Biermann and Wiegold, *Drohnen. Chancen und Gefahren einer neuen Technik*. p.12.

the-hill or over-the-compound-wall view that no other system could deliver. This added immensely to the actual, and perceived, security of the forces and their awareness of their surroundings, in particular at low hierarchical levels. On the operational level, the flexibility of the reconnaissance by the smaller UAV types proved particularly valuable. While strategic assets such as Heron, allied UAVs, or other air support had to be requested through RC North – which meant that depending on ongoing operations the requested asset may be denied, and the demand took longer to be handled – operation-level UAVs such as KZO and LUNA could be deployed flexibly when needed. That the systems did not need airstrips to start or land added to their flexibility.

Data on Bundeswehr UAV flight hours and numbers of flights in Afghanistan show that their use increased quickly as all systems were put to use as fast as possible, oftentimes from the moment they were available.

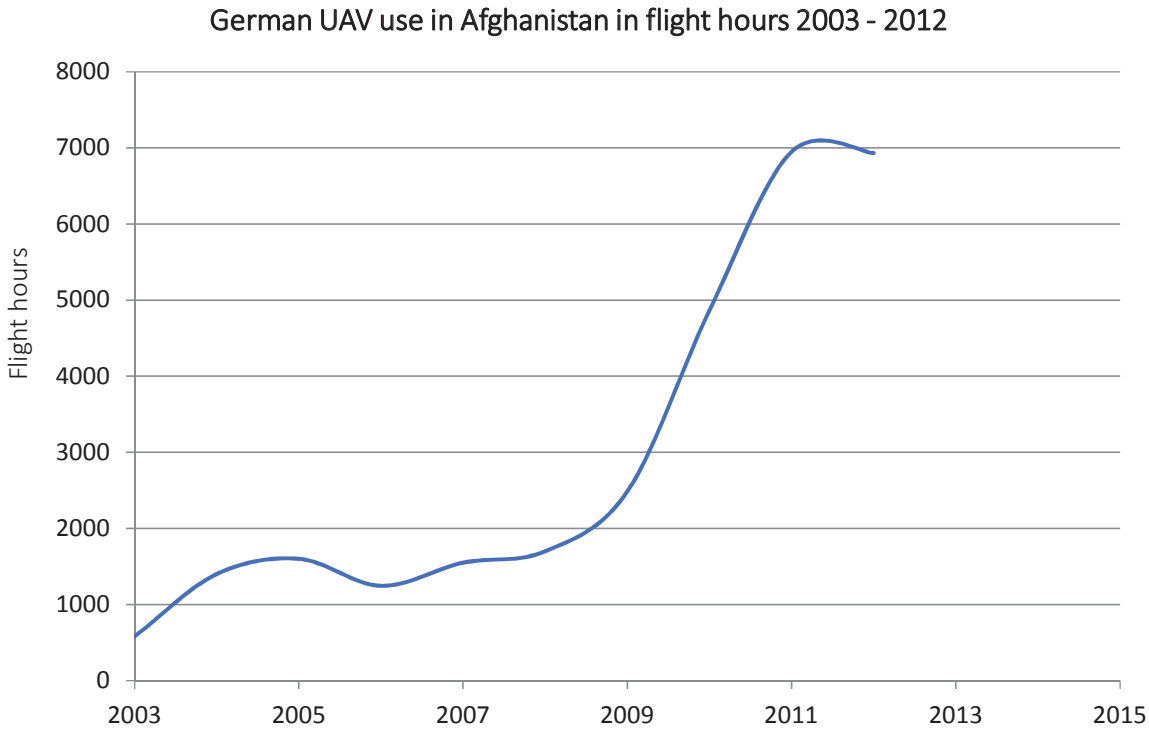

Illustration V.7. UAV use in flight hours

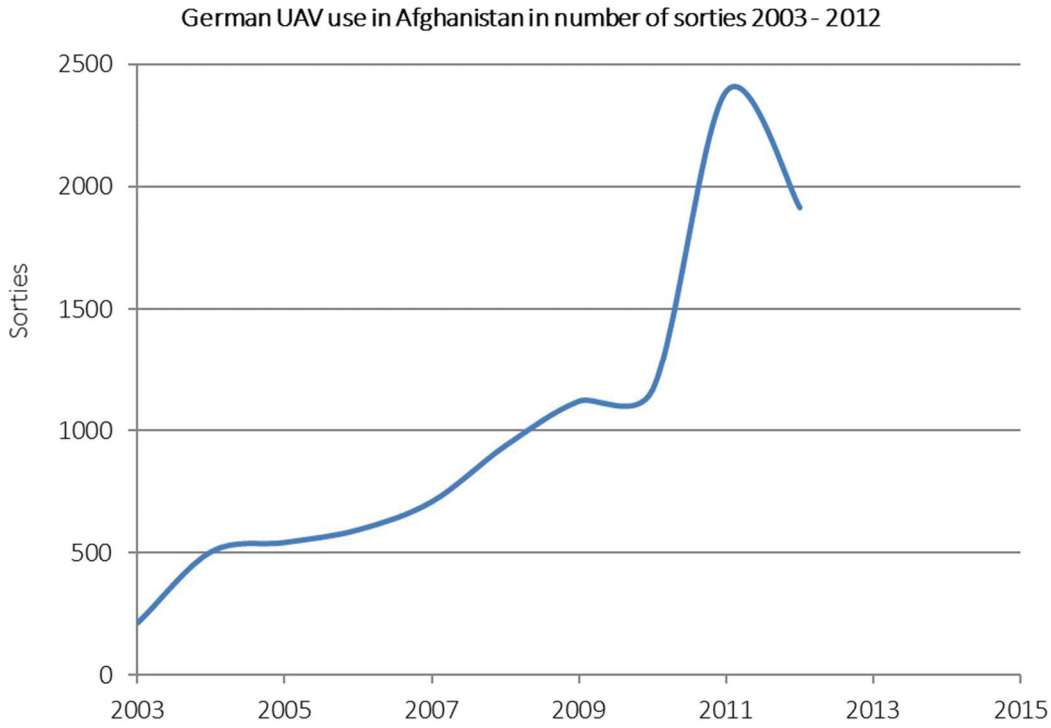

Illustration V.8. UAV use in number of sorties

Data broken down by drone type gives insights into the time when all UAV types were present in theatre simultaneously (after 2010). Illustration V.9. shows that the increase in flight hours from 2010 has been caused mainly by the introduction of Heron1, and an increase in the use of mini-UAVs. Illustration V.10. reveals that Heron's introduction caused a reduction in sorties of the tactical systems, which points toward a substitution, meaning that Heron took over some tasks previously fulfilled by the mid-sizes systems. While mini-UAVs make up most flights (mainly due to the extensive use of MIKADO), they contribute little to the overall flights hours because of their low endurance. The sharp decline in their use after 2011 (Illustration V.10.) is due to a change in tactic, in particular a reduction of patrols that would require mini-UAVs.

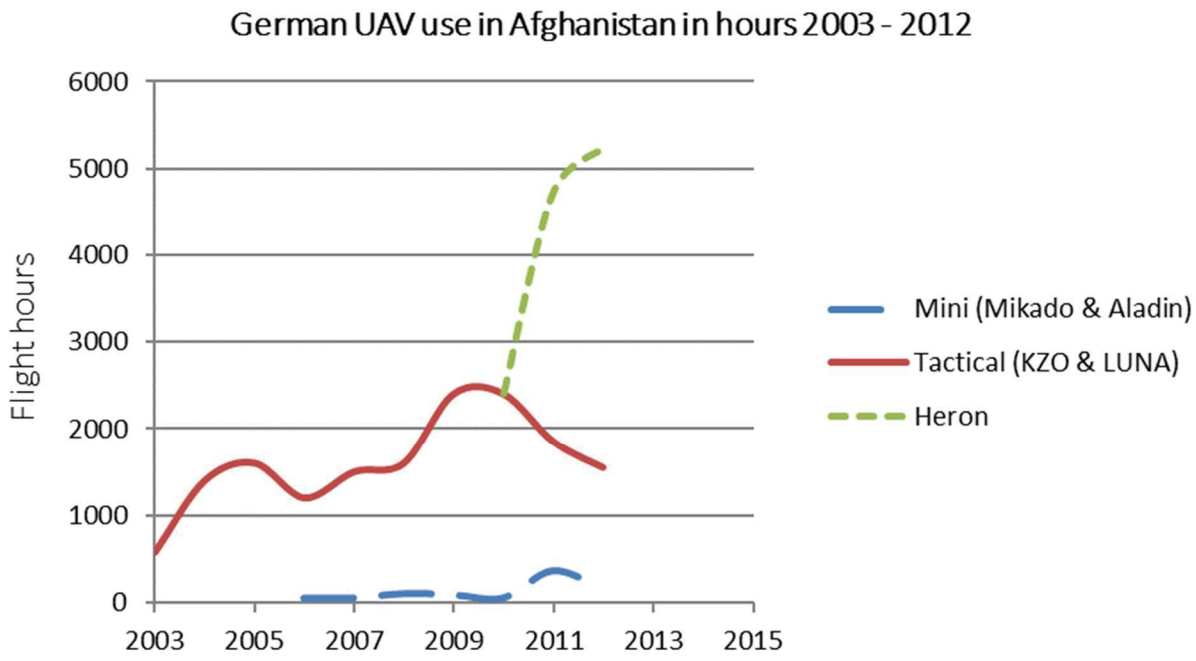

Illustration V.9. Flight hours different systems

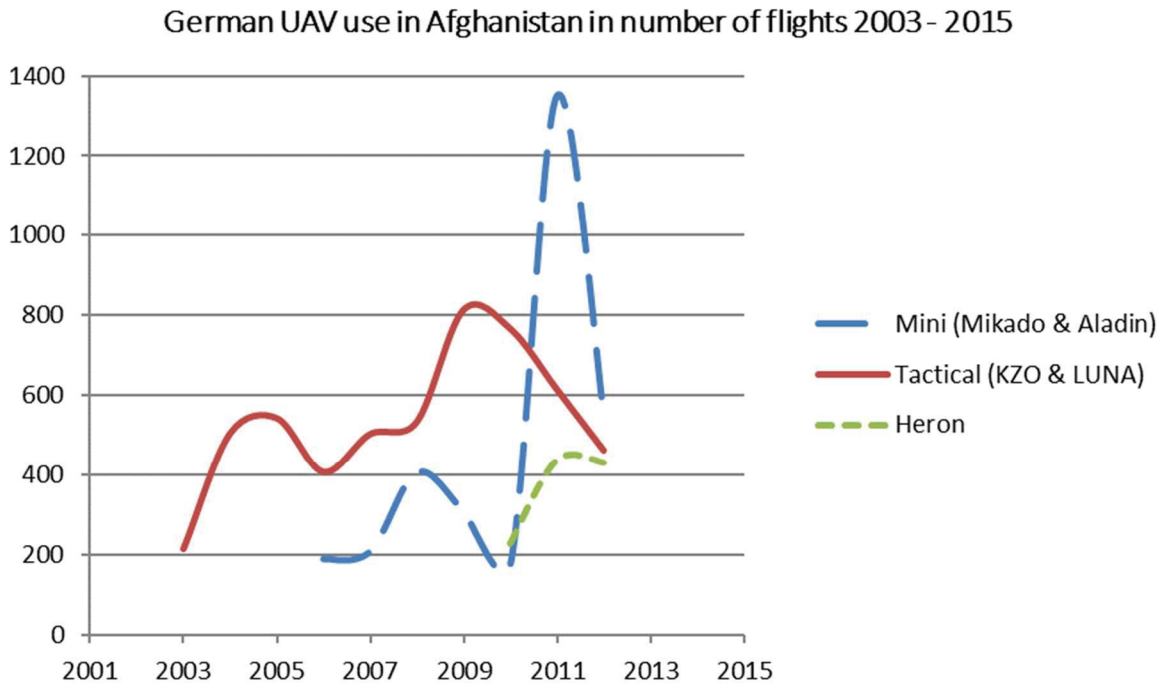

Illustration V.10. Different UAV systems sorties

With five drone systems, the Bundeswehr had a comparatively large range of UAV types in use in Afghanistan. On the tactical level, ALADIN and MIKADO proved their worth and, as one was a fixed-wing and one a VTOL system, were used in different circumstances. The continuous, strategic-level surveillance offered by Heron provided clear value added. "Once the soldiers have had a Heron with them, they a hooked – and never want to be without it".[754] KZO and LUNA capabilities, however, overlapped with each other, and having two systems proved largely nonsensical, in particular as some of their tasks were taken over by Heron. The mid-sized systems also had high loss rates, caused mainly by susceptibility to weather. In this regard, smaller and lighter UAVs by design struggled most and could at times not be used because of strong winds. KZO's delayed development meant that it was obsolete before having been introduced to the battlefield, cumbersome compared to LUNA and more suited for the Cold War than the 21st century. KZO was

[754] Interview anonymous Luftwaffe officer, April 2014.

plagued by quick erosion combined with a lack of replacement parts. It would have been preferable if KZO had been substituted by LUNA and Heron.

Many written accounts by soldiers returning from Afghanistan do not mention UAVs or assign them much importance. It could be that soldiers fighting in Afghanistan simply do not know war without drones – this had been the Bundeswehr's first 'real' combat operation and most soldiers are too young to have been deployed to Kosovo. Yet, given that many Bundeswehr soldiers did several tours in Afghanistan, they could have noticed the difference the gradual introduction of the different systems made. Two conclusions can be drawn from this: first, for the soldiers, the presence of drones became normalised quickly. Another reading is that for the majority of soldiers, drones simply did not play a central, a revolutionary role. In fact, through interviews and analysis of written accounts, it has become clear that members of the military do not believe in the Unmanned Revolution narrative. When asked directly, no soldier would agree with the assessment that revolutionary change had taken place. With or without UAVs, they argued, the fundamental realities of armed conflict remain the same. Soldiers appeared generally sceptical of the idea that one system, one technology, could ever have such a fundamental impact. This is in line with the general German approach to warfare which emphasises integrated solutions.

The fog of war was thus not lifted. Drones did their part to illuminate the battlefield, but as the commander of PRT Kunduz's first Infantry Company asserts: "good gear and intensive preparation notwithstanding, it is impossible to control and even less to predict

what is happening on the battlefield."[755] This reality was not changed by the presence of "digital vantage points".[756]

An interesting finding is that a comparatively high number of UAVs is needed in order to use them in military operations. Out of several hundred German UAVs, only a fraction was employed in Afghanistan at any one time due to the need for training and maintenance. Furthermore, many vehicles were destroyed in accidents or lost. In a few situations, drones caused problems, namely when UAV crashes required troops to recover the wreckage, such as at the start of the Good Friday battle. On 19 December 2010, the recovery of the second crashed Heron almost cost the lives of a helicopter crew. An American Chinook helicopter attempted to tow the UAV. Due to its low weight, Heron was lifted by the head wind, flying for a while parallel to the helicopter and risking being caught in its rotors.[757] Luckily, no one was hurt. The recovery was eventually aborted, and the aircraft destroyed.

Finally, the presence of unarmed unmanned systems appeared to have awakened the interest in armed ones. A Luftwaffe publication deplored that Heron could not provide the capabilities of an armed system.[758] Heron operators described the ability to see an ambush while not being able to help comrades as extremely frustrating.[759] Hence, the argument by anti-drone activists who oppose the use of unarmed systems precisely because they consider them a slippery slope towards the procurement of combat

[755] Trenzinger, "Isa Khel, Karfreitag 2010." p.35.
[756] "Was sagen fuhrende Offiziere der Luftwaffe zum Einsatz des Heron?," *Wehrtechnik* 2010.
[757] Biermann and Wiegold, *Drohnen. Chancen und Gefahren einer neuen Technik*. p.60.
[758] "Immer und überall gegenwärtig - der Heron 1 im Einsatz (Letzter Teil)."
[759] Interview anonymous Luftwaffe officer, April 2014. Also see "Es liegt was in der Luft," *Süddeutsche Zeitung*, 29 January 2014.

drones,[760] has, at least for the German case, proven correct. “I don’t know anyone [in the Luftwaffe] who does not want an armed system”, an operator noted.[761] Armed drones would have been useful at several instances and might have saved lives, it seems unlikely that the presence of German armed drones in Afghanistan would have fundamentally changed the situation. During the thirteen years of operation, German troops were supported by American armed drones twice.[762]

Despite speculations about “wars by remote-control”, with several thousand Bundeswehr soldiers on the ground – including all drone operators – over fifty killed in action and many more wounded, this was no remote-controlled war for the Bundeswehr, the use of several hundred drones notwithstanding. During Halmazag enemy fighters were so close that paratroopers had to spend days in trenches without supply.[763] Air support was impossible during the Battle of Good Friday as enemy troops could not be targeted without risking hitting own troops.[764]

4. UAVs in German doctrinal and strategic thinking

Many have argued that post-WWII Germany lacks a strategic culture, thus impeding strategic thinking. Tom Dyson in this context talks about “doctrinal stagnation”,[765] partly explained by the ‘ban on thinking’ on all things military since WWII. The fact that Germany only resumed full sovereignty in 1990 and the comparative underdevelopment of security

[760] Interview with a MP of the Linkspartei, March 2014.
[761] Interview Michael Hogrebe March 2014.
[762] Bartels, "'Drohnen sind nicht die Spitze der Technik'. Interview mit Hans-Peter Bartels (SPD)." "Antwort der Bundesregierung auf Große Anfrage "Haltung der Bundesregierung zum Erwerb und Einsatz von Kampfdrohnen". 17/13655," ed. Deutscher Bundestag (2013). p.2.
[763] Schraven, "Die erste Schlacht der Bundeswehr in Afghanistan."
[764] Trenzinger, "Isa Khel, Karfreitag 2010." p.26/28.
[765] Dyson, "Managing Convergence. German Military Doctrine and Capabilities in the 21st century."

policy institutions also hampered the development of coherent strategies and doctrines. Much like German politics, doctrinal and strategic development is done in a highly-consensual manner: "No one individual has the capacity to over-ride objections or changes to doctrine, hence even minor alterations involve a highly-bureaucratic process".[766] It is thus unsurprising that regularly published doctrinal documents are not a recurring feature in the German debate.

Six documents are most relevant for Germany's drone doctrine and strategy, all of which were written while UAVs were used in Afghanistan: the 2006 White Book,[767], the 2004 and 2013 'Bundeswehr Conception', the 2013 'Bundeswehr Reorientation, the 2013 'Army Reorientation' and the 2008 'Conceptual Assumptions on the use of UAVs'.

4.1. White Book

The White Book is Germany's highest-level doctrinal document. Published by the MoD since 1969, it formulates the goals of German defence policy and lays out the government's military planning. Over the last 50 years, twelve White Books have been published. The latest White Book was published in 2016.

The 2006 White Book, on 160 pages, mentions UAVs thrice. It alludes to the EuroHawk, intended to close the capability gap caused by the phasing-out of SIGINT aircraft Breguet Atlantic. In passing, it describes UAVs as one element of ground-based and airborne reconnaissance. The section dedicated to the Luftwaffe offers the most detailed mention of UAVs, which is surprising as the Air Force did not have any UAVs at time of writing and to date still only has one system; "Capabilities for airborne, stand-off and all-weather

[766] Ibid. p.254.

[767] In 2016, a new White book was published. While not within the period studied in this analysis, it will be discussed briefly at the end of this section.

surveillance and reconnaissance are to be ensured in the future mainly by means of unmanned aerial vehicles operating at medium and high altitudes."[768]

To compare, the 1994 White Book, although it included more details on armament projects, did not mention drones – even though the Army had an unmanned system in use, had just phased out another and three major UAV programmes were under development.

4.2. *Konzeption der Bundeswehr*

Two 'Conceptions' have been published, in 2004 and 2013. The cover picture of the 2003 Conception, showing a birds-eye view of a training exercise, was most likely taken by a drone. In the document however, no mention is made of unmanned systems. The importance of top-quality, modern equipment is emphasised several times, but without going into detail. "Worldwide reconnaissance" is however one of the four areas of expertise priorities.[769] But either UAVs were not considered crucial for this worldwide reconnaissance or no one thought it necessary to specify their role. Controlling the information space is also considered crucial: "the revolutionary developments in the area of information technology provide the opportunity to gather large amounts of information in a fast and secure manner and to send and process. It is crucial to control this area".[770]

Drones feature in the Conception 2011 – but the first mention is not about how the Bundeswehr should use drones but how to face the danger of drones being used against Germany: "it is to be expected that the threat by small arms, including RPGs and IEDs remain high in future conflicts, while [...] *the threat from [...] (small) unmanned aircraft […]*

[768] "White Paper 2006," ed. Federal Ministry of Defence. p.83.
[769] "Grundzüge der Konzeption der Bundeswehr," ed. Bundesministerium der Verteidigung (Berlin: 2004). p.17.
[770] Ibid. p.15.

will increase".[771] In this respect the publication was ahead of its time. The second reference is broad: "the combined use of manned and unmanned systems increases the protection of the deployed personnel and improves and enlarges capabilities […]".[772]

4.3. *Neuausrichtung der Bundeswehr*

The 'Reorientation strategy' was published in March 2013. It represented a major reform of the Bundeswehr structure to be implemented by 2017, aimed at increasing efficiency, but driven in particular by budgetary constraints and the wish to reduce personnel numbers. (As of 2017, the Bundeswehr in fact aims to increase its numbers and the government has pledged to increase the defence budget).

The Reorientation states that "the Luftwaffe will be able to provide up to two flying units […] including unmanned surveillance and reconnaissance in up to two theatres".[773] It further notes that the Luftwaffe will have five EuroHawks, four GlobalHawks (probably referring to the planned NATO aircraft) and 16 MALE drones. The inclusion of the MALE systems is surprising, as it is premature – four years after the document's publication, there is still no final decision on their procurement. No statement is made on whether these systems will be armed.

The Army published its own reorientation document shortly afterwards. It is the first document among those discussed to mention specific, existing systems: "airborne unmanned imagery intelligence is a major element of the Army's tactical reconnaissance system. Based on the LUNA close reconnaissance aerial vehicle and the KZO target acquisition drone, it delivers in near real-time information from the area of responsibility

[771]"Konzeption der Bundeswehr ", ed. Bundesministerium der Verteidigung (2013). p.30. (emphasis added).
[772] Ibid. p.36.
[773] "Die Neuausrichtung der Bundeswehr," ed. Bundesministerium der Verteidigung (2013). p.51.

and interest in particular to the tactical levels of command."[774] The document further predicts that in the "medium and long term" the infantryman will likely be supported by unmanned systems.[775]

While nothing more on drones is being said and no lessons-learned have made it into the document, the new structure of the Army should be noted. It is based on six brigades that include reconnaissance battalions which "exercise command over ground reconnaissance forces, short- and very short-range airborne reconnaissance assets (drones)".[776]

The Luftwaffe formulated already in 2012 a 'plan for realisation', somewhat anticipating the Reorientation. In it, it envisages the same structure with up to 16 MALE UAVs and nine HALE UAVs. It planned with two unmanned squadrons with either MALE or HALE systems.[777] In what kind of operations or in what way these systems are planned to be used was not further detailed.

4.4. *Konzeptionelle Grundvorstellungen zum Einsatz unbemannter Luftfahrzeuge in der Bundeswehr (KGv)*

The document whose title sounds as if it holds the answers to all questions about Bundeswehr UAVs, is classified. Published on 21 February 2008, the 'Conceptual Assumptions on the use of unmanned aerial vehicles by the Bundeswehr' is "the Bundeswehr's principal document regarding the use of UAVs" and "provides the conceptual framework for the introduction, use, and further development of UAVs in the

[774] "The Reorientation of the German Army," ed. Deutsches Heer (2013). p.84.
[775] Ibid. p.90.
[776] Ibid. p.30.
[777] "Realisierungsplan für die Einnahme der Luftwaffenstruktur," ed. Luftwaffe (2012). p.3.

Bundeswehr".[778] Unfortunately, attempts to access the document were unsuccessful – the Luftwaffe argued that it required "considerable annotation".[779] The only publicly available information on the matter is in an answer to a question in parliament and deserves a full citation:

> *"The KGv notes as current options for UAV use various reconnaissance and surveillance missions. In the future, UAVs shall be able to provide all-weather, long-range combat-reconnaissance and detection of [ABC] weapons or substances. In the long term and depending on technological developments, uses of UAVs for the following missions are conceivable:*
>
> - *As communications-relay,*
> - *for aerial refuelling,*
> - *for tactical transport of material,*
> - *use of weapons (e.g.to suppress ground-based air defence systems),*
> - *as addition to intelligence operations,*
> - *for early warning and targeting of ballistic missiles."*[780]

4.5. Other Documents

Answers to minor interpellations and parliamentary questions provide further insights into the government's and MoD's thinking on drone use. Four answers are directly relevant.[781]

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[778] "Antwort der Bundesregierung auf Kleine Anfrage, Einfuhrung und Bedeutung unbemannter militaerischer Fahrzeuge und Luftfahrzeuge 16/12193."
[779] Email to the author May 2014.
[780] "Antwort der Bundesregierung auf Kleine Anfrage, Einfuhrung und Bedeutung unbemannter militaerischer Fahrzeuge und Luftfahrzeuge 16/12193." p.2/3. Own translation.
[781] Ibid. "Antwort der Bundesregierung auf Kleine Anfrage. Entwicklung und Planung unbemannter Systeme der Bundeswehr. 17/9316," ed. Bundestag (Berlin: 2012). "Antwort der Bundesregierung auf Kleine Anfrage. Militärische Drohnen-Strategie der Bundesregierung: Kampfdrohnen. 17/14053," ed. Deutscher Bundestag (Berlin: 2013). "Antwort der Bundesregierung auf Kleine Anfrage. Abstürze von Drohnen. 17/14436," ed. Bundestag (Berlin: 2013).

In these answers, the MoD repeatedly emphasised that drones improve Germany's miliary capabilities – but are not seen as causing radical change: "UAVs are a technical solution and no new capability. No consequences for security- or armament policy are to be expected," "[u]nmanned systems do not represent an improvement per se".[782] Drones' long endurance which allows for continuous surveillance is seen as one of two main advantages.[783] This point is emphasised in several answers which is interesting as this statement holds true only (or mainly) for the Heron. The second advantage is the possibility for personnel reduction as UAVs offer reconnaissance previously provided by troops,[784] and the removal of troops from the battlefield thanks to MALE UAVs that can be piloted from a secure base.[785] Personnel reduction is a crucial element for a country with declining growth rates; the 'Reorientation' is specifically aimed at making its structure more "demography-resistant". On possible future uses the answers are very cautious – one adds the empty statement that "likely task will be international conflict prevention and the handling of crises".[786]

An interesting piece of information relates to the policy of how to handle the loss of a UAV. Two documents refer to the policy that UAVs are being recovered, or destroyed if recovery is impossible.[787] It is hinted that Bundeswehr RoEs are formulated in a way that lost UAVs are being abandoned "earlier than necessary" in order not to put soldiers in danger.[788]

[782] 16/12481, p.12 and 17/9316, p.9.
[783] 17/9316 p.9.
[784] 16/12481, p.3. Also see 17/9316 p.3.
[785] 16/12481, p.3.
[786] 17/9316, p.3.
[787] 17/9316, p.3, and 17/14436, p.5.
[788] 17/14436.

4.6. Conclusion – No unified thinking on drones

The analysis of German doctrinal writing has shown that doctrinal and strategic thinking about drones is underdeveloped in Germany. Lessons learned from Afghanistan appear to have not been fed into the writing. The analysis was hindered by the fact that the 2008 'Conceptual Assumptions on the use of unmanned aerial vehicles by the Bundeswehr' were classified. It appears as if both the political realm and the Bundeswehr preferred not to have any written commitments they may be made accountable to.

The availability of drones did not change Germany's official military strategy or the Bundeswehr's doctrine. Unmanned systems were thought as complementary to manned aircraft.[789] Future plans were ambitious, but remain unfulfilled; a decade after the declaration by the 2006 White Book that ISR capabilities are to be ensured mainly by MALE and HALE UAVs, the Bundeswehr still only has six (leased) MALEs. The gap between what is said and what is being done appears wide – particularly as already in 1982 (!) the government, in an answer to an interpellation, stated that within less than ten years, high-risk missions would increasingly be carried out by unmanned systems.[790] "Drones for surveillance and combat of armoured targets" were also considered a priority in 2000.[791]

Attention was directed to systems that are not yet in use, almost as if current systems were not thought to play an important role in the future. Particularly striking in the existing writing is the focus on MALE and HALE UAVs. The latest White Book from 2016 does not suggest a change in this approach – it includes solely mentioning of future European MALE UAV projects. Only the Air Force's MALE and HALE systems appear worthy

[789] Schneiderhan, "UV's - an indispensable asset in operations." p.91.
[790] "Antwort der Bundesregierung auf Kleine Anfrage "Weiterentwicklung der verteidigungstechnischen Industrie" 9/1401," ed. Deutscher Bundestag (1982). p.3.
[791] "Bundesbericht Forschung 2000 14/4229," ed. Deutscher Bundestag (2000). p.216.

of doctrinal and strategic attention, while Army systems are being ignored, despite the fact that as of 2017, the Bundeswehr has exactly six MALE and one HALE system (the EuroHawk demonstrator), but 600 other Army drone vehicles.

The Unmanned Revolution narrative was not mentioned in German doctrinal and strategic thinking, only the 2004 'Conception' mentions "revolutionary changes in the area of Information Technology".[792]

5. Organisational change

5.1. Training of UAV operators and integration into force structures

The fast introduction of UAVs into active combat led to training structures being put in place swiftly. For the smaller systems, this often meant training on the job and in theatre, as training beyond the initial instruction was at times impossible in Germany as all UAVs were deployed.[793] Heer and Luftwaffe UAV operators were trained independently of each other, with little exchanges on lessons learned regarding UAV taking place.[794]

The main user of drones in the Army was the newest Bundeswehr corps, the Army Reconnaissance (*Heeresaufklärungstruppe* HAT). KZO is also in use with the artillery and ALADIN and MIKADO are used by combat troops, armoured infantry formations, and the Special Forces (KSK). The systems were stationed all over Germany to allow for the training of all troops. The Army trained its drone operators at the School for Army Reconnaissance Münster and the Artillery School Idar-Oberstein on flight simulators and

[792] "Grundzüge der Konzeption der Bundeswehr." p.15.
[793] Heike Hasselbach, "Aufklärungsbataillon 6 Eutin: Aufklärer im Einsatz," *Bundesministerium der Verteidigung* (2008). Gerrit Ludwig and Tim Krüger, "Mikado sorgt für Überblick: Heer setzt Minidrohne in Afghanistan ein," *Bundeswehr Nachrichten* 30 May 2011.
[794] Interview with anonymous, February 2014.

real aircraft. By 2012, 1500 soldiers had been trained at KZO, LUNA, ALADIN und MIKADO.[795] Training courses usually took about three months; training on the smaller UAVs was shorter, with the MIKADO training course only lasting nine days.

A Luftwaffe crew for the Heron included the pilot ('air vehicle operator'), the payload operator ('tactical operator'), a mission commander, and an imagery analyst. The tactical operator oversaw use of the payload, the pilot controlled the aircraft, while the mission commander ensured communication with other units. Luftwaffe UAV pilots were recruited from the pool of manned systems' pilots all German MALE UAV pilots fly also manned systems in parallel to retain their licence.[796] Only tactical operators were not necessarily from the flying units. Both pilot and tactical operator were commissioned officers.

By early 2016, 80 Heron pilots and over 50 payload operators had been trained.[797] The training consisted in an 11-week course run by IAI in Israel – four weeks of theoretical training followed by a practical phase. Heron was flown by the Tactical Reconnaissance Squadron 51 "Immelmann", which also flies Recce-Tornados. Heron operators had their own badge, depicting a Heron over a globe.[798]

The Luftwaffe flew Heron for five years before finally acquiring a flight simulator stationed at Jagel Airbase, home of 51 Squadron. This had caused discontent among pilots; a few months before the decision to procure the simulator was taken, a Heron operator told

[795] Newer information is unfortunately not available. "Antwort der Bundesregierung auf kleine Anfrage. Änderung des Luftverkehrsgesetzes zum Drohnen-Einsatz. 17/8693."
[796] "[D]ie Ausbildung und die Erfahrung eines selbst fliegenden Luftfahrzeugführers [sind] von hohem Wert." "Fünfzehn Tonnen unbemannt ", *Y Das Magazin der Bundeswehr* 2010.
[797] "Die UAV-Piloten der Luftwaffe," *Flugrevue* (2017). Also, at least 11 EuroHawk pilots were trained before the project's cancellation. M. Werther and T. Braam, "Meilenstein der unbemannten militärischen Luftfahrt," *Luftwaffe.de* 2011.
[798] "Ausbildung am Heron 1," *Luftwaffe.de* 2011.

me: “We keep asking for one, but the answer always is ‘we’ll only fly the Heron for a little while longer, it’s not worth buying one.’”[799] The Luftwaffe had not planned to have Heron for as long as it did, as it was procured as interim solution, through short-term leasing contracts that were continuously renewed. Not having a simulator created problems, as after the 11-week trainings, there was no possibility for follow-up training before pilots were deployed into the area of operations. The fact that two of the three accidents that led to Heron destructions were due to operator error, casts an unfavourable light on this decision.

The Bundeswehr, over the last two decades, has gone through multiple organisational changes and reform, yet, no changes appear to specifically have been due to the introduction of UAVs. Rather, UAVs and their operators were integrated in existing structures. The new structure for the Army as laid out in the Bundeswehr ‘reorientation’ plans for the reconnaissance battalions to exercise command over short- and very short-range drones.[800] Unlike in the US, there was never a debate of creating an unmanned command or any other specific UAV structure.

In Afghanistan the presence of drones somewhat contributed to blurring the boundaries between Luftwaffe and Heer, as they worked together as one, with Heron directly working for and with Army troops. A Heron pilot pointed out “we are now really a member of the Heer troops”.[801]

[799] Ulrike Franke, "Armed Drones? Jein! Germany’s Qualified Decision for Armed UAVs," in *Security Watch* (2014).
[800] "Die Neuausrichtung der Bundeswehr." p.51.
[801] Interview with anonymous Luftwaffe officer, April 2014.

5.2. Conclusion – Little organisational change

As in the US, the introduction of UAVs into the Bundeswehr, led to the appearance of a new class of solider, UAV operators. In the Army, these operators were recruited from among the existing troops and did not stand apart other soldiers. In the Air Force, the distinction between UAV pilots and pilots of manned systems also appeared weaker than in the US, which can be explained by the much smaller numbers of operators, and the fact that UAV operators also kept piloting manned systems. Overall, no major organisational changes caused by drones can be detected in the Bundeswehr.

6. Social and societal change

6.1. Individual soldiers' experiences

6.1.2. Heer

The introduction of drones had major implications for the Army soldiers that operated them. It did not remove them from the fighting as Army drone pilots were on the ground, as part of regular (reconnaissance) troops. One of the people killed on Good Friday was trying to recover a downed UAVs, most likely its operator. More importantly however, drones, particularly the smallest UAVs that are used by individuals or small groups of soldiers provided infantry soldiers with a battlespace awareness that was inexistent before. The ability to look over compound walls, or navigate through urban street mazes, provided Army drone operators a much higher level of independence and self-determination, as they were no longer dependent on information from the commander. This information was available at comparatively low hierarchical levels, as units had their own small UAVs with them or where in contact with operators. The use of tactical drones also led to a further specialization of soldiers.

6.1.2. Luftwaffe

When Heron was first introduced, there was some reluctance among Luftwaffe personnel to become UAV pilots. This however changed quickly, as UAVs were seen as a future technology – and the guarantor of a secure workplace in a shrinking Bundeswehr. In 2014, an operator noted that there were more applications than free posts.[802]

Contrary to the US experiences, the difference between flying manned and unmanned systems was not as notable, as operators were still deployed to Afghanistan, where they lived on base with the soldiers, and were in constant interaction with the Army troops they were working for. Pilots considered the experience of flying UAVs not so different from flying manned systems: "In my head it's the same. One has certain processes that needs to be carried out whether one is in the cockpit or the ground control system – the same checks, the same communication with the crew. But of course, it feels different, as one cannot feel accelerating force, or weather [while fling the UAV]."[803]

As Herons were not armed, pilots were much less subject to psychologically taxing situations. Some describe seeing troops being hit by an IED, but they did not regularly have to deal with the consequences of attacks they carried out themselves. So far, there have not been any reports about PTSD among German drone pilots. A pilot notes that the fact that there are so few pilots also means that they stick together, able to exchange experiences. A psychologist assisted the operators.[804]

[802] Interview anonymous Luftwaffe officer, April 2014.
[803] Thomas Wiegold, "Interview mit einer Drohnen-Mannschaft: 'Ich bin nicht trigger-happy, kein Computerspieler'," in *Augengeradeaus*, ed. Thomas Wiegold (2015).
[804] Ibid.

Luftwaffe drone pilots rejected the 'PlayStation gamer' label even more forcefully than their US colleagues and clearly felt misunderstood by the media: "I read […] about us pilots being computer freaks… This is not correct. […] I don't have the desire to kill someone. The way we are being portrayed [by the media] is so extreme – 'these computer freaks who would just shoot at anything'. On the contrary! […] I don't want to just drop a bomb […] I want to be able to signal the enemy to leave our boys alone. You feel connected to [the troops on the ground]. And this is why we say that we need weapons".[805] "It's certainly not like watching a movie, or playing a video game. We are in the situation, at least psychologically," another operator concurs. "I am no trigger-happy gamer."[806]

While drone operators have complained about not receiving enough support by the public (a complain they share with other Bundeswehr soldiers), there have been no reports about problems within the troop. "Everyone in the Bundeswehr and the Luftwaffe know that we are doing a good job with the drone. We receive recognition and respect for that."[807] Interestingly, the operator linked this respect directly to the deployment: "they know that we are deployed one to three times a year, including over Christmas or birthdays. That wins acceptance." [808]

6.2. Democratic accountability

Any Bundeswehr operation needs to be decided by the Bundestag, as stipulated by the 'Parliamentary Participation Act'. Parliament had voted on the Afghanistan operation on

[805] Interview anonymous Luftwaffe officer April 2014.
[806] Wiegold, "Interview mit einer Drohnen-Mannschaft: 'Ich bin nicht trigger-happy, kein Computerspieler'."
[807] Ibid.
[808] Ibid.

22 December 2001.[809] In reaction to the experiences and debates in the US, the German government aimed to alleviate concerns about drone operations possibly undermining democratic accountability before this became an issue in Germany. In 2014, Defence Minister von der Leyen emphasised that the use of a drone – armed or not – always required a Bundestag mandate: "There is no operation of the Bundeswehr without clear rules on the deployment of weapons. Hence, the deployment of drones by the Bundeswehr is only possible if all legal – international as well as national – rules are being respected, and only after the decision is made by the Bundestag."[810] In fact, von der Leyen even suggested that the deployment of armed drones would underlie stricter rules than any other system; she suggested that parliament may have to specifically rubberstamp the use of armed drones.[811] That the minister decided to suggest creating a higher threshold for the parliamentary procedure for the use of armed drones than for the use of any other system is remarkable. And it is a direct result of the heated controversy that has characterised the German drone debate. Thus, in Germany, the argument that drones can be used in operations without implicating the public has hence been turned on its head, with operations likely to receive more attention – including by the political realm, if von der Leyen's additional rules for the deployment of armed systems are adopted.

7. Conclusion

UAVs have found their place in Bundeswehr operations. Within seventeen years, the Bundeswehr went from zero systems to seven; the German government is planning the procurement of an armed system and has decided to fund a European combat drone.

[809] Bundestag, "Stenographischer Bericht, 14/210, 22 Dezember," ed. Deutscher Bundestag (Berlin: 2001).
[810] See Franke, "Armed Drones? Jein! Germany's Qualified Decision for Armed UAVs."
[811] See Thomas Wiegold, "Neue Probleme bei Beschaffung bewaffneter Drohnen," *Augengeradeaus*, 20 June 2017. Also see Thomas Wiegold, "Von der Leyen Will Kampfdrohnen leasen," *Augengeradeaus*, 1 July 2014.

Several thousand Army soldiers have been trained as UAV operators, as well as over 100 Luftwaffe officers. The use of drones in Afghanistan has improved ISR at every level and saved lives. German military operations can no longer be imagined without unmanned systems. Yet, it does not appear that drones fundamentally changed the Bundeswehr's operations, doctrinal and strategic thinking or Bundeswehr organisation. The most important change caused by the introduction of drones pertains to the experiences of drone operators who experienced fundamentally new level of battlespace awareness.

The German drone debate was highly controversial and permeated by the Unmanned Revolution narrative. It had direct impact on drone doctrine and strategy, insofar as doctrinal and strategical thinking, already underdeveloped in Germany, was further stifled by the concerns of inciting controversy. That Germany, decades after first entertaining the idea of acquiring an armed drone system, as of 2017, still does not have an armed UAV, is also a result of the debate.

In fact, the public and political debate is one of the most striking and revolutionary elements of the introduction of drones in Germany. More than any changed caused by the use of drones, it is the debate surrounding them that has caused most upheaval in Germany. The public debate was caught between hype and hysteria, leading to a situation in which factual debate was difficult. The almost exclusive focus on US drone use has created the impression among the population that all drones are armed, that they are predominantly being used to kill individuals outside designated warzones. The opposition to drones has led to a reawakening of the peace movement, and has created an interest in military question in the general population that is extremely unusual in Germany. Minister von der Leyen noted, "it would be wrong to ignore the population's discomfort with

unmanned weapon systems. [...] [T]he very emotional drone debate shows, that we Germans are very sensitive to the type of weapons used by the Bundeswehr."[812]

The strong focus on US drone use – and the German role within the US drone architecture – while not seriously upsetting the relationship to the US, created some problems for German governments. Three Yemenis brought a claim to court, accusing the German government of complicity in the deaths of civilians by US drone strikes because it allowed the relaying of data through Ramstein Airbase.[813] This German involvement was also subject of numerous parliamentary questions.[814]

[812] "Ministerin im BAMS-Interview. Von der Leyen bei Kampfdrohnen skeptisch," *Bild*, 11 January 2014.
[813] Kate Connolly, "Court Dismisses Claim of German Complicity in Yemeni Drone Killings," *Guardian*, 27 May 2015.
[814] See Drucksache 18/11023 "Drucksache 18/11023 Antwort der Bundesregierung auf die kleine Anfrage. Die US-Basis Ramstein als wichtiger Knoten im weltweiten Drohnenkrieg," ed. Deutscher Bundestag (Berlin: 2017).

VI. United Kingdom

This chapter discusses British UAV use and the changes the introduction of UAVs has caused in the British way of war, doctrinal thinking, organisation, and society. It follows the same structure as the other case studies, starting with a short overview of past British UAV operations, and an analysis of the British drone debate. The core of the chapter is the discussion of British drone use in Afghanistan mainly Task Force Helmand between 2007 and 2014.[815] *The case study ends with a discussion of the doctrinal, strategic, organisational, and societal changes this UAV use has caused in the United Kingdom and its armed forces.*

1. Background on British UAV use

After efforts with target drones in the years preceding WWII (see chapter II), the UK began using surveillance UAVs in 1961. Between then and 2007, when it started acquiring the current systems, the UK employed three drone systems: SD-1, CL-89 Mirage, and Phoenix. Despite their limited capabilities, these systems laid the ground for future British drone usage.

1.1. British surveillance drones 1961 - 2008

1.1.1. SD-1

The Royal Artillery became one of the earliest users of reconnaissance drones worldwide, when, in 1961, it procured the AN/USD-l (SD-1 in the UK), the world's first reusable

[815] I focus my work on Helmand, as Helmand was the UK's main area of operation and Task Force Helmand was the UK's most important operation. Most soldiers' accounts are from Helmand; see for instance Doug Beattie and Philip Gomm, *Task Force Helmand: a soldier's story of life, death and combat on the Afghan front line* (Pocket Books, 2010), and *Helmand. Diaries of front-line Soldiers* (Oxford: Osprey, 2013). Reaper operations which went beyond Helmand (see illustration VI.8) are also discussed in this chapter.

surveillance UAV.[816] SD-1's airframe was provided by US manufacturer Radioplane, ISR equipment was built in the UK. In a rare video recording from 1965, SD-1 is shown as the Artillery's pride and joy.[817]

SD-1 was a tactical-size UAV, 4m long with a wingspan of 3.5m. The 195kg vehicle had a range of 160km. The system's biggest flaw was its limited endurance of only 30 minutes. The drone carried still picture and optional TV cameras and was equipped with illumination flares for night reconnaissance. Its main task was to spot targets for the artillery. As for other systems at the time, the drone had to be retrieved after landing for the data to be analysed. SD-1 remained in use until early 1972. Contrary to its successor, SD-1 never saw active duty and has been largely forgotten.

1.1.2. Midge 501 (CL-89)

Canadair 'Midge 501', the British CL-89 version replaced SD-1 in 1972, used again by the Artillery. Based in Celle, the regiment trained jointly with the Bundeswehr.[818] The CL-89 carried an automatic exposure control camera, capable of taking pictures by day and night.[819] As with SD-1, the film had to be retrieved after landing, making the surveillance of moving targets difficult.

Whereas Germany and France replaced CL-89 with the CL-289 in the early 1990s, the British Army kept Midge until 1999, as its successor system Phoenix was severely delayed. One unit served in the First Gulf War 1990/1991, a mission that highlighted the system's

[816] Information on the SD-1 gathered from the following sources: Draper, *Sitting ducks & peeping toms*. p.289. Andreas Parsch, *Northrop (Radioplane) SD-1/MQM-57 Falconer* (2007 [cited 2015]); available from http://www.designation-systems.net/dusrm/m-57.html. *The Northrop Radioplane Target Drone*, (2005 [cited 2015]); available from http://www.ctie.monash.edu.au/hargrave/rpav_radioplane6.html. Flight, *Northrop Radioplane RP-71 Falconer, SD-l* ([cited).

[817] *Artillery Entertain Public 1965*, (1965).

[818] John Walton, "Gunners eyes and ears." See Germany chapter for more on CL-89.

[819] Draper, *Sitting ducks & peeping toms*. p.296.

limitations, namely limited endurance and no real-time data. Overall, a post-war analysis concluded, Midge "made little contribution to the war."[820]

1.1.3. Phoenix

Phoenix, the first UK-built drone, paved the way for British military UAV use. Its real-time capabilities were a "step-change in capability".[821] Phoenix was supposed to enter service in the late 1980s, but an ever-growing number of problems delayed the project until 1999.[822] The UK bought 198 Phoenix, which, until 2007, were the only UAV in regular service with the British Forces.[823]

Phoenix was a 175kg aircraft, with a wingspan of 5.6m, and 5 hours endurance – a considerable improvement on previous systems.[824] Phoenix was a day-and-night, real-time surveillance system. To ensure the vehicle would not require a runway, the drone landed by parachute.

In May 1999, only months after entering service, a Phoenix battery was rushed to Kosovo, beginning flights just days before the 78-day air operation ended, a decision motivated by the wish to demonstrate the system's capabilities. Once the air operations were over, Phoenix remained in Kosovo until 2001, and flew surveillance flights in support of KFOR patrols: "We're doing ethnic protection, helping protect enclaves through deterrence".[825] Phoenix – designed to spot for the artillery in a war against the Soviet Union on the north

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[820] Tim Ripley, *British Army Aviation in Action* (Casemate Publishers, 2011). p.55.
[821] "Phoenix: Rising out of the Crashes," *Jane's Defence Industry*, 1 February 2000.
[822] For a very detailed account of Phoenix development and deployment history, see Draper, *Sitting ducks & peeping toms*. p.297-314.
[823] *Phoenix Unmanned Aerial Vehicle (UAV) - No Longer In Service*, ([cited 10 February 2015]); available from http://www.armedforces.co.uk/army/listings/l0099.html.
[824] "Phoenix – Unmanned Vehicle (UAV) Specifications & Data Sheet," *unmanned* 1 January 2011
[825] "British Army to rationalise UAV operations," *Jane's Defence Weekly*, 6 September 2001.

German plain[826] – was thus used for the type of operations most modern UAVs are flying today. But Phoenix did not fare particularly well in Kosovo; the Army lost a quarter of the 50 drones it had deployed,[827] and sources complained about frustrating experiences.[828]

In early 2003, Phoenix became the first UK force element to cross the Iraqi border, when 89 upgraded Phoenix were used in the initial invasion.[829] Anti-aircraft fire shot down a dozen UAV, and the system gained some prominence when militants paraded a downed Phoenix through the centre of Basra.[830] Overall, Phoenix flew several hundred sorties. But the infrastructure to exchange data gathered by drones was lacking; imagery analysts had to recover the data at the ground control station, analyse it in their offices, save their intelligence products on CDs and hand-deliver them to commanders.[831] The intelligence would not be seen by the forces in the field. The system struggled with heat; 124 of originally 198 UAVs were lost.

Because of high loss rates, most commentators considered Phoenix a costly failure. Still, it laid the ground for all future British UAV operations. An analyst recounts: “At that time, the British military’s understanding of UAV ISTAR was in its infancy. It took a while until people began to understand what intelligence and imagery products UAVs could offer.”[832] Phoenix made its last operational flight in June 2006 in Iraq.

[826] Ripley, *British Army Aviation in Action*. p.30/31.
[827] "Phoenix: Rising out of the Crashes."
[828] Bernhard Pfoh, "Eine Bilanz des Luftkriegs der NATO gegen Jugoslavien," in *Kosovo. Humanitäre Intervention und kooperative Sicherheit in Europa*, ed. Joachim Krause (Opladen: 2000). p.72.
[829] Ripley, *British Army Aviation in Action*. p.105.
[830] Draper, *Sitting ducks & peeping toms*. p.308.
[831] Interview anonymous December 2015.
[832] Interview anonymous December 2015.

Past British UAV systems			
Name	**SD-1**	**'Midge 501' (CL-89)**	**Phoenix**
Manufacturer	Radioplane (US)	Canadair (Canada)	GEC-Marcon, later BAE
Beginning of development		1959	1985
In use by UK	1961	1972 - 1999	1999
Type	Fixed-wing reconnaissance UAV	Fixed-wing, reconnaissance UAV	Fixed-wing, reconnaissance UAV
Dimension			
Wing Span	3,50m	0,94m	5.6m
Length	4m	(excl. booster): 2,60m	
Height		0,33m	
Max. Weight (incl. payload)	195kg	108kg	175kg
Performance			
Speed	300km/h	c. 740km/h	166km/h
Endurance/radius	30min/160km	n.a./60km	5h/60km
Ceiling	5000m	300m – 3000m	
Armament	none	none	none
Payload	Still picture, optional video cameras (no real-time), illumination flares	Optical and an infrared camera	Thermal imaging camera
Used by	Royal Artillery	Royal Artillery	Royal Artillery
Used for	Target spotting	Division level surveillance	Target spotting/reconnaissance
Participation in British military operations	None	Kuwait	Kosovo, Iraq

1.2. Cancelled British UAV programmes

In the last decade of the Cold War, the UK, like Germany, considered procuring an 'anti-radar drone'.[833] The project was conceived shortly before the fall of the Soviet Union and became a victim of post-Cold War budget overhauls.[834] Another system, the 'Observer' (also 'Battlegroup Unmanned Aircraft'), was pursued in the 1990s. The plans were for an

[833] "RAF go-ahead for anti-radar drone ", *Jane's Defence Weekly* (1989).
[834] "The UAV goes to war."

Army UAV with a range of 30km to conduct reconnaissance, surveillance, and target-acquisition missions, to be operated by an unskilled operator.[835] A system demonstrator underwent testing in 1998,[836] but the idea never came to fruition. Other previously separate efforts by British producers ('Sender', 'Spectator', 'Extender') were eventually combined into the Watchkeeper project.[837] Overall however, UAV technology was initially not considered important: The MoD spent c.10 million GBP on UAV research in the 1990s – during this timeframe, the US spent 3bn USD.[838]

1.3. UAVs in the British armed forces (as of 2017)

As of 2017, the British armed forces have over 500 drones, of four different types. Three more systems, Hermes 450, Tarantula Hawk, and Black Hornet have recently been taken out of service but were used in Afghanistan and are thus discussed here, while ScanEagle will not be discussed, as it was not deployed. Of these seven systems, five were used by the Army, while RAF and Royal Navy had one UAV respectively. The UK acquired its modern drones comparatively late; the bulk of them entered service after 2007. All but one drone was acquired as 'Urgent Operational Requirement' (UOR) for ongoing operations, all but one were foreign-built.

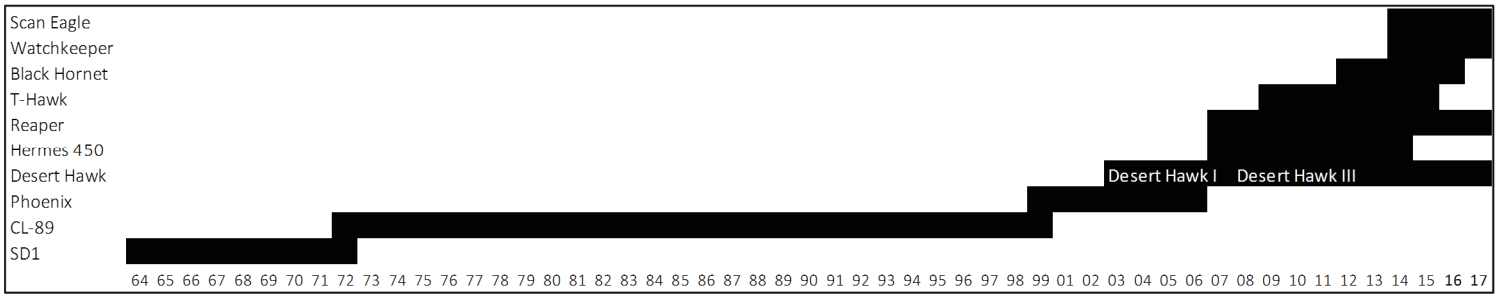

Illustration VI.1. Timeline British armed forces' UAVs
Own illustration

[835] "DERA tests Observer UAV concept using new air vehicle," *International Defence Review*, 1 Nov 1998. And "Forward Console Developed for UK UAV Operations," *Jane's Defence Weekly*, 23 September 1998.
[836] "Forward Console Developed for UK UAV Operations."
[837] "Pilotless progress report - UAVs have made exceptional strides recently."
[838] "Written answers, question by MP Hoyle, 11 November," ed. House of Commons (London: 2003). Though the US number includes procurement and is thus not directly comparable.

1.3.1. Desert Hawk III (2007-)

The Army procured Desert Hawk from US manufacturer Lockheed Martin as UOR for Iraq in 2003. Once in the field however, the aircraft did not respond to commands and many went missing. In his post-tour report, a commander described Desert Hawk as "a joke".[839] It was later discovered that the drone's communications system's frequency band was the same as an Iraqi mobile telephone network, causing interference.[840] In May 2006, an Artillery Battery deployed for a five-month tour with 24 modified Desert Hawk I+.

In 2007, the MoD procured eight improved Desert Hawk III systems (64 vehicles), deploying them to Iraq in May 2007 and to Afghanistan in mid-2008.[841] Thanks to significant upgrades, the slightly bigger Desert Hawk III had a better endurance (90 minutes compared to 60 minutes), range (15km compared to 10km), and payload, and proved overall more reliable.[842] Desert Hawk III was a hand-launched mini-UAV, less than one meter long and with a wingspan of 1.37m. It carried 1kg of different day/night cameras and sensors for detecting improvised explosive devices.[843] It was controlled by a hand-held console. An upgraded version ("Desert Hawk IV") was introduced in 2015.[844] Following positive experiences, MoD decided to introduce Desert Hawk into the long-term inventory.[845]

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[839] Ripley, *British Army Aviation in Action*. p.130.
[840] Draper, *Sitting ducks & peeping toms*. p.318.
[841] Gareth Jennings, "UK troops begin using Desert Hawk III in Afghanistan," *Jane's Defence Weekly*, 21 August 2008.
[842] Draper, *Sitting ducks & peeping toms*. p.320. "Momentum builds for the UK's UAV capability," *Jane's Defence Weekly*, 7 July 2008.
[843] Jennings, "UK troops begin using Desert Hawk III in Afghanistan."
[844] "More than meets the eye: small UASs become advanced assets," *Jane's International Defence Review* (2015).
[845] Nicholas De Larrinaga, "DSEI 2015: UK to keep Black Hornet and Desert Hawk UAS in service," *Jane's Defence Weekly*, 17 September 2015.

1.3.2. Hermes 450 (2007 – 2014)

In early 2007, the MoD decided that it urgently needed a UAV "to supplement reconnaissance, surveillance and force-protection capabilities in Iraq and Afghanistan".[846] Hermes 450 was procured as interim system to fill the gap between the withdrawal of Phoenix and the introduction of Watchkeeper. The Israeli Hermes 450, on which Watchkeeper was based, was chosen within a month, and five aircraft were immediately deployed to Iraq (and later Afghanistan).[847]

Rather than buying, the MoD leased Hermes 450 under a fly-by-the-hour service provision which also included the training of operators and logistic support. Initially, the contract was for one or two years;[848] Hermes 450 remained in service with the UK for seven years, until it was replaced by Watchkeeper.

As Phoenix was designed for Cold War scenarios and Desert Hawk was a hand-held tactical vehicle, Hermes 450 provided a novel UAV capability for the UK forces. Crucially, it provided long-term surveillance, as the 6m long UAV had up to 20h endurance. It carried electro-optical and infrared sensors and a laser subsystem. Plans to arm the systems were developed,[849] but eventually abandoned.

1.3.3. Reaper (2007 -)

In 2006, the MoD asked the US Congress for an export licence for one General Atomics Reaper system with two air vehicles (later increased to three). The system was to be purchased as an UOR to fill ISTAR gaps in Afghanistan.[850] The UAVs were initially purchased

[846] "UK seeks urgent tactical UAV capability for forces by mid-2007," *Jane's Defence Weekly*, 6 February 2007 2007.
[847] Another three aircraft were added later. Draper, *Sitting ducks & peeping toms*. p.315.
[848] Andrew White, "UK plans to increase use of Hermes 450 UAV," *International Defence Review* (2007).
[849] Tim Ripley, "British Army makes plans for armed UAVs " *Jane's Defence Weekly*, 7 August 2010.
[850] "Congress mulls UK request for Predator," *Jane's Defence Weekly*, 2 October 2006.

unarmed but while waiting for delivery, the UK requested they be fitted with missiles and bombs.[851]

The UK Reaper – at this point unarmed – had its first operational flight in October 2007 in Afghanistan, "a major milestone for the RAF", according to the Chief of the Air Staff.[852] Two more aircraft followed in 2008. This fast introduction onto the battlefield was in part possible because RAF pilots had participated in a joint US/UK Combined Predator Task Force since 2004, flying US Predators, an experience that later benefitted Reaper pilots.[853] At first, RAF Pilots controlled the Reapers from Creech Air Force base in Nevada. In 2013, a second RAF Reaper drone squadron, 13 Squadron, was stood up at RAF Base Waddington, from were roughly half of the flights were controlled. 39 Squadron remains in Nevada, training and operating alongside the USAF.

In May 2008, the Reapers were armed with GBU-12 laser guided bombs and AGM-114 Hellfire missiles, also provided by the US. The weapons were used the same month, although reports of this only surfaced in June.[854] The UK was the first nation to buy the American-built Reaper and the first nation allowed to fly the armed version. Reapers' use in Afghanistan made the UK the third country – after the US and Israel – to use armed UAVs in combat operations.

In March 2010, the UK's arsenal was augmented to five Reaper. By then, the MoD had spent a quarter of a billion GBP on the system.[855] The last of eventually 10 vehicles was put into operation in 2014.

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[851] Tim Ripley, "UK looks to arm expanded Reaper force," *Jane's Defence Weekly*, 3 May 2007.
[852] Michael Gething, "First RAF Reaper takes to the air in Afghanistan," *International Defence Review* (2007).
[853] Ibid.
[854] Tim Ripley, "UK Reaper UAVs cleared for combat operations," *Jane's Defence Weekly*, 6 June 2008.
[855] Tim Ripley, "UK reveals spending on Iraq, Afghanistan UAVs," *Jane's Defence Weekly* (2010).

The RAF's Reapers were initially set to retire after the end of Afghan operations. But in late 2014, two Reapers were relocated to Iraq to fight Daesh. Within a week, the Defence Secretary announced that they were to be used also for surveillance missions in Syria,[856] where in August 2015 they were used in a kinetic strike (see below). The UK is set to ramp-up its unmanned armed capabilities with 20 upgraded Reapers, now called 'Protector'.[857]

1.3.4. T-Hawk (2010 - 2015)

The RQ-16A Tarantula Hawk, 'T-Hawk', was a vertical take-off mini-UAV with a diameter of only 35cm. A DARPA development, T-Hawk, because of its unconventional design, has been called 'flying beer keg' or 'flying dustbin'. It was, according to an operator "in essence, a set of very expensive cameras attached to a lawnmower engine";[858] it even had an engine cord to start. T-Hawk could take-off from any ground, flown by a single soldier using a handheld terminal to which the imagery was relayed.

T-Hawk was developed by US manufacturer Honeywell to counter the IED threat in Iraq. The UK procured T-Hawk as part of the Talisman route-clearing system, consisting of an armoured vehicle, an engineer excavator, a Talon ground robot, and the T-Hawk.[859] The Army had 18 T-Hawks.[860] The systems were delivered in September 2009 and deployed to Afghanistan, first with the Royal Engineers, later with 32 Regiment Royal Artillery. Tarantula Hawk was withdrawn from service in 2015.[861]

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[856] Ministry of Defence, "Surveillance mission over Syria confirmed," *gov.uk* 2014.
[857] Tim Robinson, "RAeS helps set the drone agenda," *Royal Aeronautical Society* (2015).
[858] Jay Kirell, "Why I Hated Being A Drone Pilot in Afghanistan," (2014).
[859] "'Flying Robot' pilot helps find IEDs in Helmand," *Ministry of Defence* (2010).
[860] "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume II Written evidence."
[861] Louisa Brooke-Holland, "Overview of military drones used by the UK armed forces," ed. House of Commons Library (London 2015). p.23.

1.3.5. Black Hornet (2012 - 2017)

The Black Hornet was the smallest UAV in use with the British forces – and remains, to date, the smallest military drone worldwide. The little helicopter had a 12cm rotor span and, including cameras, weighed 16 grams. Officially, its range was up to 3km, but MoD data suggested a range closer to 600m in operation, and a 15-20minutes flight time. The UAV carried three cameras that provided live video and snapshot images. The system included a handheld controller, a display, a base station and two drones, all weighing less than 1.5kg.

Britain selected Black Hornet as UOR for Afghanistan in November 2011, buying it off-the-shelf from Norwegian manufacturer Prox Dynamics. After successful operational deployment, the MoD ordered an additional 160 PD-100 Black Hornet (worth 20m GBP) in February 2013.[862] In July 2017 however, it was reported that the Army had retired Black Hornet, citing a "diminished requirement".[863]

1.3.6. Watchkeeper (2014 -)

Watchkeeper is the only (partly) British-made UAV in use with the British armed forces. Its turbulent development history spanned more than a decade, beginning in 2000 when the MoD conceived a project to "amalgamate all its future UAV requirements under an all-embracing program now known as Watchkeeper".[864] Thales UK and the Israeli Elbit systems won the bid for two UAVs with "advanced sensor packages, passing data into network-centric warfare systems connecting strike weapons and mobile ground stations"

[862] Nicholas de Larrinaga, "UK MoD orders more PD-100 nano UAVs for Afghanistan," *Jane's Defence Weekly*, 5 February 2013, ibid.
[863] Tim Ripley, "British Army retires Black Hornet micro UAV," *Jane's Defence Weekly*, 11 July 2017.
[864] "Pilotless progress report - UAVs have made exceptional strides recently."

in 2004.[865] Quickly after, the programme was reduced to one system.[866] Conceived in the context of a substantial defence budget increase, Watchkeeper programme was valued at 700 million GBP, making it one of the costliest UAV programmes worldwide. From the beginning, difficulties plagued the programme. Watchkeeper made its maiden flight in Israel in 2008 and in the UK in 2010. As it became obvious that the system's introduction would be delayed, Hermes 450 was leased as interim solution.

Given that Watchkeeper was based on an existing off-the-shelf system, the extent of the delay is surprising. The airframe was only changed slightly. Whereas Hermes 450 only had an electro-optical/infrared payload, Watchkeeper has a modular multi-sensor capability, including, most importantly, a synthetic aperture radar (SAR). Furthermore, Watchkeeper had more autonomous functions, reducing costs for manning and training and ensuring that Watchkeeper can be operated by soldiers, not pilots.[867] Mobility was emphasised; the complete system is transportable in an international standard container.

Because of the many delays, there are concerns that Watchkeeper's supporting command, control, and imagery distribution architecture have been overtaken by new technologies and concepts of operations.[868] The system continues to make headlines with crashes,[869] and full operating capability is currently forecast to be achieved in 2018, and

[865] Roxana Tiron, "U.K. Watchkeeper Sets Tone for UAV Programs " *National Defense* (2002).
[866] "Special Report: UAVs - Frontline Flyers," *Jane's Defence Weekly* (2006).
[867] Chris Pocock, "From H450 to Watchkeeper: Will the Long and Costly UAV Journey Be Worthwhile?," *AINonline* 2012.
[868] Tim Ripley, "UK looks again at Watchkeeper UAV force structure," *Jane's Defence Weekly* (2016).
[869] Gareth Corfield, "Yet more British military drones crash, this time into the Irish Sea," *The Register*, 14 September 2017.

will have cost 927 million GBP.[870] The system is planned to remain in service for the next 30 years.

[870] Unmanned Air Vehicles:Written question - 8078, Asked by David Linden, 4 September 2017, House of Commons.

UK UAVs				
Name	**Desert Hawk III**	**Hermes 450**	**Reaper**	**Tarantula Hawk**
Manufacturer	Lockheed Martin (US)	Elbit Systems (Israel)	General Atomics (US)	Honeywell (US)
Type	Fixed- wing Mini-UAV	Fixed-wing medium-sized reconnaissance UAV	Fixed-wing armed UAV	Vertical take-off, reconnaissance UAV with hovering ability
Payload	Exchangeable payloads: Infrared, electro-optical, low-light B/W Sensors for detecting IEDs	Infrared and electro-optical camera, laser subsystem	SAR Radar, Cameras Armament: GBU-12 laser guided bombs, AGM-114 Hellfire missiles	
Introduced	Desert Hawk I: 2002/ III: 2007	June 2007	2007	2010 (?)
Used by	Army, Marines[1]	Army	Air Force	Army
Numbers in use[2]	222	8	10	18
Military operations	Afghanistan, Iraq	Afghanistan, Iraq	Afghanistan, Iraq	Afghanistan,
Dimensions Wing Span Length Max. Weight (incl. payload)	Desert Hawk III 1,37m 0,9m 3kg	 10.5m 6.1m 450kg 150kg	 20m 11m 4760kg 1700kg	 Diameter 0,35m 8,4kg
Performance Speed Endurance Operating altitude Armament	 90+min 300m none	 130-175km/h >16h 5500m None	 482km/h >23h 15000m Missiles and bombs	 40min 3200m none
Other				Four US T-Hawks were used in 2011 at Fukushima nuclear plant after the devastation of the plant.

[1] Tim Ripley, "Uk Commandos Train with Mini-Uavs," *Jane's Defence Weekly*, 24 April 2014.

UK UAVs (Continued)			
Name	**Black Hornet**	**Watchkeeper**	**ScanEagle**
Manufacturer	Prox Dynamics (Norway)	Thales / Elbit Systems	Insitu Boeing (US)
Type	Vertical take-off, nano reconnaissance UAV	Variant of Hermes 450, medium sized fixed-wing reconnaissance UAV	Mid-sized fixed-wing reconnaissance UAV
Payload	Video and snapshot camera >10g	SAR radar, ground-moving target indicator radar	Electro-optical and infra-red cameras
Introduced	2012	2014	2014
Used by	Army	Army	*Navy*
Numbers in use[3]	324 (162 systems)	29	
Military operations	Afghanistan	Afghanistan	
Dimensions			
Wing Span	Rotor span 12 cm	10.5m	3.11m
Length		6.1m	1.60m
Max. Weight (incl. payload)	16 grams	450kg 150kg	22kg 3.4kg
Performance			
Speed	36km/h,	130-175km/h	148 km/h
Endurance	<25 min,	>16h	>12h
Operating altitude	<100m	5000m	>6000m
Armament	none	none	None

[2] Louisa Brooke-Holland, "Overview of Military Drones Used by the Uk Armed Forces," ed. House of Commons Library (London 2015).
[3] Ibid.

2. The British drone debate

2.1. The British media's drone coverage

The British press has a tradition of covering military and defence matters. National media outlets employ specialised journalists with expertise in defence topics (although this number has been falling more recently). As there is no language barrier, the British press also regularly features American experts, which steered the British drone debate closer to the US debate.

In the early 2000s, the first defence correspondents began reporting on unmanned systems. Drones were mentioned in the contexts of the operations in Kosovo and Afghanistan, though they were rarely singled out.[871] The arming of the US Predators did not escape British media.[872] Initially, the *Guardian* saw nothing wrong with armed drones per se, and in 2001 implicitly criticised the US for waiting too long to arm the Predator so that Bin Laden could slip away.[873] The first US drone strike in Yemen in 2002 however was considered illegal: "The Yemen attack violates basic rules of sovereignty. It is an act of war where no war has been declared."[874] Yet, the same article oscillated between mockery and techno-enthusiasm:

> "Zap! Pow! The bad guys are dead. […] Living his presidency like Tom Clancy's Jack Ryan, George Bush etched another notch in his gun butt this week, blowing away six 'terrorists' in Yemen's desert. Their car was incinerated by a Hellfire missile, fired by a CIA unmanned aerial vehicle (UAV) or drone. Dealing out death via remote-controlled flying robots could be the spooks' salvation after the September 11 and Afghan intelligence flops. It makes the agency look useful. It is quick and bodybag-free. It is new wave hi-tech, a 21st-century equivalent of James Bond's Aston Martin."[875]

[871] For instance: Garth Alexander, "Battle over Orders for Unmanned Aircraft," *Sunday Times*, 11 November 2001. Julian Borger and Richard Norton-Taylor, "Taliban claim to have downed US unmanned spy plane," *Guardian*, 23 September 2001.
[872] "The war yesterday," *Guardian*, 6 November 2001.
[873] Julian Border, "War in Afghanistan. US spurned chances to kill Bin Laden," *Guardian*, 24 November 2001.
[874] "Drones of death - Bush takes the law into his own hands," *Guardian*, 6 November 2002.
[875] Ibid.

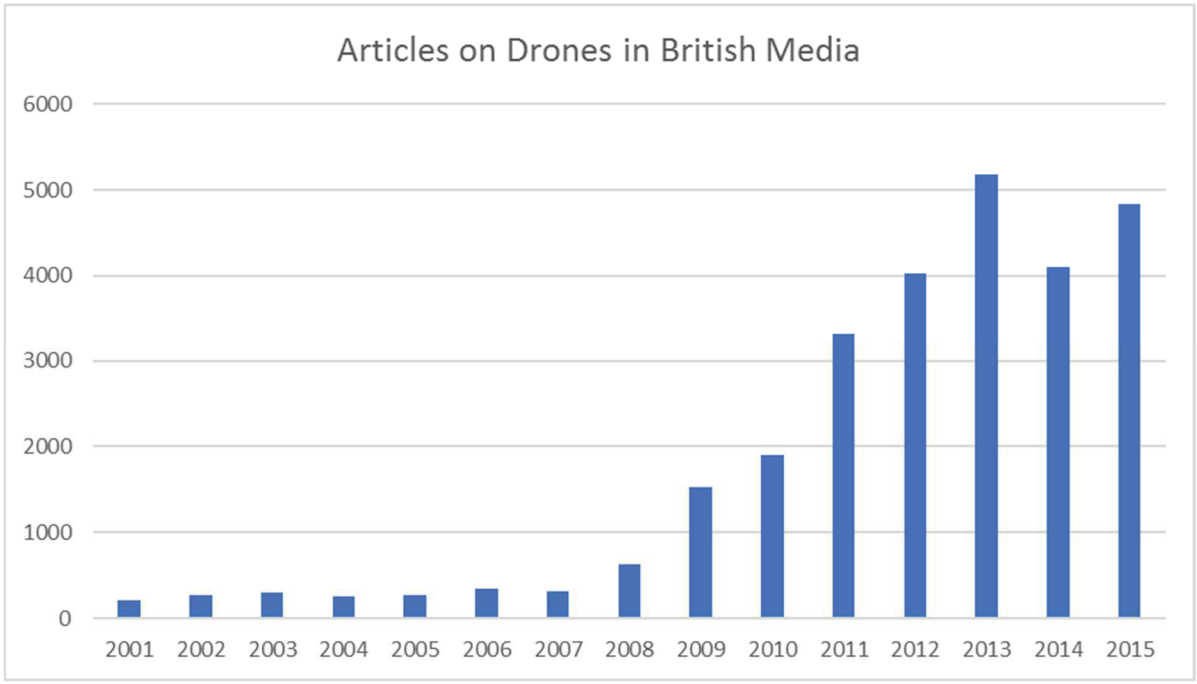

Illustration VI.2. UK News Articles on drones 2000 – 2015
Source: Own illustration, data from Faktiva (*BBC, Daily Mail, Financial Times, Guardian, Sun, Times*)

From 2001 onwards, the British quality press covered drones reasonably regularly. Notably, compared to reporting in the US and Germany, the British media showed interest in other countries' drone use, specifically Israel's.[876] Reporting markedly increased from 2009 onwards, with the international debate about US operations in Pakistan gaining momentum. Articles spoke about a "new kind of warfare".[877] Yet, despite the increased interest, reporting on *British* drones remained low. Between 1 January 2000 and 31 December 2015, the British press published 19 913 articles mentioning drones, but only 1813 of them specifically discussed UK Army or Air Force drones.[878] Of these, the focus

[876] "Israel scraps arms deal with China," *Guardian*, 27 June 2005. Richard Norton-Taylor, "Arms sales: British weapons exports to Israel valued at pounds 4m," *Guardian*, 19 February 2010.
[877] Pete Warren, "Launching a new kind of warfare," *Guardian*, 26 October 2006.
[878] Data from Factiva, 1.1.2000 – 31.12.2015, Articles from BBC, Daily Mail, Guardian, Sun, Telegraph, Times.

was clearly on RAF systems (1349 articles, compared to 464 on Army drones).[879] The arming of the British Reapers in 2008 barely was mentioned in the press.[880]

A specificity of the British media environment is the comparatively strong bifurcation into quality outlets and tabloids. The latter (*Daily Mail, Sun*) began its drone reporting considerably later than the former, around 2013.[881] As in the US, the tabloids' language was more bellicose – RAF drones "blitz the enemy" and turned IED planters "into pink mist".[882] At the same time, tabloids were also sometimes critical of the "deadly US drone programme, which has killed scores of civilians."[883]

[879] Nick Hopkins, "Afghanistan: How RAF takes on the Taliban - by joystick from Las Vegas," *Guardian*, 6 July 2011.; Emily Smith, "RAF bomb the Taliban from 8000 Miles Away," *Sun*, 21 March 2009.
[880] A *Jane's* report suggests that one reason for the secrecy may have been that both weapon systems had to be bought from the US. See Robert Hewson, "RAF Reaper may be armed 'within weeks'," *Jane's Defence Weekly*, 18 April 2008.
[881] There is not one reason that explains the sudden increase in 2013, rather, it appears to have been the culmination of several events, including the Brennan hearings in the US that got a lot of coverage, increased concerns about UK involvement in US secret operations, the opening of Waddington Air Base, RAF pilots getting their own wings, and more engagement of anti-drone groups. See "John Brennan confirmed as CIA chief after Sen. Rand Paul finally gets his answer from the White House on drones after his epic THIRTEEN HOUR filibuster," *MailOnline*, 10 March 2013, Robert Verkaik, "US Drones bombing Africa operated from RAF Bases," *Mail on Sunday*, 10 March 2013. "Drones' UK Base," *Sun*, 24 April 2013. David Leppard, "GCHQ finds Al-Qada for American Strikes," *Sunday Times*, 25 July 2010. Jasper Copping, "Drones Club: The first RAF Airmen trained to fly unmanned craft earn their wings," *Daily Telegraph*, 3 April 2013.
[882] Tom Newton Dunn, "RAF drones' blitz on Taliban Chiefs," *Sun*, 28 October 2010.
[883] Robert Verkaik, "Britain's secret role in America's drone war," *Daily Mail*, 20 April 2013.

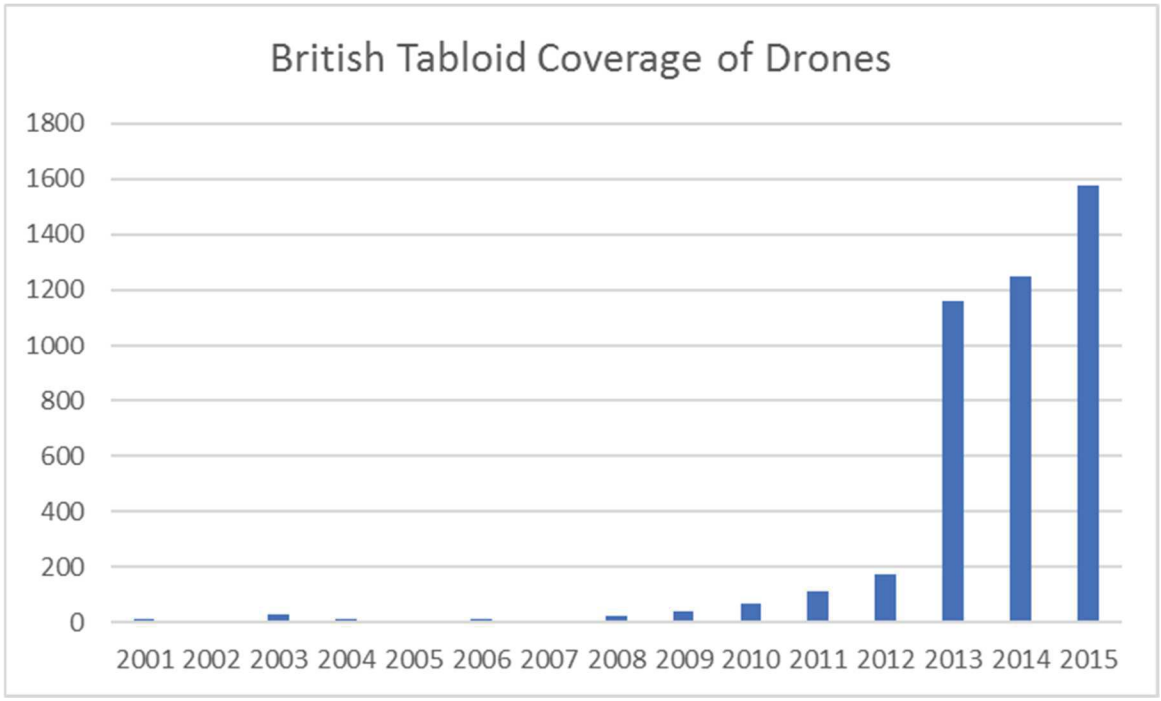

Illustration VI.3. British Tabloid Articles on Drones
Source: Faktiva

Among the quality newspapers, the *Guardian* was by far the most engaged in the debate, publishing most articles and original analysis. The paper became a staunch critic of the US covert drone programme, "more persistently than any mainstream American media outlet", as an observer pointed out.[884] From early on, it criticised US Pakistan drone operations as strategically unsound.[885] Opinion pieces called President Obama a "George W. Bush on steroids",[886] whose "murderous spree in Pakistan"[887] led to the "normalisation of extrajudicial murder".[888] The *Guardian* also featured op-eds by anti-drone activists.[889]

[884] Satia, "Drones: a history from the British Middle East." p.19.
[885] "Pakistan: How to undermine an ally," *Guardian*, 24 November 2008.
[886] "Drone strikes: Playing God in Pakistan," *Guardian*, 6 June 2012.
[887] Pankaj Mishra, "From dreams to drones. Who is the real Obama?," *Guardian*, 5 June 2012.
[888] Michael Boyle, "Obama's drone wars and the normalisation of extrajudicial murder," *Guardian*, 11 June 2012.
[889] Sharkey, "Robot wars are a reality." Sharkey, "America's mindless killer robots must be stopped, Clive Stafford Smith, "The horror that Hitler's doodlebugs brought to London is being repeated by CIA drones in Pakistan," *Guardian*, 25 September 2012.

In August 2015, a British drone strike killed two British citizens in Syria. This should have been a double-whammy for the British government – not only was it the UK's first drone strike outside an official battle zone, and in an area in which Parliament had specifically not authorised combat actions[890] but it also targeted and killed two British citizens. A similar incident in the US in 2011 had attracted public attention and caused political uproar (see chapter IV). Yet, the reaction in the UK was much tamer. The *Sun* showed support, titling "Wham! Bam! Thank you Cam".[891] Possibly, the reaction was mitigated by the fact that British citizens had died in US drone strikes before,[892] and that the attack had been directed against Daesh members reportedly planning attacks in the UK.

Overall, the discussion of drones in the British media was less idiosyncratic than the German debate. It was close to the US debate, albeit slightly more critical. This can be explained by the fact that several researchers who adopted a critical stance towards US drone operations were based in the UK, notably Chris Woods, Chris Cole, and Noel Sharkey. Equally, UN Special Rapporteur Ben Emmerson, author of the 2013 study of civilian casualties caused by US drone operations, operated out of London. Although US drone operations were regularly discussed in the media, US and British drone use was bizarrely disconnected. For instance, despite the fact that the UK flew US Reapers from the US and carried out joint drone operations in Afghanistan, the *Guardian*, having reported for a decade on US drones, suddenly put 'drone' in quotation marks when talking

[890] Tara McCormack, "The Emerging Parliamentary Convention on British Military Action and Warfare by Remote Control," *RUSI Journal* 161, no. 2 (2016).
[891] Referring to then-Prime Minister David Cameron. Tom Newton Dunn, "Wham! Bam! Thank You Cam," *Sun*, 7 September 2015.
[892] Simon Hughes, "Terrorist Brit killed fighting in Pakistan," *Sun*, 14 February 2013. Nick Parker and John Kay, "Bragging Brummie Killed by US drone," *Sun* 2010.

about British systems, as if discovering a new technology.[893] Issues surrounding drone use in general, such as legal or ethical concerns, were usually discussed in relation to US drone use, as if British drones were exempt from these questions.

The Terminator/killer robots narrative was not widespread – one of the first terminator references in the British media was in fact a reference to the DCDC joint doctrine of 2011 that raised the issue (see below).[894] Most importantly, the Unmanned Revolution narrative was almost absent.[895] When the *Daily Mail* wrote about a "Revolutionary superdrone" it meant the future project Taranis.[896] Similarly, *The Times* wrote about "A revolution in spying" – but referred to future micro-drones the size of insects.[897]

2.2. British drone literature

A specifically British body of literature on drones cannot be identified as British authors took part in the US-dominated English-speaking debates. Historical and factual accounts of British UAV use exist; defence writers wrote about British military equipment – including three well-researched chapters on British UAVs in Iraq and Afghanistan by defence journalist and author Tim Ripley.[898] The House of Commons Defence Committee published several reports on UK UAV capabilities.[899] Yet, these publications were factual, rather than analytical. Ultimately, those most interested in British drone use were journalists working

[893] Nick Hopkins, "Four Afghan civilians killed in RAF drone attack," *Guardian*, 6 July 2011.
[894] One rare reference here Chris Ayres, "Robot wars are for real as battle turns high-tech," *Times*, 4 December 2004.
[895] A rare example: Nick Hopkins, "Welsh airfield at the centre of Britain's drone revolution," *Guardian*, 6 May 2013.
[896] Robert Verkaik, "Set for take-off: Britain's deadly superdrone that picks its own targets but experts warn plane could mark the start of 'robot wars'," *MailOnline*, 26 January 2013.
[897] Russell Hotten, "Scientists '18 Months away' from developing Insect-sized aircraft," *Times*, 28 February 2004.
[898] See for instance Ripley, *British Army Aviation in Action*, Tim Ripley, *Conflict in the Balkans 1991-2000* (Osprey Publishing, 2013).
[899] "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume 1." "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume II Written evidence."

for specialised publications such as *Jane's* – and activists. *Drone Wars UK* (see more below) from 2010 onwards tracked UK drone use. *Remote Control*, an NGO hosted by Oxford Research Group equally regularly published updates on UK drone use.[900]

Most academic authors chose to extrapolate from US experiences rather than studying British experiences. Even RAF officers writing for RAF publications focused on US operations.[901] The London-based International Institute for Strategic Studies in its in-house journal published an analysis of "Obama's Drone Wars", but no one wrote about "Cameron's Drone Wars".[902] An exception is Peter Lee's work (cited in more detail in the discussion of societal changes below), who studied the experiences of British Reaper pilots.

The Birmingham Policy Commission recognised this lack of UK focus. The Commission, formed in 2014, studied the strategic context, law, ethics, proliferation, civil use, and regulation of British UAVs. Their report rejected the notion that UAV technology was intrinsically problematic, and concluded that the threshold for the use of force would not be lowered by the availability of RPA to UK armed forces, "as long as Parliament plays its proper oversight function". It sketched out a 2035 future of UK UAV operations in which UAV use "is viewed as an integral, essential, and normal component of UK airpower".[903]

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[900] See for instance Caroline Kennedy-Pipe, James Rogers, and Thomas Waldman, "Drone Chic," *Remote Control* (2016). also see Chris Abbott et al., "Securing change. Recommendations for the British government regarding remote-control warfare," *Open Briefing, Remote Control Project* (2015).

[901] Joe Doyle, "Rise of the Robots? Western Unmanned Air Operations in Iraq and Afghanistan 2001 to 2010," *Air Power Review* 16, no. 2 (2013).

[902] Trevor McCrisken, "Obama's Drone War," *Survival* 55, no. 2 (2013).

[903] Birmingham Policy Commission, "The Security impact of drones: Challenges and opportunities for the UK," ed. University of Birmingham (2014).

2.3. Political debate

There has been little disagreement about drones and UK drone policy between the two major parties in the British parliament. Therefore, the political drone debate in the UK has been driven predominantly by activists, most notably *Drone Wars UK*, a small non-profit organisation.

2.3.1. Parliament

The debate at parliamentary level began late, as illustrated by the parliamentary questions relating to drones asked between 2000 and 2017. MPs and the Lords took little notice of drone use before 2012. In 2012, the 'All Party Parliamentary Group' (APPG) on Drones was founded, "to examine the use of drones (unmanned aerial vehicles) by governments, for domestic and international, military, and civilian purposes"[904], which led to increased political attention on the topic.

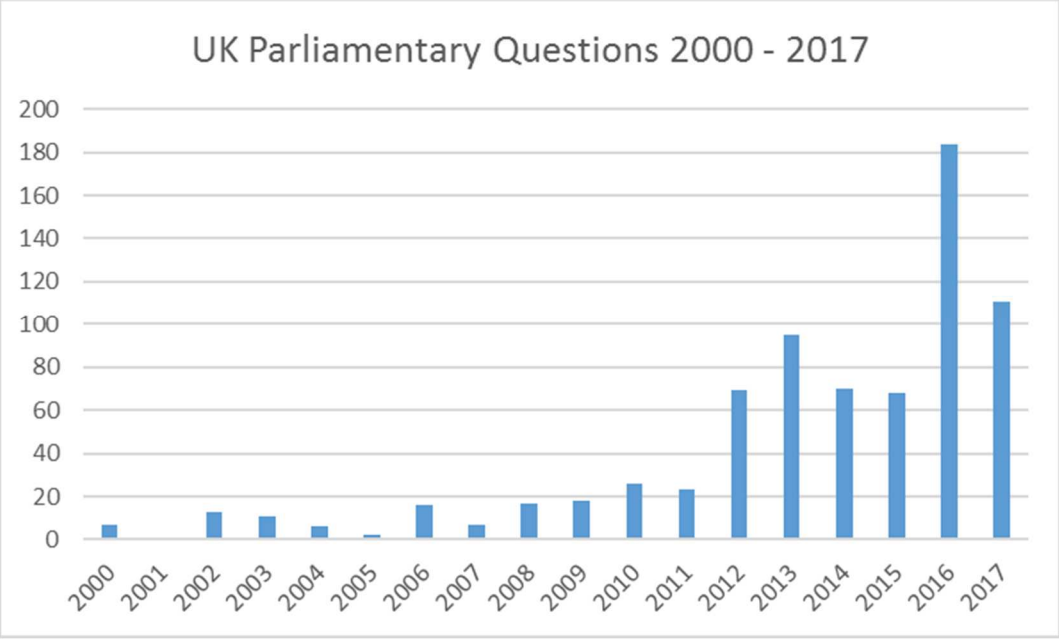

Illustration VI.4. Number of Parliamentary questions relating to UAVs, 2000-2017

[904] "Register Of All-Party Groups [as at 30 July 2015]," ed. Parliament.

The parliamentary debate was carried out with comparatively little controversy. MPs of all parties agreed on the military usefulness of UAVs: Rehman Chishti (Con): "I am not against the use of drones",[905] Sir Nick Harvey (Liberal Democrats): "There is nothing inherently wicked or virtuous about a remotely piloted aircraft."[906] Kevan Jones (Labour, and as Nick Harvey a former Junior Defence Minster): "the technology helps to protect and support our armed forces.[…] If we did not use their surveillance capacity in relation to convoy protection we would have many more casualties in Afghanistan".[907] In the House of Lords, Lord Tunnicliffe expressed the same sentiment: "I must state categorically that we on these Benches believe that unmanned aerial vehicles are a good thing, particularly in the military environment, and that by a "good thing" we mean that we believe that their value-added exceeds their risks."[908]

Since 2000, there have been four relevant debates in the House of Commons, and one in the House of Lords, the first of which took place on 6 November 2012. Much as in Germany, any discussion about drones in the British Parliament included references to, or primarily discussed US drone use. US operations in Pakistan were of particular interest, as Britain is home to one of the largest Pakistani diasporas worldwide. The first parliamentary debate on drones in 2012 was initiated by Rehman Chishti, a Conservative MP born in Pakistan who asked the government about its policy on the use of drones, "particularly in Afghanistan *and Pakistan*"[909], thus inviting the British government to comment on US drone use. He further inquired about the UK's sharing of intelligence with

[905] "Westminster Hall debate, Tuesday 6 November," ed. House of Commons (2012).
[906] Ibid.
[907] "Westminster Hall debate, Tuesday 11 December," ed. House of Commons (2012).
[908] "Drones: Code of Conduct, Question for Short Debate, 25 June," ed. House of Lords (London: 2015).
[909] Emphasis added

the US on the Pakistan strikes.[910] The second speaker, Labour's Yasmin Qureshi, was equally of Pakistani descent and referred to the reactions of her constituents to drone attacks – many of whom were of Pakistani and Afghan heritage.

This focus on the US operations, specifically in Pakistan, lasted. US operations were used as the yardstick by which to measure targeting procedures,[911] or the chain of command.[912] The APPG Drones identified "the use of drones by the United States in Pakistan, Yemen, Somalia and elsewhere" as one of its foci.[913]

The most animated political debates came after revelations in September 2015 that UK drones had been used to kill two UK citizens in Syria. A debate took place in the House of Commons,[914] and the UK's Joint Committee on Human Rights opened an inquiry, about the government's policy on the use of drones for targeted killing. The Committee's report criticised the government over unclear legal justification, which might even expose operators to "criminal prosecution for murder or complicity in murder".[915] It asked the government to clarify its policy and be more transparent. Once again looking at the US, the committee asked the British government to clarify the legal basis on which it provided "any help which facilitates the use of lethal force outside of armed conflict by the US."[916]

[910] A month before, Chishti had asked a parliamentary question about intelligence sharing with regard to the US Pakistan operations: "Oral Answers to Questions, Defence. Monday 22 October," ed. House of Commons (2012).
[911] "Westminster Hall debate, Tuesday 1 December," ed. House of Commons (London: 2015).
[912] "Westminster Hall debate, Tuesday 6 November."
[913] APPG Drones About us, http://appgdrones.org.uk/about-2/
[914] "Westminster Hall debate, Tuesday 1 December."
[915] "The Government's policy on the use of drones for targeted killing. Second Report of Session 2015–16.," ed. Joint Committee on Human Rights (London: 2016). p.6.
[916] Ibid.p.8.9.

2.3.2. Activists

Activists and other non-governmental groups played a crucial role in the British drone debate, most notably the *Bureau of Investigative Journalism* (*BIJ*), *UK Drone Wars*, and the legal charity *Reprieve*. In November 2010, the 'Drone Campaign Network', the world's largest anti-drone network, comprising 32 organisations was founded in London. Under its guidance, protests have been organised, including at RAF Waddington,[917] and against UAV manufacturer that were supplying the Israeli military.[918]

BIJ, a journalism NGO started its drone programme in 2009 under the direction of Chris Woods. The Bureau provides datasets with casualty numbers for US drone strikes outside official warzones. It published accounts of each reported action, and aims at naming all US drone strike victims.[919] It has worked with UN Special Rapporteur Ben Emmerson, and provided evidence to the UK Parliament.

One of the most active activist groups has been *Drone Wars UK*. A one-person endeavour founded in 2010, it is run by Chris Cole, a long-time peace activist, motivated by the concern about US targeted killing and the wish to offer research on (British) drone use "from a critical perspective".[920] Drone Wars UK's first publication was the report Convenient Killing: Armed Drones and the 'PlayStation' Mentality.[921] Drone Wars UK has substantially advanced public knowledge about UK drone operations through multiple information requests under the Freedom of Information Act (FOIA). These FOIA requests

[917] Emily Norton, "Four drone protesters arrested after cutting fence at RAF Waddington," *Lincolnite*, 5 January 2015.
[918] James Cartledge, "Shenstone factory 'shut down' in Israel drone protest," *Birmingham Mail*, 6 July 2015. "UK subsidiary of Israeli drone manufacturer shut down in Gaza protest," *Corporate Watch* (2014). Jonathan Owen, "Israeli-owned drone manufacturer shut down by pro-Palestine protesters," *Independent*, 17 February 2015.
[919] Naming the dead project, see https://v1.thebureauinvestigates.com/namingthedead/?lang=en
[920] Interview Chris Cole, October 2015.
[921] Cole, Dobbing, and Hailwood, "Convenient Killing, Armed Drones and the 'Playstation' Mentality."

played a similar role in the UK as did parliamentary questions in Germany, enabling the publication of more details about the country's UAV capabilities and operations.

The London-based legal charity *Reprieve* worked from 2010 onwards with victims of US drone strikes in Pakistan and Yemen, bringing their cases to courts worldwide. In the UK, *Reprieve* launched a case on behalf of a Pakistani man whose father had been killed in a US drone strike, claiming that British intelligence organisation GCHQ shared information on the targets' location with the CIA. (The case was rejected on the grounds that an eventual judgment could be viewed as "condemnation of the US" by the court.)[922] A *Reprieve* lawyer admitted that for most of the cases winning was more about influencing public opinion than winning in the court of law.[923]

2.3.3. Military

The armed forces have shown unmitigated enthusiasm for UAVs, speculating in 2011 that a third of the RAF could be made up of remotely controlled aircraft within 20 years.[924] The Military and MoD however have not participated much in the public debate – an RAF officer complained about the MoD's "deafening silence" on UAVs.[925] From June 2008 until September 2012, the RAF published updates on their Afghanistan operations, including drone strikes, (although the first drone strike listed is in January 2010). The last reported strike was in August 2012; the weekly updates ceased in September 2012, and the originals were removed from the web.[926] No explanation was given, but this decision

[922] Alice Ross and Ian Cobain, "Son lodges action against Germany and US over father's alleged drone killing," *Guardian*, 21 September 2015.
[923] Interview Jennifer Gibson December 2015.
[924] Nick Hopkins, "Afghan civilians killed by RAF drones," *Guardian*, 5 July 2011.
[925] "Ethical warriors?" Lecture by Richard Mason, 20 May 2014, Oxford University, Changing Character of War programme. Own lecture notes.
[926] For the most comprehensive overview of these reports see Chris Cole, *UK Drone Strike Stats* (August 2017 [cited 16.12.2017 2017]).

coincided with the beginning of the broader drone debate in the UK. A year later, when the debate had reached the tabloid press, then-Defence Minister Philip Hammond published an essay in the *Guardian* "In Defence of Drones".[927] He noted that "few defence issues have excited as much passion over recent years as military drones", deploring the fact that "[w]e in the Ministry of Defence have not done enough to correct these misapprehensions." The article was part of a larger charm offensive, which included the RAF hosting journalists at Waddington airbase.[928] Overall, the military realm showed considerable concern about public opinion. The British Ministry of Defence advised its representatives, "when talking to the media", to use the terms Remotely Piloted Vehicle and Remotely Piloted Air System, to avoid "confusion over the level of human control over the system, which may lead to concerns being raised, particularly with regard to the employment of weapons and flight in non-segregated airspace.[929] The renaming of the next batch of UK Reapers as 'Protectors', a less bellicose and more soothing name was most likely also a reaction to the perceived dislike of drones and the criticism of US drone operations.

2.4. Conclusion – A comparably well-informed debate driven by activists

The British drone debate was carried predominantly by a small group of NGOs and activists, while the political level agreed on the usefulness of the unmanned technology, only discussing specificities of the US drone use. The US drone operations played an important role in the debate, particularly as the big Pakistani diaspora in the UK meant a special interest in the attacks on the Pakistani borderlands. Because of the close US-UK (military) relationship, the US was often referred to as the standard against which the UK

[927] Philip Hammond, "In defence of drones," *Guardian*, 18 December 2013.
[928] Jonathan Beale, "Inside Britain's military drone base at RAF Waddington," *BBC News*, 18 December 2013.
[929] "The UK Approach to Unmanned Aircraft Systems, Joint Doctrine Note 2/11."p.2-1/2-2.

measured itself. Because of this US focus, researchers, academics, politicians, and the public for a long time disregarded the possibility that all these issues might also apply to themselves.

In general, the debate was comparatively well-informed. British MPs showed a better knowledge and understanding of military matters, and the media debate was less sensationalist than elsewhere. Despite concerns in the political realm about the public having misguided and/or negative views of drones,[930] overall, the public's view was not too negative. The Unmanned Revolution narrative was not particularly prevalent, even among those who vehemently reject the use of drones, while the killer robot terminology was regularly used by activists, though mainly aimed against autonomous systems.

3. Afghanistan

3.1. The British Afghanistan mission and Task Force Helmand[931]

The British armed forces fought in Afghanistan for thirteen years. They were first deployed in November 2001. Throughout the war, the UK provided the second largest troop contribution to the international mission after the US. In 2005, as the US became increasingly preoccupied with the war in Iraq, Britain took on a leading role in Afghanistan. From 2006 onwards, British forces were in charge of Helmand Province in southern Afghanistan. Although the military had recent combat experience, the experiences in Helmand had an important impact on the armed forces, and led to the procurement and

[930] Commission, "The Security impact of drones: Challenges and opportunities for the UK." Also see James Gray intervention in "Westminster Hall debate, Tuesday 11 December."

[931] This analysis focuses mainly on Task Force Helmand which began in 2005, because the beginning of Task Force Helmand coincides with the beginning of British drone operations, all British UAVs were used in Helmand, and most analyses and first-hand accounts focus on Helmand. Reaper operations that went beyond Helmand are however also covered.

fielding of new equipment. The Afghanistan mission claimed the lives of 453 British service personnel.

Initially, there was hope that Helmand would remain peaceful: then-British Secretary of Defence John Reid famously stated that the military would be "perfectly happy to leave in three years' time without firing one shot".[932] Accordingly, only a quarter of the soldiers initially deployed were combat infantry, the majority consisting of engineers and support groups.[933] Within weeks British troops were locked into heavy fighting. In the first six months in Helmand, they expended half a million small arms rounds, and over 13 000 artillery and mortar rounds.[934] The ensuing political and public pressure led the UK to increase its military spending and to acquire new equipment, including drones. When the British mission in Iraq ended in 2009, the UK was able to concentrate more resources on Afghanistan. The force in Helmand grew to 10 000 personnel,[935] which, during the eight years in Helmand, mounted several major offensives. Troops were reduced gradually from 2013 onwards, Task Force Helmand was disbanded in April 2014, some 450 troops stayed behind in mentoring roles.

3.1.1. Territory, climate, and threats

Helmand Province is about half the size of England and has a population of less than one million. Located in southern Afghanistan, it borders Pakistan. Camp Bastion, the main base for British troops, and the regional logistics hub for ISAF was established to the northwest of the provincial capital Lashkar Gah and accommodated up to 32 000 troops (mainly UK and US).

[932] Leigh Neville, *The British Army in Afghanistan 2006-14: Task Force Helmand* (Osprey, 2015). p.4.
[933] Mark Urban, "The battle for Helmand," 6 January 2016 2011.
[934] Neville, *The British Army in Afghanistan 2006-14: Task Force Helmand*. p.4/5.
[935] "Lessons from Afghanistan: The UK experience," *Jane's Defence Weekly*, 19 November 2013.

Helmand is less mountainous than the rest of Afghanistan, cut by the lush terrain of Helmand River, called the 'Green Zone', with thick vegetation and irrigation ditches for opium cultivation. A soldier stationed in Helmand wrote: "this fertile land was the territory the Taliban had made its own, building strongholds amongst the smothering foliage".[936] Temperatures in the area can rise above 50°C in summer and fall below -20°C in winter. One of the central opium trading locations is Sangin. Traditionally supportive of the Taliban, Sangin became "the deadliest area in Afghanistan", a "totemic place" for the British forces.[937] While IEDs were a major problem all over Afghanistan, the Sangin area was eventually treated as an unofficial minefield.[938] Firefights were common; in 2008, the MoD estimated that each patrol in the Sangin Valley had an 80% chance of being attacked by hostile forces.[939]

3.2. British drones in Afghanistan

When British forces went to Afghanistan in October 2001, they did not bring any UAVs. Phoenix, the only British UAV at the time, was not deployed, as it struggled with hot weather. In little more than a decade, the British armed forces went from having no significant UAV capability to commanding the full range of tactical and strategic, surveillance and armed UAVs, acquiring six systems (all but one bought as an Urgent Operational Requirements). The Army's Chief of ISTAR noted that "mountains [were]

[936] Doug Beattie and Philip Gomm, *Task Force Helmand: a soldier's story of life, death and combat on the Afghan front line* (Pocket Books, 2010). p.42.
[937] Karen McVeigh, "Royal Marines speak of 'horrible' reality of life on patrol in Afghanistan," *Guardian*, 17 November 2010.
[938] Ibid.
[939] Jennings, "UK troops begin using Desert Hawk III in Afghanistan."

moved" to deploy additional ISTAR assets within such a short time frame.[940] All UAVs were withdrawn from Afghanistan at the end of 2014.

Britain was fighting in both Afghanistan and Iraq, and between 2003 and 2009, the focus was on Iraq, a fact mirrored in UAV procurement; Desert Hawk was procured for Iraq in 2003; Hermes 450 was sent to Iraq first. The focus shifted when the situation worsened in Helmand and British forces began to withdraw from Iraq from 2006 onwards. The following three UAV systems – Reaper (2007), T-Hawk (2009) and Black Hornet (2012) – were purchased for Afghanistan.

British UAVs in Afghanistan						
	Desert Hawk I & III	Hermes 450	Reaper	T-Hawk	Black Hornet	Watchkeeper
UOR?	Yes	Yes	Yes	Yes	Yes	No
Bought for:	Iraq	Iraq & AFG	AFG	AFG	AFG	
Deployed to Afghanistan	October 2005/ May 2007	Early 2007	October 2007	Sept 2009	2012	Feb. 2014
Withdrawn	Dec. 2014	February 2014 No longer in service	Dec. 2014	Unknown. No longer in service	Dec. 2014	Dec. 2014
Used by	Army	Army	RAF	Army	Army	Army
Maximum numbers used in Afghanistan	>70 vehicles (in 12 detachments)	5	10	18	>200	4

[940] Tony Skinner, "UK forces failing to fully exploit ISTAR assets," *Jane's Defence Weekly*, 22 October 2007.

3.2.1. Desert Hawk III – the beginning

The 1.3m x 0.9m Desert Hawk was the first UAV to be introduced to Afghanistan, the DHI in 2002 and DHIII in 2007. This made it the guinea pig of British UAV operations, allowing troops, commanders, and imagery analysts to acquire knowledge of unmanned capabilities. Desert Hawk was employed by detachment units, three-man teams with several air vehicles, controlling and communication equipment, spare parts, and repair kit.[941] At the height of operations, there were 12 detachments in Afghanistan, controlling c.70 air vehicles.

The detachment units could be assigned to different units for specific operations and were often working out of Forward Operating Bases (FOB), small bases for tactical operations often situated deep in enemy territory.[942] This flexibility has been praised by many as it meant that the intelligence gained from the UAV was directly integrated with the units, rather than going through command centres; "They own it, decide when to fly it and where it will fly".[943] Similar to the German ALADIN system, Desert Hawk provided small units an around-the-corner and over-the-next-hill view that had not existed before.

But, as Desert Hawk was introduced without prior training experience, the operators had to find out how to use it. "We had to come up with the products, how to produce actionable intelligence", an imagery analyst stated, "You are there to provide what the customer wants. But if the customer does not know what he wants, how do you provide that? How do you give them a product that you don't know the utility of?"[944] Desert Hawks were eventually found most useful for the protection of patrols going out of FOBs

[941] Mike Clark, "Desert Hawk III quieter and more stable than Raven," *sUAS news*, 29 November 2011.
[942] Email Interview Ben Mcniff, 2016.
[943] Tim Ripley, "UK UAV operations in Afghanistan reach new milestones," *Jane's Defence Weekly* (2010).
[944] Interview anonymous December 2015.

and for over-watch of static and mobile units. Desert Hawks also acted as a deterrent: "they provide a deterrent by flying low enough or by switching on lights and bleepers to alert possible enemy to the fact they are being observed".[945] This psychological impact also worked in the opposite way: "troops got a confidence boost when they knew that they had over-watch from any platform, [and] the most visible was Desert Hawk."[946] However, this detectable noise signature could be problematic too; infantry men criticised that the noise could make the system ineffective at times, allowing the enemy to identify their position.[947]

While the official view and the experiences of the operators were positive, interviews and soldiers' accounts showed that there was a shortage of systems, and accidents made operations difficult. Soldiers' accounts of the Helmand campaign, especially those on the early years, rarely ever mention Desert Hawk. Captain Doug Beattie, who spent many months in Helmand in 2008, mentions UAVs only once in 300 pages.[948] In addition, Beattie describes many situations in which UAV support would have been useful, such as on patrol from FOBs. He explains: "I did have available the Desert Hawk which did give real time observation on the ground, but this was normally limited to FOBs and didn't always reach the isolated outposts. It was a sparse resource and underused [...]."[949]

Desert Hawk also suffered from a high loss rate, due to the difficult operating conditions. First-hand accounts from Helmand are full of UAV crashes: "We did have a small task of taking the UAV detachment up to Shrine Hill for them to overfly the area we're putting a

[945] Email Interview Ben Mcniff, 2016.
[946] Email Interview Ben Mcniff, 2016.
[947] Email Interview Doug Beattie, September 2016.
[948] Beattie and Gomm, *Task Force Helmand: a soldier's story of life, death and combat on the Afghan front line*. p.47. Emphasis added.
[949] Email Interview Doug Beattie, September 2016.

sniper in tomorrow", Lieutenant John Thornton writes on 24 November 2007, "However the UAV crashed within about 5 minutes of taking off, and so we got back for a fairly early night".[950] In his front-line diary from late 2007, a commanding officer mentions UAVs four times – all of them crashes.[951] Cannibalisation of parts became commonplace.

There were other problems. Initially, imagery could not be distributed easily beyond the screen of the people on the ground. Landing the aircraft in confined locations could also be tricky.[952] Jamming was another challenge as electronic counter measures caused problems to transmitter receivers.[953] Although Desert Hawk could be used in combat situations, there are no reports on this having happened.

As Desert Hawk was the first British UAV in theatre, its use also set standards for subsequent UAV operations. Most crucially, one death and major injury sustained during the recovery of a Desert Hawk in 2006 (see below) led to the order being introduced that: "Life is not to be put at risk to recover an Unmanned Aircraft".[954]

In sum, Desert Hawk in Afghanistan provided a new level of ISTAR at tactical level, the over-the-next-hill view, highly valued by troops.[955] It was used often: according to an official report, Desert Hawk III flew c.30 000 hours in Afghanistan.[956] But the scarcity of the system on the ground meant that it was often not available when needed.

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[950] *Helmand. Diaries of front-line Soldiers* (Oxford: Osprey, 2013). p.47.
[951] Ibid. p.105.
[952] Email Interview Ben Mcniff, 2016.
[953] Email Interview Ben Mcniff, 2016.
[954] Email Interview Ben Mcniff, 2016.
[955] Ripley, "UK UAV operations in Afghanistan reach new milestones."
[956] "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume 1." p.16. A 2015 MoD powerpoint speaks of "in excess of 30k (+) hrs on operations since 2007".

3.2.2. Hermes 450 – widely available images

Hermes 450 was introduced into Afghanistan in 2007, after having made its first flight for British forces in Iraq. An imagery analyst who oversaw the introduction of UAVs in Afghanistan said it was an advantage that the smaller Desert Hawk had been introduced before, as "we could find out what to do with [UAVs]" before the bigger, more sophisticated Hermes 450 turned up".[957] Three air vehicles were initially delivered to Afghanistan, by 2010 this number had risen to four.[958]

The systems were airborne for up to 14 hours every day,[959] to provide continuous ISR for ground troop protection. As the first British ISTAR asset in Afghanistan to provide long-time endurance, Hermes data was used to study patterns-of-life – crucial knowledge that helped alert troops of possible traps or to warn if the element of surprise of an advance had been lost.[960] The detection of IEDs became a growing concern. Hermes 450 were also used to monitor suspicious individuals – an operator reported having followed an insurgent for fourteen hours.[961] Hermes was tasked almost exclusively for pre-programmed ISR collection, but was occasionally "pulled towards TICs [troops-in-contact] situations", providing the troops in distress with intelligence.[962]

It took some time to get used to the new system, as Hermes 450 provided new capabilities but also raised new challenges. For instance, Hermes required a runway, unlike Desert Hawk. The artillery also had to cooperate with the RAF more closely than before, as they

[957] Interview anonymous December 2015.
[958] Ripley, "UK UAV operations in Afghanistan reach new milestones."
[959] Ibid.
[960] Ripley, *British Army Aviation in Action*. p.12.
[961] Ibid. p.37.
[962] Ibid. p.37.

now shared an airspace in which UAV operations were conducted under the same rules and regulations as manned assets.[963]

The main crew for a Hermes consisted of two pilots and a mission commander in the Ground Control Station, with crews rotating while the system was in the air. Contractors handled take-off and landing.[964] The larger crew involved in a UAV mission included imagery analysts, air traffic controllers and engineers. All were stationed at Camp Bastion.

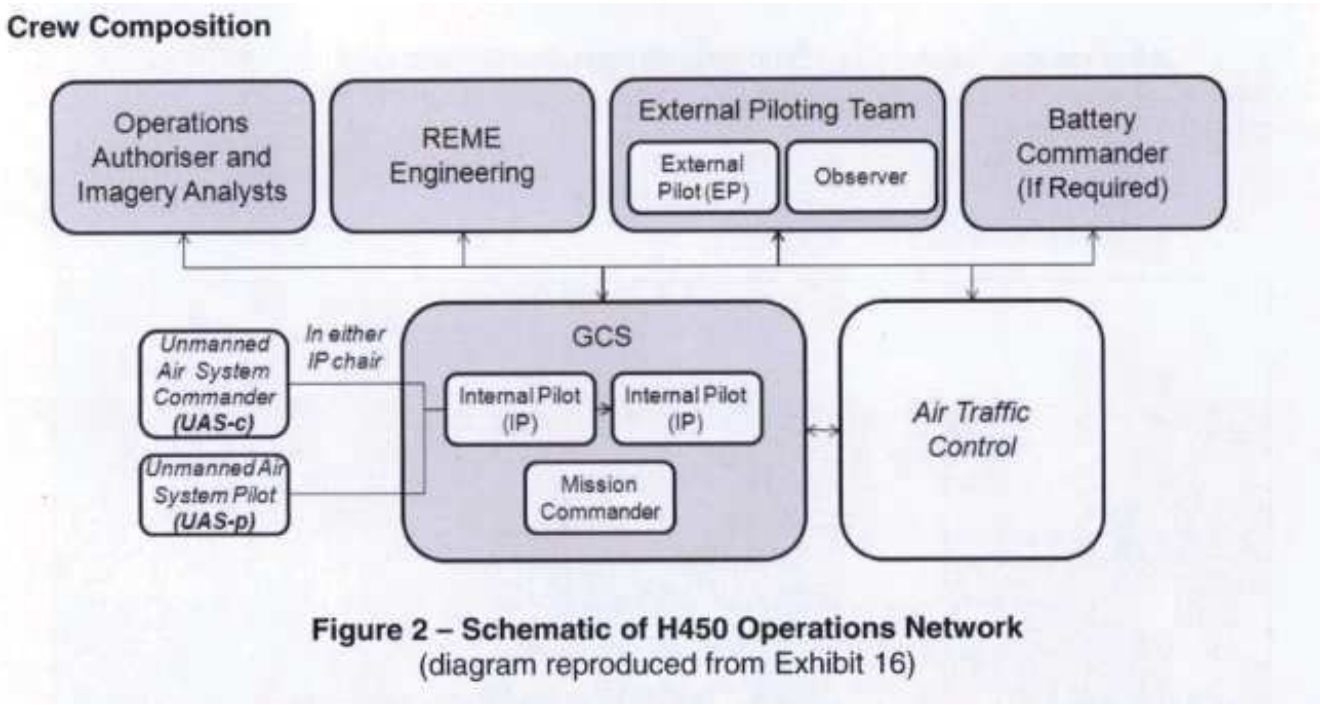

Illustration VI.5. Crew composition Hermes 450

Source: Hermes 450 official accident report[965]

Unlike the imagery from Desert Hawk which was only viewed by ground troops, Hermes' images were distributed to many parties. The Army formed 'ISTAR Tac Parties', two-person teams that could be attached to infantry battlegroups (or integrated into unit level

[963] Email Interview Ben Mcniff, 2016.

[964] Claire Button, "Unmanned Aerial Vehicles on Operation: Overcoming the Challenges," *RUSI Defence Systems* (2009).

[965] Hermes 450 official accident report accessible at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/34175/zk515_hermes_part_1_3.pdf p.1.3 -2.

HQs), which would bring with them Hermes 450 transportable remote viewing terminals (Rover).[966] Imagery was also streamed to Task Force Helmand Headquarters in Lashkar Gah. One operator complained that this led to micromanagement: "commanders often started directing what the payload should look at or became distracted by the live imagery".[967] After an adoption phase, the system was used regularly; flight hours increased from 1500 in 2007 to almost 15 000 hours in 2010.[968]

Because Hermes 450 had been in use with other armed forces before, technical problems were rare. But weather conditions in Afghanistan were particularly harsh; five Hermes 450 were lost in Afghanistan, three of which in a short period in summer 2012.[969] Equally, Hermes could not take off during the hottest parts of the day, a predicament circumvented by having the drone take off early and loiter while awaiting its tasks.[970] Dust proved a problem for Hermes' electro-optical/infrared sensor.[971] Overall, H450 received much praise, as it provided the British troops with persistent ISTAR capabilities.[972]

3.2.3. Reaper in Afghanistan – 24/7 surveillance combined with precise kinetic force

Reaper, the only Air Force drone, was procured as an UOR for Afghanistan where it first flew in October 2007. From May 2008, the system flew armed. The vehicles were based at Kandahar airfield (to the east of Helmand), and were started and landed by operators there, who used line-of-sight control. Once the vehicle was airborne, operators in the

[966] Button, "Unmanned Aerial Vehicles on Operation: Overcoming the Challenges."
[967] Email Interview Ben Mcniff, 2016.
[968] Gary John Schaub Jr, Kristian Søby Kristensen, and Flemming Pradhan-Blach, "Long Time Coming: Developing and Integrating UAVs into the American, British, French, and Danish Armed Forces," (Center for Military Studies Copenhagen 2014). p.26.
[969] Gareth Jennings, "UK reveals extent of UAV losses and serious incidents," *Jane's Defence Weekly* (2015).
[970] Email Interview Ben Mcniff, 2016.
[971] Beth Stevenson, "British Army praises performance of Watchkeeper during debut deployment," *Flight Global*, 17 November 2014.
[972] James Hardy, "Former British commander in Helmand claims major operational improvements," *Jane's Defence Weekly*, 20 June 2011.

Creech (US) or Waddington (UK) took over. From 2008 onwards, the UK had enough systems for a sustainable Reaper 'orbit', providing 24/7 surveillance. The operation of one orbit required three crews, consisting of two pilots, sensor operators and mission intelligence co-ordinators. They flew in 8-hour shifts, usually broken down into two three-and-a-half hour sections.[973] British pilots had flown American Predators before. As early as 2004, an RAF unit was embedded with the US Air Force at Nellis and Creech air bases,[974] even commanding missile strike sorties from US drones.[975]

This meant that UK operators were involved early in developing best practices for flying the Predator, and experienced the introduction of the Reaper first-hand. An operator and author of the British Reaper flying orderbook, said that initially, "we took a lot from the Americans, but once we started our own independent operations, there was little crossover." Initially, "there was a lot of head-scratching about how to best use this damn thing, because there was no nice and neat doctrine for armed ISR".[976]

The initial focus was on ISR. Similar to the German Heron that flew some 1000 kilometres further north, one task for the Reaper was to prepare the movement of troops or convoys. Reaper would patrol the route beforehand to look for Taliban activity and specifically IEDs. Over time operators became familiar with their areas, which helped them to identify threats that others might have overlooked: "You look for the presence of the abnormal. If you are there for so long, you really build up a knowledge of the local situations – and much more so than the forces of the ground that rotate every few months or half a year – you are there for four years. […] It's almost the kind of knowledge that a local police

[973] Interview anonymous Reaper pilot April 2017.
[974] Kenneth Munson, "UK RAF expects first Predator B deliveries," *International Defence Review* (2007).
[975] Ibid.
[976] Interview anonymous Reaper pilot April 2017.

officer would have".[977] Reaper operators were in contact with the ground troops who received the system's images via Rover terminal, thus helping them to navigate the area and provide information on such issues as how many enemy fighters were around.[978] Reaper's surveillance task could also be more mundane but equally important: an operator recounted how he provided eight-hour night cover for Canadian troops in a FOB, allowing them to sleep a full night for the first time in two weeks.[979]

Operators have praised the level of intelligence available from a Reaper, in particular the SAR sensor:

> "We saw, before sunrise, a man leave a compound and go to an area behind a building. He started digging, interacting with the ground. The controller [on the ground] saw that and immediately suggested that it was an IED and started trying to arrange permission for us to strike […] My crew disagreed, and as we watched longer and more closely, we could pick out some of the tools he was using and started to assess them as regular farming tools. Eventually, with the first fringes of sunrise, we could tell he was just seeding a small patch of ground. […] A manned aircraft with less equipment, less time and a poorer camera would have almost certainly considered engaging [sooner]."[980]

Furthermore, Reapers would also look for and follow individuals, to find out whom they were associated with.[981] Operators have been tight-lipped about whether these pursuits led to targeted killings.

UK Reapers flew over 60 000 hours over Afghanistan, in 4490 sorties (including UK sorties in USAF aircraft).[982] Reapers flew an average of 10 000 hours per year, meaning Reapers

[977] Ibid
[978] Gordon Corera, "How UK fights remote control war," *BBC*, 6 June 2008.
[979] Smith and Serie, "'It's very odd' – a former UK drone operator speaks."
[980] Peter Lee, "The ethics and effectiveness of drone warfare," *British Army Journal* 2014. p.64.
[981] Interview anonymous Reaper pilot April 2017.

assured more than 24/7 surveillance (8760 hours). Delivering a 24/7 capability proved a strain on the Squadron personnel, who were on operations for 3-year tours, rather than the 6 months for those deployed forward in theatre.[983]

Kinetic operations

In May 2008, the Reaper was armed with AGM-114 Hellfire air-to-surface missiles and/or GBU-12 Paveway precision-guided bombs. In early 2012, the use of the 500-pound GBU-12 bomb was discontinued in favour of the less destructive Hellfire.[984]

In official statements, government and MoD constantly underlined that the "Reaper's primary mission [was] to provide a persistent intelligence surveillance and reconnaissance capability". Kinetic capabilities were only mentioned second: "being armed, Reaper has the capability to respond to requests for support from commanders on the ground and engage emerging targets."[985] The government has been reticent to publish data on kinetic Reaper operations. A particular problem for researchers has been to attribute specific attacks to US or UK UAVs, making it difficult to assess how the UK used its Reapers and whether it carried out targeted killings. This was further complicated by the fact that UK operators would use USAF Reapers for UK-tasked missions if no British Reaper was available,[986] and British pilots launched at least 39 missile strikes against suspected Taliban insurgents from American drones.[987] The available information has been obtained through

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[982] "FOIA answer FOI2014/02630. 18 July," ed. House of Commons (London: 2014).
[983] "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume 1." p.27.
[984] Gareth Jennings, "MoD confirms commencement of UK-based Reaper operations," *Jane's Defence Weekly* (2013).
[985] "Written Answers to Questions, Monday 14 June," ed. House of Commons (London: 2010).
[986] "FOIA answer FOI2014/06629. 26 November," ed. House of Commons (London: 2014). Also see "FOIA answer FOI2014/02630. 18 July."
[987] "Afghanistan:Written question - 207734, Answered by Mr Mark Francois, Ministry of Defense," ed. Parliament (2014).

parliamentary questions and, most importantly, FOIA requests by non-governmental organisations, some of which led to long battles between activists and the government.[988]

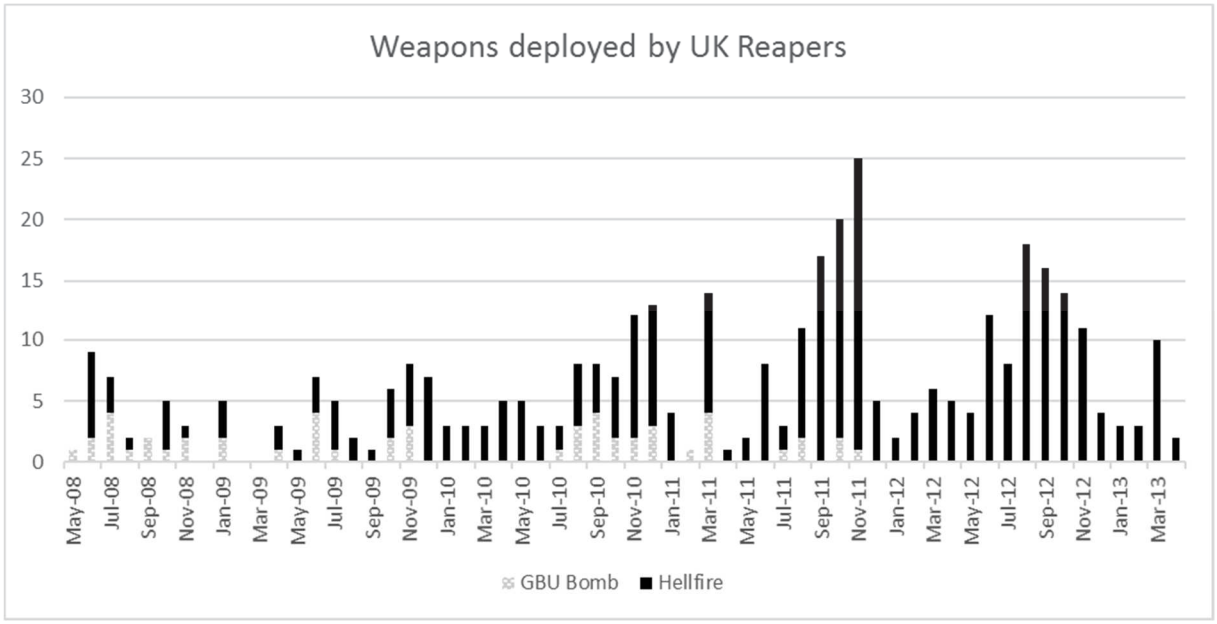

Illustration VI.6. Bomb and Hellfire releases by UK Reapers in Afghanistan
Source: Own illustration, data FOIA 4 February 2014 [989]

British-piloted drones launched a significant proportion of the total missiles fired from drones in Afghanistan, even though the UK had fewer drones than the US at its disposal. The *BIJ* calculated that between 2008 and 2011, 7% of British drone sorties resulted in a strike, compared to just over 2% of US missions.[990]

[988] Chris Cole, "Finally revealed: UK drone strikes in Afghanistan by province," *Drone Wars UK* (2015). Some of the data is contradictory, with *BIJ* and *Drone Wars UK* referring at times to different numbers and even government responses not using the same numbers. The following has been collected to my best knowledge. Where necessary, I have given preference to *BIJ* numbers over *Drone Wars UK*. As the provenience of *Drone Wars UK* numbers 2013 and 2014 cannot be retraced, they are not included here.
[989] Own graph, information from "FOIA Answer, 30-04-2013-130638-007. 4 February," ed. House of Commons (London: 2014). An additional FOI request revealed that a total of 94 Hellfire were released over 2013. See "FOIA Answer 20-01-2014-151520-012. 31 January 2014 ", ed. House of Commons (London: 2013).
[990] Alice Ross, "UK drones three times more likely than US to fire in Afghanistan," *Bureau of Investigative Journalism*, 6 September 2013.

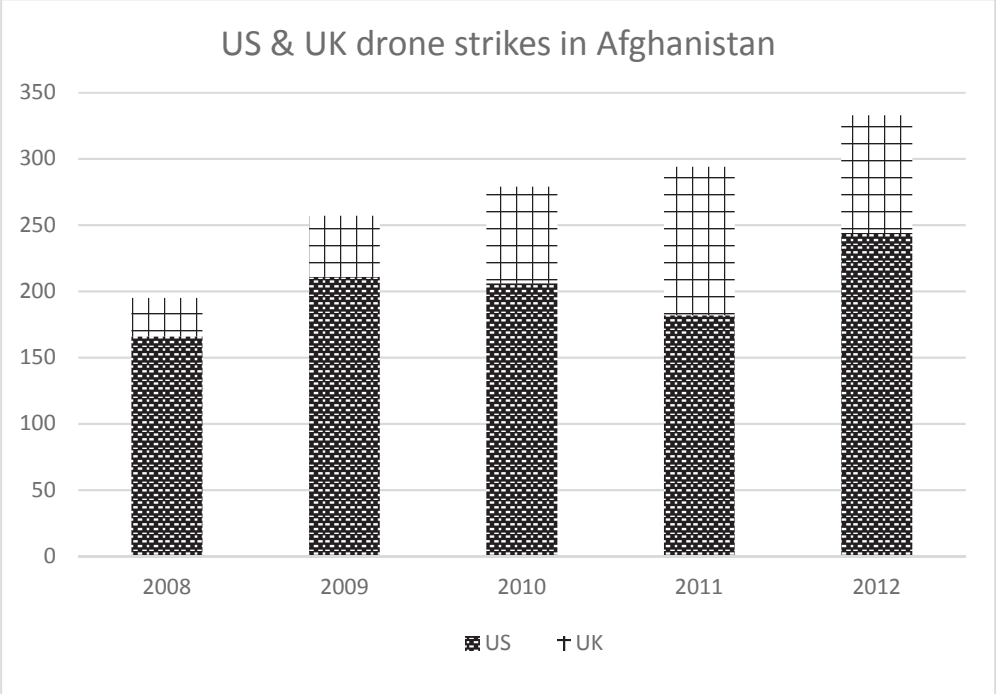

Illustration VI.7. US & UK drone strikes in Afghanistan
Source: *BIJ* 2012[991]

An early operator reported that the kinetic operations he flew were all for troops in contact situations.[992] In these types of operations, Reapers would monitor combats and engage enemy fighters with Hellfire missiles when they were far enough from own troops.

The British government has not confirmed, nor denied, that British Reaper drones have carried out targeted killings in Afghanistan. It seems however likely that the UK used its armed drones to that effect.[993] An operator confirmed that they would at times follow individuals that "were considered 'bad actors'", without specifying what would happen to these bad actors. Equally, sources explained to the *Guardian*, that a UK drone strike that

[991] Chris Woods and Alice K. Ross, "Revealed: US and Britain launched 1,200 drone strikes in recent wars," *Bureau of Investigative Journalism*, 4 December 2012.
[992] Smith and Serie, "'It's very odd' – a former UK drone operator speaks."
[993] "Written evidence from Drone Wars UK," ed. House of Commons (London: 2013).

caused four civilian casualties was “meant to kill a Taliban commander who was being tracked on the ground”.[994]

There have been no comprehensive statements on how many casualties were caused by British drone strikes. The only official statement is from 2010, when David Cameron said 124 insurgents had been killed by UK drones in Afghanistan.[995] Equally, the government has been tight-lipped about civilian casualties. For the six years of Reaper operations in Afghanistan, the government acknowledged only one operation that caused civilian casualties; an attack on two pick-up trucks loaded with explosives on 25 March 2011 that killed two insurgents and four civilians.[996]

While only four civilian casualties in six years of operation (and some 300 strikes)[997] appear unlikely, the number of civilian casualties caused by British Reaper operations seem lower than those caused by US drone operations in Pakistan. The UN Assistance Mission in Afghanistan (UNAMA) in its annual reports on civilian casualties in Afghanistan rarely mentioned drones and lists comparatively low numbers of civilian casualties caused by ISAF air operations (100 – 200 depending on the year).[998]

There are several possible explanations for this. British operators report the emphasis put on keeping civilian casualties low. British Reaper operators in Afghanistan followed the

[994] Hopkins, "Four Afghan civilians killed in RAF drone attack."
[995] Ibid.
[996] "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume II Written evidence." w.5.
[997] In 2013, defence minister Andrew Robathan said British forces have carried out 299 drone strikes in Afghanistan between 2008 and July 2013. Ross, "UK drones three times more likely than US to fire in Afghanistan."
[998] UNAMA’s annual reports are available at https://unama.unmissions.org/protection-of-civilians-reports.

same Rules of Engagement (RoE) as other systems' operators.[999] These RoEs are not publicly available, but the MoD has stated that they include a provision that weapons should not be discharged from any aerial platform "unless there is a zero expectation of civilian casualties, and that any individual or location should be presumed to be civilian in nature unless there is clear evidence to the contrary", a rule commended by Ben Emmerson, in his UN report.[1000] Accountability arrangements for UK drones were the same as those for manned aircraft, an operator even noted that he thought the release of weapons from a UAV was probably even more tightly controlled than from the manned platforms.[1001] Before every weapons' release, the pilot would search for a 'place to put the bomb if something happens' a tactic known as 'shifting cold'.[1002] An operator recounts "We follow LOAC [Law of Armed Conflict] to the letter. Specifically, I talk of distinction and proportionality. […] Many, many strikes have had to abort or shift cold to avoid that circumstance."[1003] For every weapons discharge from a Reaper, a mission report was reviewed by the most senior British officer at the Combined Air Operations Centre in Afghanistan and a legal adviser; "If there is any indication of civilian casualties, the incident is referred to the Joint Incident Assessment Team at ISAF, whose personnel are independent of the chain of command involved in any strike."[1004] It appears likely that the decision to phase out the Paveway bombs was at least partly motivated by the wish to

[999] "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume 1." p.15. And "Written Answers to Questions, Tuesday 6 November 2012," ed. Parliament (2012).Also see Button, "Unmanned Aerial Vehicles on Operation: Overcoming the Challenges."
[1000] Emmerson, "Report of the Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism."p.23/24.
[1001] Smith and Serie, "'It's very odd' – a former UK drone operator speaks."
[1002] Ibid. This procedure was the same as for the weapons release from manned systems.
[1003] http://appgdrones.org.uk/wp-content/uploads/2014/08/Dr-Peter-Lee-Submission-to-APPG-Inquiry.pdf
[1004] Emmerson, "Report of the Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism." p.22.

keep civilian casualties low – explosions caused by the much smaller Hellfire (9kg explosive material versus 90kg) were less likely to kill innocent bystanders.

The military cooperation between British and US forces was (and remains) extensive.[1005] In Afghanistan, this could most clearly be seen with regard to the Reaper. "We operate a combined fleet with the US and there is ISAF tasking. UK and US aircraft therefore fly ISAF mission tasks and they may be piloted by UK or US pilots," then-Defence Minister Hammond underlined.[1006] Particularly in the beginning, when UK had little own UAV capabilities, British troops received support from US drones. A captain with the British Army in Afghanistan in 2009 said: "During my time in Afghanistan, drones were primarily supplied by the US as our drone capability was miniscule in comparison."[1007] An obscure element of Britain's Reaper use in Afghanistan was its role in the US targeted killing campaign in neighbouring Pakistan. It appears unlikely (and would most likely have been illegal) that British pilots flew British systems into Pakistan to target alleged terrorists under US command. However, there have been reports on "chopping", the quick change of operational control of a drone in the air. *Reprieve* founder Clive Stafford Smith described the practice: A "British drone might be on the Pakistan border when the US decides to kill someone in Waziristan […]. So, the machine metamorphoses into an American drone and the US "pilot" slips into the comfy chair to let loose the Hellfire missile".[1008] This is possible as British and American pilots are based in Creech, and UK

[1005] A former military chief in 2016 warned that the UK was too reliant on the US, no longer able to defend itself independently. Sam Jones, "Britain's 'withered' forces not fit to repel all-out attack," *Financial Times* 2016.
[1006] "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume 1."
[1007] James Jeffrey, "Drone warfare's deadly civilian toll: a very personal view," *Guardian*, 20 September 2012.
[1008] Clive Stafford Smith, "We need to know the truth about UK drones policy," *Guardian*, 23 October 2012.

pilots flew US systems, including very close to the Pakistan border (see provinces 34 and 32 in illustration VI.8. below).

US Predator pilot Matt Martin described a similar scene:

> "The Nellis crew of one of our Afghan Predators, call sign *Skybird*, spotted four men hiking the trail, each carrying a weapon. [...] Today's *Skybird* crew was British working at Nellis with Americans to gain experience win combat RPA flying. The pilot, Flight Lieutenant Kevin Gambold, gave me a heads-up on the situation through his chatroom. [...] *Skybird, they're hostiles*, read the communiqué from the commander of Operation Achilles. [...] He then ordered an air strike. [But] Flight Lieutenant Gambold wavered. The War on Terror was very unpopular in Britain, with its large ad increasingly rambunctious Muslim immigrant population. The British government imposed such strict rules of engagement on its war fighters that, in most cases, the English could shoot only in self-defense. [...] I dispatched an American crew to take over Skybird's controls and settle the refined British conscience. We American's weren't quite so finicky over what we shot at."[1009]

[1009] Martin and Sasser, *Predator, The remote-control air war over Iraq and Afghanistan: A Pilot's Story*. p.285.

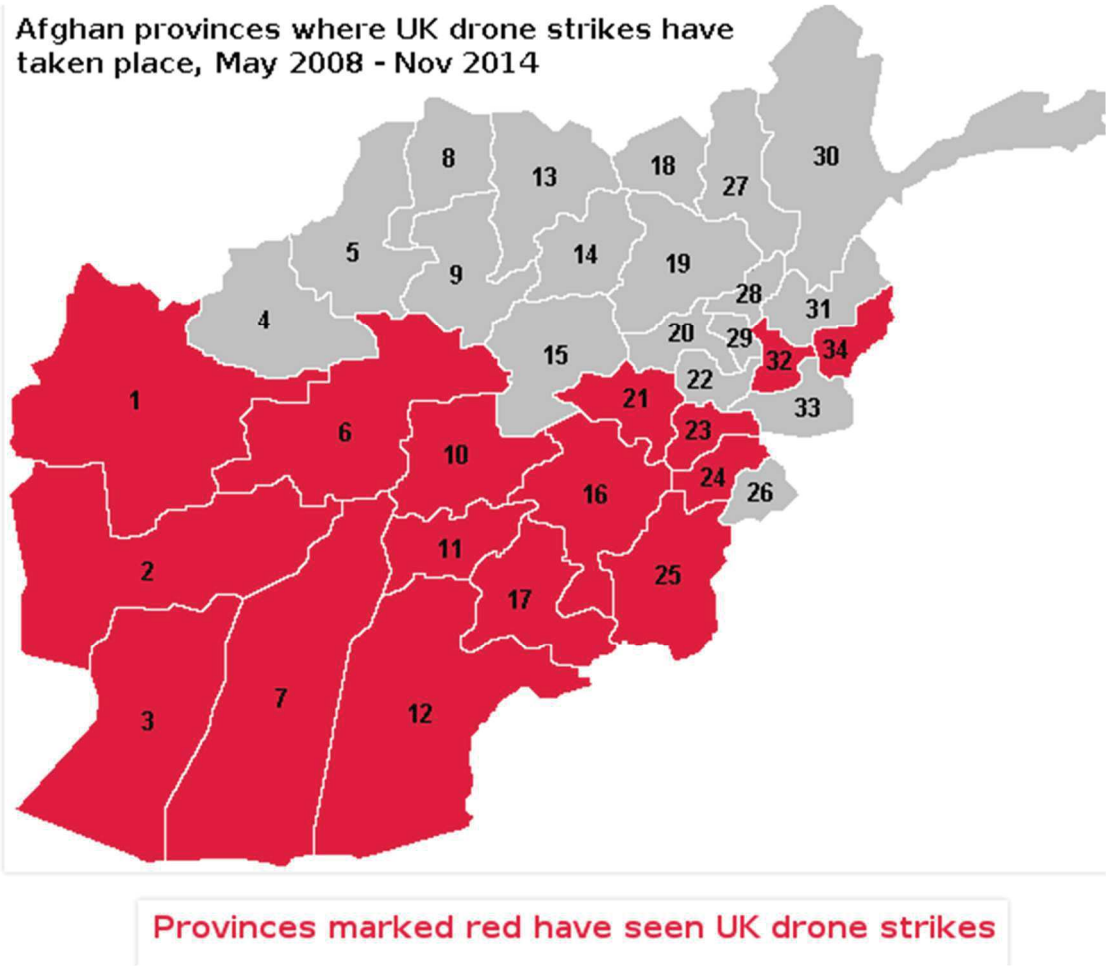

Illustration VI.8. Drone strikes by British Reapers in Afghanistan
Source: Drone War UK (2015)[1010]

The map shows that the Reaper operated much wider than only in Helmand (province 7), as British Reaper flew for ISAF operations more broadly. Provinces 34 and 32 are close to Waziristan.

3.2.4. T-Hawk in Afghanistan – the ghost of disappointed hopes

Little information is available on Tarantula Hawk, despite it having been in use in Afghanistan for four years, making its first flight in April 2010. The drone was part of the Talisman route-clearance system, a mine/IED clearing system. Talisman's role was to

[1010] Cole, "Finally revealed: UK drone strikes in Afghanistan by province."

inspect potential IED locations ahead of British patrols and to destroy the IEDs it found. T-Hawk was to ensure the safety of the crew: it could be controlled without the operator having to leave the cover of the vehicle. The airflow generated by the rotor blades, which originally had been perceived as a disadvantage, turned out to be useful as it would blow dust away from possible improvised explosive devices to aid visual checks.[1011]

An operator declared "I've probably enjoyed flying [T-Hawk] the most. I flew it 14 times on one operation where we cleared a route in [the Nahr-e-Saraj district, Helmand Province], and that route is still being used."[1012] Other operators however reported that the system was often not used as it took too long: "It was simply easier to put a guy in a suit and let him check out the IED," a British imagery analyst reports.[1013] It also produced a lot of noise. The time it took to operate the T-Hawk plus the noise risked making the disposal team a target.[1014] The imagery analyst's verdict: "Great concept. In reality, it did not work".[1015] Overall, the little information available and the fact that after being withdrawn from Afghanistan, T-Hawks were no longer in service, points to T-Hawk not having satisfied requirements.

3.2.5. Black Hornet in Afghanistan – the beginning of personal drones

The smallest UAV in service not only with the British armed forces but also with all other armed forces around the world, the Black Hornet, was introduced to Afghanistan in 2012 after being selected as an Urgent Operational Requirement. The nano-drone was controlled by a single soldier for personal close reconnaissance. Black Hornet is the only Army UAV employed by infantry soldiers rather than by the artillery. It is a non-specialist

[1011] Angus Batey, "Eyes on Target," *Aviation Week* (2011).
[1012] "UK Army likes lo-tech in Afghanistan," *Aviation Week*, 12 October 2011.
[1013] Interview anonymous December 2015.
[1014] Kirell, "Why I Hated Being A Drone Pilot in Afghanistan."
[1015] Interview anonymous December 2015

tool that can be controlled by an operator with minimal training, allowing soldiers to be as independent as possible.

Black Hornet provided a highly valued 'over-the-compound-wall view' and situational awareness in urban environments. In addition, the system was used to look for insurgent firing points and check out exposed areas.[1016] An imagery analyst who worked with larger systems did not find much added value in Black Hornet's images, but infantry soldiers who through Black Hornet got a personal drone capability praised the drone's flexibility. "If I want to get eyes-on in a nearby compound, instead of having to ask for [surveillance] assets, I just get the Hornet out. […] I can get that up and running in about a minute". [1017] The Black Hawk's biggest enemy was wind – and low endurance, both linked to its small size.

As Black Hornet was deployed to Afghanistan late, it did not have a major impact. Preliminary assessment however suggests a bright future for nano-drones. Yet, and despite initial reports that the MoD would keep Black Hornet in its long-term inventory,[1018] in 2017 it decided to retire the system.[1019]

3.2.6. Watchkeeper in Afghanistan – too little too late

Because of the programme's delays, Watchkeeper was introduced into service in Afghanistan only in September 2014, a few months before British troops withdrew.[1020] That the UAV was deployed at all can be considered a success – a House of Commons Report had concluded in early 2014 that "[d]ue to significant delays to the programme, it

[1016] Spencer Ackerman, "Palm-Sized Nano-Copter Is the Afghanistan War's Latest Spy Drone," *Wired* 2013.
[1017] "British Army operators detail Black Hornet UAV attributes," *Flight Global* (2013).
[1018] De Larrinaga, "DSEI 2015: UK to keep Black Hornet and Desert Hawk UAS in service."
[1019] Ripley, "British Army retires Black Hornet micro UAV."
[1020] Stevenson, "British Army praises performance of Watchkeeper during debut deployment."

is now unlikely that Watchkeeper will be utilised on operations in Afghanistan, the theatre for which it was originally procured."[1021]

Only three aircraft were sent. A MoD spokeswoman denied that the deployment was a demonstration, saying Watchkeeper was needed in Afghanistan because "[w]e need the best capabilities to provide force protection for the draw down".[1022] Yet, *BIJ* found that "the drones flew for a total of 146 hours, equivalent to two days each, before British forces left the country,[1023] thus making it unlikely that it had any significant impact. Unsurprisingly, official statements on the Watchkeeper's brief Afghanistan operation were still unanimously positive.[1024]

There has been a lot of debate on whether the Watchkeeper really is a better system than Hermes 450 on which it was based. The upgrade to the synthetic aperture radar appeared to have been useful improvement, as Hermes 450's electro-optical/infrared payload had struggled with dust clouds.[1025] Yet, the Reaper provided the same capabilities and, because of the continuously increasing costs, in the end the UAV costs much the same as the more capable Reaper, while otherwise not providing the same capabilities.

[1021] "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume 1."
[1022] Tim Ripley, "UK deploys Watchkeeper UAV to Afghanistan," *IHS Jane's Defence Weekly*, 29 September 2014.
[1023] Alice Ross and Jack Serle, "UK's 1.2bn bill for drone that's seen 146 hours of active duty," *Guardian*, 2 October 2015.
[1024] Gareth Jennings, "Paris Air Show 2015: British Army praises Watchkeeper's 'game changing' ISTAR capabilities," *Jane's Defence Weekly*, 15 May 2015.
[1025] Stevenson, "British Army praises performance of Watchkeeper during debut deployment."

Illustration VI.9. Comparison British drones
Source: *BIJ/Guardian*[1026]

Watchkeeper returned to the UK where the Royal Artillery continued training with the systems. In late 2015, Watchkeeper training operations were relocated to the tropical Ascension Island after the supposedly all-weather aircraft struggled with British winter.[1027]

3.3. Specific incidents

Probably the most famous incident in Afghanistan involving a drone took place in January 2007, when Royal Marines attacked a Taliban Base in Jugroom Fort, in southern Helmand.[1028] In a night raid, 200 Marines approached the heavily fortified position with amphibious and armoured vehicles. But the Taliban defended the fort with gunfire. When the commandos retreated, they realised one marine had been left behind. A Desert Hawk

[1026] Ross and Serle, "UK's 1.2bn bill for drone that's seen 146 hours of active duty."
[1027] Jack Serle, "Army moves Watchkeeper drone training to tropics for winter after flying problems in UK weather," *Bureau of Investigative Journalism*, 11 December 2015.
[1028] Declan Walsh and Richard Norton-Taylor, "Strapped to Apaches and dodging fire, how troops recovered fallen comrade," *Guardian*, 17 January 2007. Also see Ripley, *British Army Aviation in Action*. p.55.

was deployed and quickly found the missing man. It was unclear whether he was alive or not. Four of his comrades mounted a recovery mission, which earned them a place in British military history books as well as several medals, as they strapped themselves to the weapon pylons of two Apache helicopters. They recovered the body of their comrade who had died instantaneously, tragically, from wounds "very probably caused by NATO rounds".[1029] A post-operation report deplored insufficient training, and spoke of a "great deal of confusion" during the fighting, which saw a machine gunner on a Viking amphibious vehicle turn its weapon round 180 degrees.[1030] The assault failed, and the Taliban were not expelled from Jugroom fort. While the incident proved Desert Hawk's utility in looking over fortified walls and entering areas too dangerous for humans, it also gave reason to pause. Given that Desert Hawk was deployed immediately, it must have been brought on the assault, which means that its presence either did not suffice to alleviate the confusion and prevent the death, or that it was not used until later.

In another instance, a drone indirectly caused a casualty.[1031] On 11 June 2006, 18th UAV Battery was using Desert Hawks to observe a suspected Taliban position near Sangin. One of the Hawks went down. As this was in the systems' test phase, the team was anxious to know the reasons for the crash and a patrol was deployed to retrieve the drone. By the time they reached the crash site, the UAV had been driven off by locals. The troops then came under attack. A Royal Artillery officer was killed, the first British soldier to die in action in Helmand. Already at the time, the Standard Operating Procedures (SOPs) for the

[1029] Richard Norton-Taylor, "Poor training, confusion and friendly fire, the real story behind brave Apache rescue," *Guardian*, 16 August 2008.
[1030] Ibid.
[1031] Ripley, *British Army Aviation in Action*. p.55. Also see Chris W Johnson, "Military Risk Assessment in Counter Insurgency Operations: A Case Study in the Retrieval of a UAV Nr Sangin, Helmand Province, Afghanistan, 11th June 2006" (paper presented at the Proceedings Of the Third IET Systems Safety Conference, 2008).

Desert Hawk stated that "if a UAV ditches or lands short of the recovery point it should be recovered", but also warned that "the recovery of a UAV should not be attempted if there is a risk to life". The incident led to a stronger enforcement of the second part of the order.[1032]

3.4. Conclusion – British drones prove their worth

UAVs had been of marginal interest to the British armed forces before the Afghanistan War. By 2014, when the troops withdrew, the capability, initially introduced as an Urgent Operational Requirement, had become a permanent feature of British warfare. "It is difficult to imagine a future campaign where such technology will not have a role to play", the MoD concluded.[1033]

The learning curve of the British forces was steep, as lessons were learned in combat. The systems and the intelligence they could provide were new, so trial-and-error was unavoidable: "I don't want to give the impression that everything was ad hoc and on the fly. It was more that capabilities like that had never been there before. We had to find out how to implement and utilise this".[1034] In the end, British drones in Afghanistan provided battle damage assessment, confidence boosts, deterrence, general ISR, over-watch and force protection, psychological operations, route proving and clearance, targeting, and more.

Desert Hawk, Hermes 450, and Reaper became the work horses of the British unmanned operations in Afghanistan. The three systems were deployed the longest (between six and seven years) and flew several hundred thousand hours over the country, providing ISR and

[1032] Email Interview Ben Mcniff, 2016.
[1033] "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume II Written evidence."p.Ev.w5.
[1034] Interview anonymous December 2015

connecting troops on the ground with other troops, commanders, and headquarters. Black Hornet's deployment served as proof of concept that nano-drones will play an important role in future operations, even if for the British troops it won't be the Norwegian system which was retired. Watchkeeper was deployed for too little time to have a significant impact. Watchkeeper may still become an important addition to the British forces, but the question over whether it will have been worth its cost remains.

Official reports unanimously consider UAV operations in Afghanistan a success. Individual soldiers differentiate more, but overall agree that drones provided important capabilities. Most notably drones provided "twenty-four-carat intelligence".[1035] The British quickly learned how to use different UAVs and other systems for maximum ISR, an effort that included setting up an 'ISR Hub' at Camp Bastion to bring together all intelligence.[1036] Raids became more precise, as loitering drones would give information to the ground troops as to where entrances were and from where danger may come.[1037] The stationing of Reaper pilots far away from Afghanistan brought one major advantage in terms of institutional memory: while the troops in country rotated every six or nine months, Reaper operators flew for three or more years over Afghanistan, learning in detail about local patterns of behaviour. They were "the UK's most experienced people in Afghanistan", Wing Commander Chris Thirtle, noted, "except, they were not in Afghanistan".[1038] The armed Reaper provided another arrow in the quiver, combining persistence with firepower. One of the advantages many soldiers chose to emphasise related to the flexibility and the escape from bureaucracy which drones, in particular the smaller systems provided: "You

[1035] Ewen Southby-Tailyour, *3 Commando Brigade. Helmand Assault* (Ebury Press, 2010). p.65/66.
[1036] Ripley, *British Army Aviation in Action*. p.30/31.
[1037] Velicovich, *Drone Warrior. An Elite Soldier's Inside Account of the Hunt for America's Most dangerous Enemies*.position692.
[1038] Hopkins, "Afghanistan: How RAF takes on the Taliban - by joystick from Las Vegas."

don't have to ask permission from higher [up the command chain] to fly something like this", an operator said about the Black Hornet.[1039] The bigger systems, because of their long endurance, also provided a new level of flexibility valued by soldiers.

The fog of war, however, was not lifted. On the tactical level, confusion during operations still led to tragic accidents, such as during the Jugroom Fort attack. Some of this may be improved by having more drones available. For instance, in his war memoirs, Regimental Sergeant Major Beattie describes many situations in Helmand in which a UAV could have helped: "many of the tracks marked on the map didn't exist in reality. And even where they did, there was a tendency for them suddenly to peter out in the middle of a ploughed field."[1040] This is exactly the kind of issue that UAVs can help to solve. On the strategic level, the most comprehensive analysis of the Helmand conflict shows in excruciating detail that the British (and allies) until their withdrawal did not understand the local dynamics and realities, so supporting the wrong forces and not understanding who the enemy was.[1041] Drones did not help to remove this problem, as in Afghanistan the fog of war was social, rather than military. Drones helped the military efforts, but did not change the course of the war for the British. In a detailed analysis of the British war in Afghanistan, drones play no major role.[1042]

4. UAVs in British doctrinal and strategic thinking

There is a wealth of British doctrinal writing as the MoD publishes a hierarchy of regularly updated doctrinal documents. In the timeframe relevant for this thesis, there have been

[1039] "British Army operators detail Black Hornet UAV attributes."
[1040] Beattie and Gomm, *Task Force Helmand: a soldier's story of life, death and combat on the Afghan front line*. p.137.
[1041] Mike Martin, *An Intimate War: An Oral History of the Helmand Conflict* (London: Hurst, 2014).
[1042] Farrell, *Unwinnable: Britain's War in Afghanistan, 2001–2014*.

three higher level documents, two *Strategic Defence and Security Reviews* (SDSR, 2010, 2015), and the *UK Defence Doctrine* (fifth edition November 2014), and two lower-level Joint Doctrine Notes; JDN2/11 and JD0-30.

4.1. Strategic Defence and Security Reviews SDSR

There have been eight Strategic Defence and Security Review reviews since 1957. SDSRs assess current capabilities and make recommendations and previsions for the short- to medium-term future necessary to deliver the ends described in the National Security Strategy (NSS) which sets out Britain's security priorities.[1043]

SDSR 2010 foresaw a "battlespace [which] increasingly involves unmanned and cyber operations". It laid out unmanned capabilities for both land and air forces; Watchkeeper for the Army, and "a growing fleet of Unmanned Air Vehicles in both combat and reconnaissance roles," for the Royal Air Force, "to complement our strategic ISTAR assets and reduce the risk to our forces of operating over hostile territory".[1044] Surprisingly, the SDSR appeared to consider unmanned systems a future, rather than current technology, an astonishing assessment given the range of systems in use with UK forces in 2010. Watchkeeper was the only unmanned system mentioned by name. Second, although the review identifies the battlespace as involving more unmanned operations, it did not specify as to what this meant for the UK, or what types of operations UAVs were considered most valuable, even though at that time the UK had daily experiences with UAVs. This gap was noted by the House of Commons Defence Committee which criticised

[1043] In 2015, the NSS and SDSR were combined, and a National Security Capability Review is due to be published in spring 2018.

[1044] Ministry of Defence, *Securing Britain in an age of uncertainty: the strategic defence and security review* (The Stationery Office, 2010). p.17. In order: p.17; p.5; p.24,26.

the SDSR for not sufficiently outlining plans on the use of unmanned vehicles.[1045] Air Chief Marshal Lord Stirrup noticed that the thinking on how to use unmanned air vehicles (for wide area surveillance) "was not sufficiently advanced".[1046] Nonetheless, in his speech introducing the SDSR 2010 on 19 October, Prime Minister David Cameron emphasised an increased investment in unmanned capabilities: "anyone who has been to Afghanistan and seen the incredible work that is being done there knows that that is a capability in which we should be investing."[1047]

The next SDSR "A Secure and Prosperous United Kingdom",[1048] published five years later, continued to speak of UAVs exclusively in the future tense, discussing the plan to procure 20 Protector drones (Reaper variants), and referring to the collaboration to develop an unmanned combat air system with France. Only Watchkeeper and Protector/Reaper were mentioned by name.

4.2. Joint Doctrine Note 2/11

In March 2011, the MoD's Development, Concepts, and Doctrine Centre, (DCDC) published a remarkable document, Joint Doctrine Note 2/11, "The UK Approach to Unmanned Aircraft Systems". Joint Doctrine Notes are semi-official publications, but are "promulgated as directed by the Chiefs of Staff". JDN2/11 was written over eight months by DCDC researchers using open source and classified data, and conducting interviews

[1045] "The Strategic Defence and Security Review and the National Security Strategy, Sixth Report of Session 2010–12," ed. House of Commons Defence Committee (2011). p.7,54.
[1046] "Defence Committee: Evidence. Wednesday 18 May 2011. Witness: Air Chief Marshal (rtd) Lord Stirrup," ed. House of Commons Defence Committee (2011).
[1047] "House of Commons Debate 19 October 2010," *parliament.uk* (2010).
[1048] "National Security Strategy and Strategic Defence and Security Review 2015," ed. HM Government (London: 2015).

with soldiers in the field. [1049] It was aimed at a military audience, but the media and political realm soon showed considerable interest in the document.[1050]

The publication was born out of the desire to react to the rapid proliferation of UAVs and the ad hoc procurement of UAVs by the UK without clear strategic thinking and aimed to define terms. JDN2/11 praised UAVs for delivering "new or enhanced capability […] while reducing costs and threat to personnel." "Relatively cheap and simple unmanned aircraft are already capable of providing situational awareness at a tactical level that simply could not be afforded by manned means", it stated.[1051]

But it was the chapter on moral, legal, and ethical issues that proved controversial. JDN2/11 outlined ethical problems, stating that "the removal of risk to one's own forces in warfare" may create dilemmas. Quoting the famous Robert Lee statement "It is well that war is so terrible – otherwise we would grow too fond of it", the authors wondered whether drones make war too attractive. JDN2/11 showed a notable level of introspection, all the while asking more questions than it answered, and refraining from normative judgements. The chapter on legal and moral questions ended with the remarkable statement, "There is a danger that time is running out – is debate and development of policy even still possible or is the technological genie already out of the ethical bottle, embarking us all on an incremental and involuntary journey towards a Terminator-like reality"?[1052]

[1049] Interview Clive Blount, 4 September 2015.
[1050] See for instance Richard Norton-Taylor, "The Terminators: drone strikes prompt MoD to ponder ethics of killer robots," *Guardian*, 17 April 2011.
[1051] "The UK Approach to Unmanned Aircraft Systems, Joint Doctrine Note 2/11." p.1.3.
[1052] Ibid. p.5.12.

Although JDN2/11 is called doctrine, its authors admit that it was "somewhere between a concept and a doctrine note".[1053] Little is written on how the UK used, or should use UAVs in conflicts at the time. Instead, it noted that the UK only has "limited experience of operating modern, capable, unmanned aircraft", and that "relevant operational analysis is scarce".[1054] US UAV operations on the other hand feature prominently. The document compared British usage to US use and, commenting on US use for targeted killings, notes that "the recent extensive use of unmanned aircraft over Pakistan and Yemen may already herald a new era. That these activities are exclusively carried out by unmanned aircraft, even though very capable manned aircraft are available, and that the use of ground troops in harm's way has been avoided, suggests that the use of *force is totally a function of the existence of an unmanned capability* – it is unlikely a similar scale of force would be used if this capability were not available."[1055]

Most remarkable, JDN2/11 mentioned the RMA, stating that, "Unmanned aircraft now hold a central role in modern warfare and there is a real possibility that, after many false starts and broken promises, a technological tipping point is approaching that may well deliver a genuine revolution in military affairs". Pressed on this question, JDN2/11's authors said that they would not phrase this the same way today, but that at the time there was a feeling of being in a quagmire in Iraq and Afghanistan. People were the most expensive commodity, so the feeling was that a technology that might lead to warfare without people would be revolutionary.[1056]

[1053] Interview Clive Blount, 4 September 2015.
[1054] "The UK Approach to Unmanned Aircraft Systems, Joint Doctrine Note 2/11." p.1.2.
[1055] Ibid. p.4.3. Emphasis added.
[1056] Interview Clive Blount, 4 September 2015.

Even before it was published, the document faced criticism from members of the military who worried that the concerns it raised in the document might inhibit future British UAV use.[1057] JN2/11 was published nonetheless, but instead of being signed by a 2-star general, as usual, it was signed by Group Captain Clive Blount, DCDC's Assistant Head. Anti-drone activists welcomed the study.[1058] The life of the JDN was thought to be "of the order of 18 months", however, it has not been renewed, although parts of it were subsumed in UK Air and Space doctrine JD0-30 (2013).

4.3. UK Air and Space Doctrine JD 0-30 (2013)

UK Air and Space doctrine JD0-30 was published in July 2013,[1059] partly superseding JDN2/11. It discussed UAV use in some detail with two special sections on drones. Praising the Reaper's surveillance capabilities as shown in Afghanistan, the document considered remotely-piloted systems an integral component of the combat and ISR network. It noted the advantages of unmanned systems, such as the increase in air power's persistence and reach, and stated that "the importance of remotely-piloted air systems in delivering air power capability will increase, potentially in all four air power roles, as the technology matures."[1060]

However, strikingly, the document considered the effects created with manned and unmanned aircraft to be "essentially the same": "remotely-piloted air systems change the way that we deliver air power rather than its more fundamental outputs or capabilities". It continued: "This means remotely-piloted air systems will complement, not replace,

[1057] Interview Clive Blount, 4 September 2015.
[1058] Norton-Taylor, "The Terminators: drone strikes prompt MoD to ponder ethics of killer robots."
[1059] In December 2017, a second edition of JD0-30 was published, which will not be analysed here.
[1060] The four areas are control of the air, intelligence and situational awareness, attack/coercion, air mobility. "Joint Doctrine Publication 0-30. UK Air and Space Doctrine ", ed. MoD (2013).

manned aircraft until we develop effective unmanned combat air systems," thus rejecting the Unmanned Revolution narrative.

In fact, the document identified many weaknesses of unmanned systems in contested air environments, including low speed, limited fields of view, drones' inability to sense and avoid air traffic, their dependence on space capabilities, and their specialisation that "limit[s] the scope of the missions they can fly". Three moral and ethical issues were listed; the lowered threshold for conflict, autonomous systems, and the impact on pilots. The first risk is mitigated by "parliamentary scrutiny and its associated checks and balances". On autonomy the UK vows to "retain human oversight over all weapon-release decisions". The effect on the pilot is seen through the video-game mentality prism which is countered by calling on "stringent rules of engagement that ensure we lawfully use armed force". What is not addressed are possible psychological effects – on the contrary, the "sobering reality" of observing a target area for a significant period prior to, and following, an engagement is considered positive in its ability to counter the video game effect.

Overall, while drones were recognised as important, the doctrine appeared careful not to sound too enthusiastic. UAVs were not portrayed as offering new opportunities – their endurance was noted as an asset, but they are generally seen as having the same capabilities as other systems. Interestingly, there is no mention of targeted killings in the document. Maybe most striking of all is the caution regarding "political and military risks associated with [drones'] use": the doctrine warns that the "nature of remotely-piloted air systems means operations may attract adverse media attention".[1061]

[1061] Ibid.p.3-11.

4.4. Targeted killing by drone

The UK's approach to targeted killing with drones remains opaque. Officially, Britain has no formal drone programme equivalent to the covert US drone war.[1062]

When Reyaad Khan, a 21-year old British citizen was killed by missiles fired from a British Reaper drone in Syria in August 2015, Prime Minister Cameron called it "a new departure" for the UK, as a British military asset had been used in a country in which the UK was not involved in a war.[1063] The strike was justified as part of the UK's counterterrorism strategy seeking to prevent plots against the UK, which, it could be argued, is not unlike the US approach to the global War on Terror. However, at the UN, the UK stated the strike had been taken in collective self-defence of Iraq, thus arguing it was part of the existing military conflict.[1064] These contradictory legal justifications raised eyebrows in the House of Commons, which requested an inquiry into the government's policy on the use of drones for targeted killing. The 2016 report accepted the argument presented in the UN: "the Government therefore did not use lethal force outside of armed conflict when it targeted and killed Reyaad Khan on 21 August."[1065] However, it noted, following David Cameron's statement, that "[a]lthough the Government says that it does not have a "targeted killing" policy, it is clear that it does have a policy to use lethal force abroad outside armed conflict for counter-terrorism purposes."[1066] The report asked the government to clarify this policy, in particular with regard to the definition of 'imminence', and the law applicable, as well as with regard to "the legal basis on which it provides any

[1062] Jones, "Hidden from the public: The United Kingdom's Drone Warfare."
[1063] "The Government's policy on the use of drones for targeted killing. Second Report of Session 2015–16.." p.5.
[1064] Owen Bowcott and Nicholas Watt, "UK envoy makes new legal argument for drone killings in Syria," *Guardian*, 10 September 2015.
[1065] "The Government's policy on the use of drones for targeted killing. Second Report of Session 2015–16.." p.7.
[1066] Ibid, p.7.

help which facilitates the use of lethal force outside of armed conflict by the US".[1067] The committee was clearly concerned that the UK might follow the US in its approach to a global targeted killing programme. In response, the UK government noted that the questions in relation to the use of force outside of armed conflicts were "hypothetical" and the government's answers "should not be taken as representing the Government's detailed and developed thinking on these complex issues", as future action would be considered according to the circumstances of each operation.[1068] Overall, the government's answers did little to clarify its overall approach to targeted killing by drones. A legal commentary denounced "a concerning lack of clarity as to the legal basis upon which the UK relies for its use of armed drones, and, even more problematic, an apparent lack of willingness on the part of the UK government to provide clarity when requested".[1069]

4.5. Future plans and thinking

The British military is (co-)financing the development of several UAV systems, most notably *BAE Taranis*, an unmanned combat aerial vehicle. Development began in 2005 and since 2013, BAE has tested a Taranis technology demonstrator, a stealthy, highly autonomous proof of concept.[1070] The results from the tests might feed into FCAS, the Anglo-Franco Future Combat Air System which the French and British governments agreed to jointly conduct a feasibility study on in 2014.[1071]

[1067] Ibid.p.8.
[1068] "The Government's policy on the use of drones for targeted killing: Government Response to the Committee's Second Report of Session 2015-16," ed. House of Commons (2016).
[1069] Jones, "Hidden from the public: The United Kingdom's Drone Warfare."
[1070] The system can autonomously find a target, but the decision to attack lies with the operator. Lecture at Royal Aeronautics society, 11 May 2016. Own lecture notes.
[1071] Nadia Deseiligny, "France, UK award FCAS feasibility study contracts," *Jane's Defence Weekly*, 6 November 2014.

The UK military is preparing for a future that includes but is not dominated by unmanned systems. In several future-oriented publications, the MoD lays out its thinking about likely future development. 'Future Operating Environment 2035'[1072], considered "technology and the utility of remote and automated systems" one of the most significant implications for defence in 2035 and urges "to make exploiting emerging technology and capability in automated systems a priority". The focus clearly lies on automated if not autonomous systems, though the report stated that Western militaries, as opposed to its adversaries "are likely to insist on humans continuing to make decisions on the engagement of targets by automated systems".[1073]

The 'Future Air and Space Operating Concept' provides guidance for the Royal Air Force out to 2035.[1074] It praises drones for their endurance, range, and manoeuvrability. The document previews a mix of "one third unmanned to two thirds manned" in the air force. It foresees a possibly unmanned sixth generation fighter able to survive in high-risk threat environments and argues that fourth generation-plus combat air capability could be replaced by an unmanned system by 2035. It is striking how much emphasis is put on increasing automation, even autonomy – so much so that it changes the established designation: "Remotely piloted air system is used to describe a system directly controlled by a human operator. Unmanned air system is used for autonomous or highly automated systems". It notes legal and ethical concerns for autonomous systems but appears somewhat ambiguous towards restrictions as "it is highly unlikely that similar sensitivities will restrict (or be reciprocated by) many of our potential adversaries".

[1072] MoD, "Future Operating Environment 2035," (2015).
[1073] Ibid.
[1074] "Joint Concept Note 3/12. Future Air and Space Operating Concept," ed. Ministry of Defence (2012).

It is striking that the concept focuses mostly on capabilities not currently available, such as air combat and autonomous roles, while there is little mention of the roles unmanned systems already perform well. It remains thus unclear whether it simply sees these uses as given – or irrelevant in the future.

4.6. Conclusion – Uncertainty about a British drone doctrine, and a focus on future autonomy

The extent to which past experiences with drones, particularly in Afghanistan and particularly with smaller surveillance drone systems has been neglected in British doctrinal and strategic writing is striking. This also translates into future predictions, which focus predominantly on armed, and autonomous systems. At the same time, there is also little acknowledgement of past experiences of kinetic operations with armed drones. This is an area in which the British government and MoD have chosen to be particularly tight-lipped, because they are unwilling to comprehensively reveal the policy and doctrine on armed drones, for targeted killings or other operations. As the Birmingham Committee concluded "If there is one theme that has recurred in all our deliberations as a Commission, it is the need for clearer, more forthcoming public communication and transparency on the part of the UK government and the MoD in particular".[1075]

On the British approach to targeted killings with drones, it cannot be concluded based on the available evidence that the UK has the same policy as the US, which justifies, in effect, a global military action (by drones or other means). Yet, the British thinking appears to go in a similar direction. The British government has painstakingly tried to walk the line

[1075] Commission, "The Security impact of drones: Challenges and opportunities for the UK."p.15.

between forcefully suggesting that it would not follow the US's lead into a policy that most Britons consider illegal, while at the same time aiming at not affronting a crucial ally, whose targeted killing programme the UK has supported in secret and on whose (unmanned) capabilities the UK depends.[1076] The House of Commons Defence Committee for instance noted: "We consider that it is of vital importance that a clear distinction be drawn between the actions of UK Armed Forces operating remotely piloted air systems in Afghanistan and those of other States elsewhere."[1077] But, as the *Guardian* warned, "where the US leads, Britain has a habit of following, raising concerns about what doctrine the UK will adopt in future when the two countries' armed forces are so closely bound together".[1078]

Overall, the doctrinal and strategic thinking on drones remains theoretical, and removed from actual British drone use. The DCDC has shown a good awareness of the ethical dilemmas and problems, though it appears as if the level of self-awareness in JDN2/11 did not please everyone. Overall, as pointed out by the Birmingham Commission: "the UK government has found itself too much on the back foot in its defence of using and owning these aircraft".[1079]

5. Organisational change

5.1. Training and integration into force structure

All British unmanned systems of the last decade, except Watchkeeper, were brought into service as UORs and immediately deployed. Training procedures thus had to be developed

[1076] JDN2/11, with a nod to the remarkable cooperation with the US in the realm of unmanned technology, noted that "the UK has only a limited ability to independently deploy and operate unmanned aircraft". "The UK Approach to Unmanned Aircraft Systems, Joint Doctrine Note 2/11." p.4.3.
[1077] "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume 1." p.13.
[1078] Hopkins, "Afghanistan: How RAF takes on the Taliban - by joystick from Las Vegas."
[1079] Commission, "The Security impact of drones: Challenges and opportunities for the UK."p.15.

rapidly, and the new technology and those who operated it had to swiftly find their place within the military organisation, while on deployment. As of 2017, UAVs have been fully integrated into the British Army, and detachments of all Army UAV types are now part of regular training exercises.[1080]

5.1.1. Army

Since SD-1 in the 1960s, British Army UAVs were flown by the Royal Artillery. 32 Regiment Royal Artillery was the first dedicated UAV unit. In 2008, 12 and 47 Regiment began taking turns to provide troops with Desert Hawk capabilities in Afghanistan. In 2010, the decision was taken to transform 32 and 47 regiment into dedicated UAV units.[1081] 47 Regiment Royal Artillery is trained to use Watchkeeper. 104 Regiment is the Reserves UAV Regiment which deploys Desert Hawks.[1082] Only T-Hawk was originally operated by the Royal Engineers, as it was part of the Talisman system,[1083] but was quickly taken over by the Royal Artillery.

Army UAV training was set up ad-hoc and evolved over time. Black Hornet and Desert Hawk are flown by individual soldiers, who take on the role of pilot and payload operator. For Black Hornet operators, little training is needed and was often done in theatre. As Hambling put it nicely, “Being a [small drone] operator is, like the drone itself, something you can just pick up and put down.”[1084] Desert Hawk training also took often place in the theatre of operation; today, Desert Hawks training is done in Britain.[1085]

[1080] Matt Burton, "Kirkee thunder in Kenya," *The Gunner* 2013.
[1081] Rupert Pengelley, "British Army beefs up Bastion UAV capabilities," *International Defence Review* (2010).
[1082] *104 Regiment RA*, ([cited 13 May 2016]); available from http://www.army.mod.uk/artillery/regiments/24684.aspx.
[1083] Ripley, "UK UAV operations in Afghanistan reach new milestones."
[1084] Hambling, *Swarm Troopers*. p.22.
[1085] Martin Streetly, "Parliamentary answer sheds light on UK UAV use," *International Defence Review*, 6 August 2013.

Hermes 450/Watchkeeper UAVs are controlled from the ground control station (GCS) by a crew of two: the pilot and the UAS commander, who are supervised by a mission commander and supported by imagery analysts, and maintenance workers. Training on Hermes 450 took 12 weeks in total – a five-week general training course, five days of theory, three days operator simulator course, followed by six weeks flight training which takes place in Israel. On arrival in theatre, pilots completed a theatre qualification about camp procedures and local meteorological conditions.[1086] This training regime – on paper clearly sensible – came under scrutiny following the crash of a Hermes 450 at Bastion Airfield, Afghanistan on 2 October 2011. The following enquiry revealed many training shortcomings. The report noted that there was not enough time to train and qualify pilots and deemed the standard of "just enough, just in time" insufficient.[1087] The report was particularly critical of the fact that no flight training was possible in the UK as this meant that "approximately 50% of each Battery's pilots are 'ab initio' [beginners] every time the Battery deploys." In addition, important skills such as airport communication could not be trained as communication in Israel was done in Hebrew. This was particularly problematic as because of its drones, the artillery had to cooperate closer than ever before with the RAF, since they now shared an airspace in which UAV operations were conducted under the same rules and regulations as manned assets.[1088]

In March 2014, Watchkeeper moved from the testing and evaluation phase to full flight training. Watchkeeper training is likely to be similar to Hermes' training, with one

[1086] Button, "Unmanned Aerial Vehicles on Operation: Overcoming the Challenges."
[1087] "Hermes Special Investigation ", (Military Aviation Authority 2012). The full account of the incident can be found at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/34175/zk515_hermes_part_1_3.pdf
[1088] Email Interview Ben Mcniff, 2016.

improvement: Watchkeeper has been cleared to fly in the UK, troops can thus train at home; there is now a bespoke Training Facility at the Royal School of artillery in Larkhill, southern England.[1089]

5.1.2. Royal Air Force

From January 2005 onwards, 1115 Flight was established at US Air Force Base Creech, and 45 tri-service personnel were embedded with USAF's Reconnaissance Squadron. These soldiers were flying US UAVs in Afghanistan and Iraq. Their activities also included missile strike sorties.[1090] RAF personnel had thus flown US Predators for over three years before the RAF received its own Reapers. Today RAF Reapers are flown by 13 Squadron (Waddington) and 39 Squadron (Creech), in which 1115 Flight was integrated. A Reaper crew consists of a pilot, a sensor operator, and an intelligence analyst, overseen by a mission intelligence co-ordinator, and they are supported by a wider team of around 36 personnel.[1091]

When the Royal Air Force first began flying UAVs, there were no clear career paths to becoming a UAV pilot. Rather, the RAF employed airmen who had previously qualified as pilots on other, manned, military aircraft, such as Tornado or Apache and who underwent a Reaper Operational Conversion Course (ROCC).[1092] As the Reapers directly deployed to Afghanistan, all actual flight training had to be done in Afghanistan or in the US: "In the Tornado we trained for most of the year and deployed on active operations for a few

[1089] "Pilots train on 'battle-winning' Watchkeeper," *www.army.mod.uk* (2016).
[1090] Munson, "UK RAF expects first Predator B deliveries." And *Intelligence, Surveillance, Reconnaissance*, ([cited 13 February 2015]); available from http://www.raf.mod.uk/currentoperations/intelligence.cfm.
[1091] Air Vice Marshal Mark Green, "Information Dominance & UK approach to Unmanned Systems," *Presentation at Unmanned Aerial Systems UK Conference June 2012* (2012).
[1092] Scott Gourley and Huw Williams, "RAF trials new UAS training package," *International Defence Review* (2010). *Reaper MQ9A RPAS*, ([cited 12 February 2015]); available from http://www.raf.mod.uk/equipment/reaper.cfm.

weeks each year. On the Reaper every sortie is a combat sortie."[1093] The training system changed in 2012/2013 when the RAF set up a new aircrew category – 'Remotely Piloted Air Systems Pilots' – with a specific training programme. In early 2013, the first class of RPV pilots graduated who had not been recruited from within the RAF. The airmen, all of whom are commissioned officers, have their own 'wings', a badge with blue laurel leaves (instead of brown).[1094] On completion of regular officer training, the pilots undergo the Elementary Flying Training (EFT) course before pre-employment courses and specialist training on the Reaper. The Reaper training takes six months and is completed at Holloman Air Force Base in New Mexico.[1095] The EFT course is conducted in a light manned aircraft, meaning that UAV pilots will have spent some time flying a manned aircraft, but never outside of training. (Because of their training, they can however retrain as pilots for manned aircraft).[1096] Britain is looking into a joint training regime for its Reaper pilots with France.[1097]

In terms of rules and regulations, Reaper's introduction also required change. In an interview, the author of the Reaper flying orderbook, the squadron's rulebook, remembered that at the time he was struck by the fact that "This was the first time in 60 years that we introduced an entirely new class of aircraft into service, last time something like that happened was when the jet engine was introduced! […] but still, many things were the same." However, some things were different, such as regulations that pilots had to wear a seatbelt or do regular survival drills. The decoupling of crew and aircraft also

[1093] Lee, "Remoteness, risk and aircrew ethos." p.13.
[1094] Lewis Page, "RAF graduates first class of new groundbased 'pilots'," *The Register*, 4 April 2013.
[1095] *Aircrew remotely piloted aircraft system (RPAS) Pilot* ([cited 12 February 2015]); available from https://www.raf.mod.uk/recruitment/roles/aircrew/remotely-piloted-aircraft-system-rpas-pilot/.
[1096] "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume 1."
[1097] Pierre Tran, "UK, France Discuss Reaper Pilot Training," *Defense News*, June 3 2015.

created more crucial questions such as at what time the commander's responsibility for an aircraft began and ended – in a manned aircraft that moment is when the aircraft started (and stopped) moving under its own power. But Reapers could be handed over in the air, to another crew or to ground troops who were in charge of the landing. Or it could 'disappear' – the link to the aircraft could be lost and a crash presumed but not necessarily known "we needed to come up with a rule when we call it a day and the commander's responsibility ends – when it runs out of fuel was the rule".

He recounts that it did not take long to settle into a routine of how to use the Reaper: "we built on American procedures and developed our own regulations".

Although there have been reports that RAF pilots do not find drones attractive enough, the RAF has not struggled to recruit Reaper pilots. One Reaper pilot, and former fighter pilot put it this way: "Flying a fighter aircraft was more fun. It was big, it was pointy, it went bloody fast and it carried big bombs. It was sexy. Who wouldn't want to do that? Twenty-five years after I asked to come to the Reaper because it makes a significant contribution to the war."[1098] Peter Lee, who interviewed 76 Reaper pilots observed that those pilots who had flown other systems before do not identify with the system as much: "The opening question that I have asked every one of them is: 'When asked, how do you describe what you do in the RAF?' Those who transferred from piloting another aircraft type – Tornado, Harrier, Hercules – gave almost identical answers that can be summarized as: 'I am a pilot who now flies the Reaper,' as opposed to, 'I am a Reaper pilot.'"[1099] This 'problem' may be solved eventually with the establishment of the new aircrew category 'Remotely Piloted Air Systems Pilots' and specific training programme.

[1098] Blackhurst, "The air force men who fly drones in Afghanistan by remote control."
[1099] Lee, "Remoteness, risk and aircrew ethos."p.12.

Whereas the establishment of a special drone medal in the US caused much debate and the medal was ultimately withdrawn (see chapter IV), in the UK, there have been cases of drone operators being rewarded with commendations, such as a Hermes 450 operator who was awarded an MBE (Member of the Most Excellent Order of the British Empire) for his work in Afghanistan.[1100] Peter Lee proposes establishing a medal for Reaper pilots "for meritorious service that has significant tactical or operational impact and which incurs significant mental and social costs to the personnel and families involved."[1101]

In 2016 the 'Reaper Harmony initiative' was introduced which aimed at improving the quality of life of Reaper personnel, including a support for career progression.[1102]

5.2. Conclusion

The British armed forces and MoD were initially caught off-guard by the rapid increase in UAV system types, numbers, and personnel caused. Yet, the Royal Artillery linked to its SD-1 roots and modern drones quickly found a place in the Royal Artillery. No special service was created (or its creation ever suggested), but new Army regiments and Air Force Squadrons were founded to be dedicated solely to UAVs. The rapid integration combined with the limited numbers of drones available created difficulties, but there is nothing to suggest that these initial problems will persist over time.

6. Social and societal change

6.1. Individual soldiers

The experiences of British Army drone operators are in many respects similar to those of Bundeswehr soldiers. Operators praised "this 'what's around the corner' view that was

[1100] Sarah Goodwin-Drew, "A marvellous MBE," *The Gunner* 2013.
[1101] Peter Lee, "Submission to the APPG on Drones 12 June," ed. APPG Drones (2017).p.12.
[1102] Ibid.p.5.

never there before",[1103] and emphasised an improved battlespace awareness. In particular as more Rover terminals were distributed, more troops could get access to drones' feeds, giving them real-time ISR. Most often, soldiers and commanders praised the flexibility of the smaller systems.[1104] However, as the British Army did not have that many UAVs in the field (only the smallest systems, Desert Hawk and Black Hornet were available in double digit numbers), the impact appears to not have been a fundamental one.

Many of the experiences British Reaper pilots have made are similar to those by their US colleagues – unsurprising given they have been flying the same systems, from (partly) the same bases and (partly) in the same conflicts. Much like US pilots, British Reaper pilots have testified to the difficulty of being involved in combat situations while being stationed far from the theatre of operation: "It's such an unusual life – at home, operational, at home, operational."[1105] Adding to this difficulty, British pilots had to deal with three time zones: "there is your time in Las Vegas, all the aviation time is done in Zulu time [Greenwich mean time/UK time], and the Army like to work in local time, which is in Delta time. The most interesting stuff usually happened on our local night shift, but the work was constant. [This meant that], sometimes I did not see my kids for 3 weeks – I would leave the house long after they've gone to bed and come back after they've gone to school." [1106] The workload for British Reaper pilots over the last decade has been substantial: "I have been to all the theatres since the Balkans, and I can say this is the hardest I have ever worked. There was no fat in the operation".[1107] Peter Lee, who interviewed 76 members of the British Reaper community has equally noted that "The

[1103] Interview anonymous December 2015
[1104] Interview General Nick Parker March 2015.
[1105] Interview anonymous Reaper pilot April 2017.
[1106] Ibid.
[1107] Ibid.

most common feature of every discussion about how Reaper operations affect the personnel involved is fatigue. The RAF Reaper Force shift pattern of 6 days on/ 3 days off has been used for most of the past decade. During the 6 days on duty, most personnel could find themselves regularly working 10-12 hours per day."[1108]

Also, much different to the regular rotations of the troops on the ground, British pilots would remain on assignment for years. This provided a major unexpected benefit as they became custodians of institutional memory, much more familiar with the situations that may emerge in 'their' areas than commanders on the ground.

British pilots testified that the remoteness of their stationing did not affect their feeling of connectedness to the troops in Afghanistan. On the contrary: "As soon as I was in the GCS, I was in Afghanistan, I was with the troops."[1109] This also meant that the operators saw up close the consequences of their actions: "We may watch 'target A' for weeks, building up a pattern-of-life for the individual, know exactly what time he eats his meals, drives to the Mosque, uses the ablutions – outdoors of course! What we also see is the individual interacting with his family – playing with his kids and helping his wife around the compound. When a strike goes in we stay on station and see the reactions of the wife and kids when the body is brought to them. You see someone fall to the floor and sob so hard their body is convulsing."[1110] Some operators reported psychological stress following such incidents: "I found during the days following the strikes I had issues, I felt depressed, nervous, anxious and slightly withdrawn. […] I found it hard to sleep for a couple of weeks

[1108] Lee, "Submission to the APPG on Drones 12 June."
[1109] Interview anonymous Reaper pilot April 2017.
[1110] Lee, "Submission to the APPG on Drones 12 June."p.6.

with the IR [infra-red] images of the strikes being extremely vivid when closing my eyes."[1111]

Yet, compared to the US, there have been fewer reports about the psychological stress this caused British pilots. This may simply be a result of the smaller number of British pilots. More probably however, this is the result of three policies.

First, despite the fact that providing 24/7 surveillance over Afghanistan proved a strain, the pressure on British operators appears to have been mitigated by the nature of their operations. Instead of predominantly flying targeted killing missions, British pilots provided a lot of troop support, thus being in constant contact with their comrades in the field. This also means that there have been no comparable stories in the UK to that of Brandon Bryant, the US drone operator who was told that the operations to which he contributed, caused the death of 1626 combatants.

Second, operators have emphasised the importance of having the final decision over weapons release. For British pilots, no matter the operation or chain of command, the final decision to release a weapon lied with the pilot: "I have had situation where the forces on the ground requested a strike and I was not convinced. It was my decision, so I did not deploy the weapon."[1112] This does not appear to always have been the case with US pilots.[1113]

Third, the strict zero-civilian-casualty rule helped operators accept their actions. As an operator put it, "I sleep soundly at night because every person that I have killed was a clearly identified enemy combatant engaged in hostile actions as described in the rules we

[1111] Ibid.
[1112] Interview anonymous Reaper pilot, April 2017.
[1113] Woods, *Sudden Justice. America's secret drone wars*. p.xv.

work to. I utterly refute the concept that we are capable of reducing the taking of life to a "PlayStation game" just because we are 12000 miles from the people we kill."[1114] An operator went so far as to say that several Reaper personnel would "refuse to carry out certain strikes" – i.e. legal strikes where the taking of civilian life is unavoidable – "to protect their own psyche."[1115]

Pilots, many of whom had flown manned systems before, reported that as UAV operators they felt more pressure and had to be better. As UAV operators at any time were connected to headquarters, commanders, and could seek legal advice during their operations, they felt that the level of acceptance of mistakes or misjudgement was smaller than for other operators: "We are expected to perform better because we have all that access. If you were flying a fast jet, people would not expect the same from you – because it's impossible, but since you can have it, it is expected."[1116] Another operator expressed a similar sentiment "I feel that the certain knowledge that everything we do is being watched by many others: general officers, legal advisors, operations officers etc in the command centre makes us more, rather than less, aware of the consequences of the actions we take."[1117] An operator also observed that the fact that they were stationed near the city of hedonism, Las Vegas, ensured that they did not want to appear to be enjoying themselves too much.[1118]

In this concern about how they were perceived, British operators resembled German drone operators who were afflicted by their bad public image. British testimonies are revealing: "It also frustrates me that when the MoD speaks the truth that we don't kill

[1114] Lee, "Remoteness, risk and aircrew ethos."p.15.
[1115] Lee, "Submission to the APPG on Drones 12 June."
[1116] Interview anonymous Reaper pilot April 2017.
[1117] Lee, "Remoteness, risk and aircrew ethos." p.15.
[1118] Interview anonymous Reaper pilot April 2017.

civilians, that immediately is assumed to be a lie by those whose mantra is unable to accept the paradigm shift that we genuinely don't kill non-combatants."[1119] However, overall, the debate in the UK has been overall respectful towards pilots.[1120] Particularly the political realm has shown concern over the well-being of pilots; MPs have brought the issue up during parliamentary debates.[1121] When publishing on the alleged "PlayStation mentality", *Drone Wars UK*'s Chris Cole got considerable pushback from the British public: "We got abused for that quite a lot even though it wasn't our line" [the term had been coined by UN Special Rapporteur Philip Alston]. "People don't like blaming the pilots", Cole told me. "There is a strong pro-military atmosphere in our country. You cannot criticise military policy because you are perceived as criticising 'Our Boys'".[1122]

6.2. Democratic accountability

As the Syria war escalated in 2012, Prime Minister Cameron and Foreign Secretary Hague made clear that Westminster would be consulted on any British engagement there. In summer 2013, the House of Commons voted against military action in Syria. A year later, the government received parliamentary approval for military action against Daesh in Iraq – but the vote included a provision that military action in Syria would be subject to a separate vote.[1123] (This approval was eventually given in November 2015 and the UK joined allied strikes in Syria.)

[1119] Lee, "Submission to the APPG on Drones 12 June."p. 8
[1120] Peter Lee disagrees with this assessment. See Peter Lee, "Unmanned Aerial Vehicles - Closer at a distance?" (paper presented at the UAV: Just New Technology or a new strategic reality?, Trondheim, 2013).p.11/12.
[1121] "Westminster Hall debate, Tuesday 1 December."
[1122] Interview Chris Cole October 2015.
[1123] "Commons recalled to debate Iraq: Coalition against ISIL, Motion for debate 26 September," ed. House of Commons (London: 2014).

Although the British parliament is not by law in charge of war-making, in recent years, parliamentary authorisation has come to be expected,[1124] and the above timeline suggests that the norm is intact. It however leaves out one notable military action in August 2015, namely the targeted killing of British citizen Reyaad Khan with a missile fired from a British Reaper drone in Syria.

The strike in Syria – at a time at which the UK was not at war with the country and there had not only been no parliamentary *approval* for military actions in the country, but military action in Syria had been *explicitly excluded* in the September 2014 vote,[1125] – was a new departure. The British Afghanistan operation and the use of drones during it had not posed legal questions, as drones in Afghanistan were treated and used like other military means, subject to the same rules and regulations.

Although the Cameron government later justified the August 2015 strike as having been part of the military action in Iraq and/or self-defence (see above), many observers saw the fact that parliament had not been consulted as proof that UAVs were undermining democratic control and that the UK was following in the US's footsteps: "[T]the government here engaged in extra-judicial killings of British citizens in a theatre of war that Parliament had specifically refused to authorise British military action in," Tara McCormack noted. She argued that it was no accident that this strike was done by drone

[1124] McCormack, "The Emerging Parliamentary Convention on British Military Action and Warfare by Remote Control." p.22. also see Emily Young, "Britain Goes to War: An Analysis of the Developing Role of the House of Commons in Determining Whether HM Forces Should Be Deployed on Military Operations," *Aberdeen Student L. Rev.* 6 (2015).

[1125] "Commons recalled to debate Iraq: Coalition against ISIL, Motion for debate 26 September."

rather than other military means: “this lack of democratic accountability and oversight is, however, inherent to warfare by remote control.”[1126]

To date, the August 2015 strike remains the only British military action in modern times outside an official battlefield and without parliamentary approval. Despite the importance of this incident (and given the fact that the Prime Minister said the UK would do it again)[1127], it should not put on the same level as US actions. Yet, this incident reaffirms the suggestion that using surveillance drones is a slippery slope to using armed systems. In fact, a year before the Syria strike, the *Telegraph* predicted what came later: “the Ministry of Defence announced that the RAF will send Reaper drones into Syrian airspace, but only for surveillance purposes. The question is whether this will prove to be the first step towards extending Britain’s role in the anti-[Daesh] offensive from Iraq to Syria. How long before these formidable unmanned aircraft – whose primary role is not reconnaissance but to destroy targets on the ground – will ditch their cameras in favour of Paveway laser-guided bombs?“[1128]

7. Conclusion

Although the UK had made previous experiences with unmanned systems, it was only with the wars in Afghanistan and Iraq that Britain’s armed forces began using modern drones in earnest. In ten years, the RAF and Army have developed substantial unmanned

[1126] McCormack, "The Emerging Parliamentary Convention on British Military Action and Warfare by Remote Control." p.25.
[1127] Vin Shahrestani, "David Cameron confirms UK national Reyaad Khan was killed in airstrike," *Telegraph*, 7 September 2015.
[1128] David Blair, "Britain takes a step towards bombing Syria as well as Iraq," *Telegraph*, 21 October 2014.

capabilities; as of 2017, Britain has used its UAVs in military operations in Afghanistan, Iraq, and Syria, and the Royal Artillery has deployed with several UAVs to the Baltics.[1129]

The UK initially developed its use of drones away from the public gaze. Military drones only became a topic for public debate from 2009 onwards (and from 2013 in the tabloid press), the interest having been triggered mainly by the controversies around US drone use. The UK has traditionally been one of the US's closest allies, including in military matters. With regard to drone use, the US and UK are highly intertwined. This led to a paradoxical situation in which militarily, and technologically, the US was often an important frame of reference, while politically, the UK government had at times to distance itself from US drone policies, all the while providing intelligence that supported drone strikes. The fact that the UK is home to a large Pakistani diaspora made this topic even more sensitive.

In the public and political debate, the unmanned technology was uncontroversial, in particular the political level overwhelmingly supported the use of all kinds of UAVs in military operations. US drone use however was hotly debated. The drone-critical view was promoted by a small group of activists and researchers. The Unmanned Revolution narrative was not prevalent. While the military realm did not actively participate in the debate, it demonstrated a remarkable level of independent thinking with JDN 2/11 and then-Chief Air Marshal Pulford publicly musing that "the Terminator 2 type world where machines can make decisions for themselves, we can trust them and send them off to make decisions" was "undoubtedly coming."[1130] Despite this, the military has not (at least

[1129] *Enhanced Forward Presence (eFP)*, ([cited 22.12. 2017]); available from http://www.army.mod.uk/operations-deployments/23423.aspx

[1130] "World of Terminator is coming, says RAF chief," *Channel 4 News*, 13 September 2013.

publicly) developed novel doctrines and strategies for the future of drone use. Instead, the thinking has focused firmly on future systems with current systems being portrayed as useful but not necessarily as offering revolutionary new capabilities. No drone-centric strategies have been developed. Rather, in particular with Watchkeeper, the focus is on integrating the system into existing network and connecting systems among each other, so as to ensure imagery exploitation and dissemination across troops, and employ unmanned systems in a mixed grouping.[1131]

Overall, the public debate and the Unmanned Revolution narrative have not overly influenced British drone use or procurement. Although the newest British drone doctrine cautions that the "nature of remotely-piloted air systems means operations may attract adverse media attention",[1132] there is no sign that this 'adverse media attention' has played a major role in political or military decision-making. On the contrary, the Cameron government disregarded the media's concerns that the UK might align itself with US policy. In 2015, it went against a parliamentary decision not to use force in Syria, and deployed armed Reapers to target and kill British Daesh fighters, in an operation reminiscent of the US targeted killing campaign in Pakistan, Yemen and Somalia. Although this strike was a new departure, two years later it does not seem that this was the beginning of a new policy as this strike has remained an exception.

The Afghanistan operation has been the most important deployment of British UAVs to date. Afghanistan has been a crucial learning experience for the British armed forces in general, and even more so for the Army and Royal Air Force with regard to drones; all

[1131] Pocock, "From H450 to Watchkeeper: Will the Long and Costly UAV Journey Be Worthwhile?." Also see Combat ISTAR, as described by Angus Batey, "British UAV Officials talk future hopes, needs," *Aviation Week* (2012).
[1132] "Joint Doctrine Publication 0-30. UK Air and Space Doctrine ".

modern British drone systems were deployed to the country. The learning curve has been steep, as troops in theatre had to find ways how to best use the new equipment. The MoD has cautioned that the lessons from Afghanistan may not be universally applicable, as Afghanistan had "permissive (and relatively uncongested) air space" and the theatre offered "adequate basing and lines of communication", while the adversary was "technologically unsophisticated",[1133] several lessons can still be drawn from the Afghanistan experience.

The analysis of the Afghanistan operation shows that UAVs did not revolutionise the operation, but still added value. Of the six systems, three did most of the work, Desert Hawk, Hermes 450, and Reaper – incidentally, one system of each group (small, tactical, MALE). The most important capabilities that UAV technology have brought were endurance, versatility, (bureaucratic) flexibility, connectivity, battlespace awareness at low hierarchical levels, institutional memory, and precision.

Endurance (Hermes 450, Reaper): the longer drones could remain in the air, the more value they added. Long-term ISR allowed operators to learn local patterns-of-life and develop a feeling for the normal and abnormal. This is crucially important in a counterinsurgency operation.

Versatility (Hermes 450, Reaper): As drones remained in the air for a long time, they could be re-tasked while in flight, support troops that unexpectedly had come under pressure, follow a suspect, or inspect a potential IED. This versatility and flexibility allowed quick reactions to changing circumstances.

[1133] "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume II Written evidence." p.Ev.w5.

(Bureaucratic) flexibility (Desert Hawk, Hermes 450, Black Hornet): An effect generally overlooked in the existing literature that has been praised by soldiers. Smaller systems are deployed with individuals (Black Hornet), or small teams/tactical parties (Desert Hawk, Hermes 450) and thus do not require bureaucratic requesting and tasking procedures.

Connectivity (Hermes 450, Reaper): The drones in Afghanistan worked particularly well when they were integrated into the chain of communications. For instance, at times, Reaper pilots operated as relays – when troops on the ground struggled to connect to their headquarters but were in contact with the drone operators, the operators could connect the two.

Battlespace awareness at low hierarchical levels (Black Hornet, Desert Hawk, Hermes 450): Crucially, troops on the ground could view images, either through Rover terminals or directly through the control mechanism. This provided troops that previously were dependent on the battlespace awareness of their commanders a new opportunity to assess their immediate surroundings at a level previously unavailable. It is thus not surprising that the smaller, less 'glamorous' platforms are gaining in popularity with the troops.[1134]

Institutional memory (Reaper): A particularly interesting finding has been that the remote stationing of Reaper pilots has provided a type of institutional memory and local knowledge that previously had not been possibly in a military system that sees troops rotate every six or nine months. Reaper pilots, who, thanks to the hours spent monitoring the territory already build a level of regional knowledge that one operator likened to the

[1134] Batey, "Eyes on Target."

knowledge of a police officer, also remain virtually in country for much longer than any other troops, thus becoming the most experienced people on site, without being on site.

Precision (Reaper): While the high levels of civilian deaths caused by the US drone campaign in Pakistan has created doubt as to the level of precision armed drones can provide, the British experiences in Afghanistan have shown that drones allow for precise targeting. The focus on keeping civilian casualties low – at the expense of having at times to abort missions – has worked, and has had an unexpected positive impact on the pilots.

In fact, the biggest change that drones have caused in the British armed forces and society has been the impact drone operations have had on its operators. Reaper operators that have been stationed in the UK or US, far away from the battlefield have unique experiences of being in combat while being in complete security. They were not deployed but saw more action than many of those that were. And because of the institutional memory they provided, they were among the most important and experienced combatants. Army drone operators in theatre had a level of situational and battlespace awareness previously only available to commanders. This will increase, furthermore, as more personal drones can be expected despite the taking out of service of Black Hornet.

VII. Conclusion

This concluding chapter brings together the findings from the three case studies to answer the research questions about 1) the impact of the introduction of drones into the armed forces of the US, Germany, and the UK, and 2) the impact of the perception of drones as a revolutionary technology. It begins by identifying the four changes the introduction of drones has caused in the US, British, and German armed forces and society, which can be considered revolutionary: (1) the US global anti-terrorism strategy, (2) the changed role of the CIA in the US, (3) the German public debate, and (4) the changed experience of warfare and combat by soldiers, present in all three cases. It goes on to argue that the public debates and designation of drones as revolutionary have not had the expected consequence of helping the Unmanned Revolution come about. Rather, where present, the Unmanned Revolution narrative has complicated drone procurement and policy. The second part of the chapter highlights important findings from the case studies, and identifies lessons that can be drawn from them. In an effort to be policy-relevant, this part includes recommendations for the armed forces and policy-makers. In a third part, the consequences of the introduction of drones for international relations and geopolitics more broadly are being discussed. The chapter finishes with an outlook into the future of military drones and suggestions for further research.

Case studies summary			
Type of Change	**US**	**Germany**	**UK**
Debate	**Moderate** Inward-turned. Unmanned Revolution narrative not prevalent	**Substantial** Emotional and controversial debate. Unmanned Revolution narrative prevalent.	**Moderate** Driven mainly by activists. Unmanned Revolution narrative not prevalent.
Operational change	**Moderate** A novel type of operation with many parallels to previous ops.	**Moderate** Considerably improved battlespace awareness.	**Moderate** Considerably improved battlespace awareness.
Doctrinal/strategic change	**Substantial** Changes more prevalent in actions than writing. Drones as constituent part of global war on terror.	**Limited**	**Limited**
Organisational change	**Substantial** A fundamentally changed role for the CIA. Creation and integration of a new soldier class.	**Moderate** Creation and integration of a new soldier class.	**Moderate** Creation and integration of a new soldier class.
Social and societal change	**Substantial** A fundamental new experience of warfare and combat by drone operators.	**Substantial** Drone debate stimulated important political debates and unusual public interest, revived peace movement. A fundamental new experience of warfare and combat by drone operators.	**Substantial** A fundamental new experience of warfare and combat by drone operators. Parliamentary approval questioned.

1. Have drones caused revolutionary changes? What role did the debate play?

1.1. United States

In the US case study, the covert operations in Pakistan and associated changes were studied in detail. Three changes related to the use of military drones by the US appear fundamental, and can be considered revolutionary change: (1) the development of a new global anti-terrorism strategy (strategic change); (2) the changed role of the CIA (organisational change); and (3) the new experience of warfare and combat by drone operators (social change).

1.1.1. A new US global anti-terrorism strategy

The US is the only one of the three countries that has developed a use specific to drones, namely, the drone-only US campaign in Pakistan. This operation is part of a larger US strategy, which, while never made comprehensively public, is a coherent strategy aimed at depressing the formation and organisation of terrorist groups in ungoverned places around the world, through covert military actions carried out predominantly by intelligence services. It is exceptional in its geographical reach, in the way that it blurs the boundary between war and peace, and between places where the US is at war, and places where it is not. The advent of UAVs has played an important role in the development of the strategy, as it put a new military tool in the hands of the CIA. However, it should be noted that drones were only one of several elements that have allowed this development to happen – it would not have been conceivable without the changes in political attitudes following 9/11, and it is likely that a similar – though not identical – strategy may have

been developed without drones. The study of US doctrinal and strategic writing suggests that this development was incidental, rather than planned.[1135]

1.1.2. A changed role for the CIA

The operation in Pakistan, while revolutionary as part of the larger US strategy, is not fundamentally new from a military viewpoint. Aerial-systems-only operations are not novel, and it is unconvincing that the unmanned nature of the Pakistan air operation makes the operation revolutionary. The focus on individuals is unusual, but only in its exclusivity. Targeted killings and signature strikes, insofar as the latter are similar to strikes on targets of opportunity, are not novel, although it is unusual for them to be the only element of a long-term military operation. Thus, militarily speaking, the US operation in Pakistan is not revolutionary novel. What is revolutionary about it however, is the actor that carried out this military campaign, the Central Intelligence Agency. The transformation of the CIA from an espionage service into a de facto military organisation, in charge of a major long-term operation, a development in which UAVs played a decisive role, has fundamentally changed the balance of power within the US security sector and impacted the level of political accountability.[1136]

1.1.3. A new experience of warfare and combat

The introduction of drones has fundamentally changed the individual experience of warfare by drone operators. In the US case study, the focus was on pilots in remote-split operations. The work of those pilots differs substantially from the work of the generations

[1135] Although this impression may have been created by the fact that elements of the strategy are secret. This 'unplanned' development is not unheard of; research suggests for instance that the Blitzkrieg doctrine was only conceptualised as such after the fact. Harris, "Debate the Myth of Blitzkrieg."

[1136] The second development is a second- rather than first order effect, as it was caused by the change of the CIA rather than by the introduction of drones.

of soldiers, combatants, and warriors that came before them. They face a new reality of warfare, marked by an exceptional level of intimacy with their targets while simultaneously being geographically removed. Operators who commute to war and who are in no physical danger, yet are more involved in combat operations than many deployed soldiers, represent a fundamental social change.

1.2. Germany

Germany used its drones in Afghanistan with success, increasing the battlespace awareness of soldiers and commanders, although drones were unable to lift the fog of war. Drones have found their place in the Bundeswehr's organisational structure. As expected, German doctrinal and strategic writing and thinking was disappointing, with little innovative thinking being published, and one possibly important document being classified. For Germany, the most fundamental changes caused by the introduction of drones were social and societal: (1) the changed combat experience by drone operators (social change); and (2) the drone debate itself (societal change).

1.2.1. A new experience of warfare and combat

Bundeswehr drone operators experienced combat and warfare in a novel way, with 'over-the-next-hill/-compound-wall' views available at low hierarchical level. Contrary to US and British Predator/Reaper pilots, all Bundeswehr operators, including Luftwaffe pilots, were deployed to, and stationed in Afghanistan. The majority operated outside the air bases (the exception being Heron pilots who were stationed in Mazar-e-Sharif). The ability to look over compound walls, or navigate through urban street mazes, provided Army drone operators with a heightened battlespace awareness, allowing soldiers to understand their surroundings better and reduce the risk to their lives. Furthermore, the experience of

warfare was not only changed for the immediate operators of drones, but also for those that got access to the data. Information was available at low hierarchical levels, giving infantry soldiers a battlespace awareness previously only available to commanders (although the limited number of drones meant that this effect was not as widespread as it could be). Drone operators stationed at base experienced being involved in combat while in the safety of their GCS.

1.2.2. The drone debate that revived German interest in military topics

The public and political debate on drones was more extensive in Germany than in the other two countries. The public fascination with the topic and the force of the debate was highly unusual for the still predominantly pacifist country. No other military topic has created as much debate in Germany since the NATO Double-Track Decision in 1979 which created the German peace movement – which the drone debate has now revived. And yet, some voices in Germany still complain that the debate (particularly regarding armed drones' procurement) has been insufficient.[1137]

As the modern German media has no history of covering military topics, and as the MoD and Bundeswehr were reticent to weigh in, the debate was less well informed than for example in the UK, and oscillated between hype and hysteria. The impact of the US targeted killings with drones cannot be overstated, as it overshadowed the debate. Drones were equated with US targeted killings, which emotionalised the debate and made rational discussions, such as on the procurement of armed drones for Germany, difficult.

[1137] "Drucksache 18/2241, Kleine Anfrage. Beschaffung Bewaffnungsfähiger Drohnen nach Ende der "gesellschaftlichen Debatte"," ed. Deutscher Bundestag (Berlin: 2014).

1.3. United Kingdom

Drones successfully supported the British operation in Afghanistan, improving ISR, and providing additional, precise, kinetic capabilities, without, however, fundamentally changing the operation. The British armed forces did not develop novel doctrines or strategies associated with drones, although official writing proved surprisingly open-minded (JDN2/11). UAVs and UAV operators were integrated successfully into the British military; in Afghanistan, the use of small, flexible 'tactical parties' proved useful. The one change caused by the introduction of UAVs into the British armed forces that appears consequential is the change in combat experience by drone operators (social change).

1.3.1. A new experience of warfare and combat

As the British armed forces employed both ISR and armed UAVs which were controlled from both within the battlefield and outside it (Creech/Waddington), their experiences show parallels with both the US and German experiences, with some particularities.

Army operators praised the 'over-the-next-hill' view and emphasised an improved battlespace awareness. The availability of images through Rover terminals which allowed getting access to real-time drones' feeds was particularly important, as was the flexibility – including from a bureaucracy point of view – of the smaller drone systems. Similar to the German case, a higher number of these drone systems might have changed the soldiers' experience even more.

The experiences of British Reaper pilots were in some ways similar to those of their US colleagues, who flew comparable systems often in the same theatres. Much like US pilots, British Reaper pilots have testified to the difficulty of being involved in combat situations while being stationed far from the theatre of operation. Pilots emphasised that they were

still feeling connected to the troops on the ground, and their actions. Instances of PTSD appear to have been fewer than in the US, although it has been warned that it may be too early to make definite statements about psychological effects of Reaper operations.[1138] Still, the case study suggests that some differences between British and US policy may have mitigated the stress for British Reaper pilots, most importantly the nature of the mission (providing troop support as well as targeted killings), the strict zero-civilian-casualty rule, and the operator's final say over weapon release, in addition to the permanent availability of legal consult. An unexpected benefit was the institutional memory and local knowledge provided by Reaper pilots who, contrary to the troops on the ground, did not rotate out of their posts within months but stayed on their missions for several years.

1.4. The role of the debate

Overall, the 'revolutionary' designation has not had the expected impact of supporting the Unmanned Revolution and helping to bring it about in the three countries. First, in the US and the UK, the narrative was not as prevalent as expected, and thus had little impact on drone use and procurement. In Germany on the other hand, the designation as revolutionary hindered rather than helped the adoption of military drones. Thus, the perception and designation of drones as revolutionary had the opposite effect from what I initially expected.

The public debate in the US was tame, in particular when compared to the debate the US drone use caused in other countries. The US debate focused almost exclusively on the US's targeted killings outside official battlefields, and the secrecy around them. As the

[1138] Lee, "Submission to the APPG on Drones 12 June."p.11.

political realm was largely supportive of it (with some notable exceptions), the outcry was muted. And while on the one hand the secrecy of the campaign fuelled indignation among activists, it hindered reporting on the other. The media sporadically speculated about a drone revolution, but it was not the main narrative and, importantly, not taken up by military decisionmakers. The military realm appeared sceptical, possibly because of the mixed experiences with the IT-RMA. The debate does not appear to have influenced US drone use in major ways.

In Germany, the Unmanned Revolution narrative was prevalent and impacted procurement and policy. Had drones not been considered revolutionary, Germany would in all likelihood have armed drones today, as well as possibly more doctrinal and strategic thinking. While the lack of the latter can partly be blamed on Germany's "doctrinal stagnation",[1139] the heated debate around drones certainly reduced any interest in publishing official thinking about drones, as the classification of the *Konzeptionelle Grundvorstellungen* suggests. The attempt to regulate (armed) drones more than any other weapon systems, by making their deployment dependent on a special parliamentary vote, as proposed by the German defence minister is another consequence of the high level of public interest and concern.

The debate in the UK was more balanced than in Germany. In the UK, politicians broadly supported the use of UAVs in military operations. Also, the debate was better informed than in Germany. The US use of drones for covert targeted killings influenced the British debate as it fuelled activism. As Britain is home to a large Pakistani diaspora, the US use of drones in Pakistan, and the support the UK intelligence services provided to the US were

[1139] Dyson, "Managing Convergence. German Military Doctrine and Capabilities in the 21st century."p.10.

an important topic. At the same time, it can be assumed that the crucial cooperation with the US discouraged political stakeholders from taking strong stances. The Unmanned Revolution narrative was largely unimportant and did not influence British drone policy.

And yet, decision-makers in all three countries showed concern over the way drones captured public imagination. US roadmaps,[1140] UK doctrine notes[1141] and German guidelines[1142] noted the public interest – and anxieties – with regard to drones. The official concern about the impact of public opinion was, unsurprisingly, strongest in Germany. But it was followed closely by the UK, where the British military and political realm showed a surprising level of concern about public opinion, despite the comparatively tame public debate. Official documents warned that the "nature of remotely-piloted air systems means operations may attract adverse media attention",[1143] and concerns over controversial elements of Joint Doctrine Note 2/11 led to the doctrine being signed by a lower-level officer than usual. The renaming of the British Reapers into 'Protectors' also shows concern about public opposition. This points to a generally heightened sense of the impact of public opinion on policy in 21st century liberal democracies.

2. Lessons

Comparing the three cases and identifying the most fundamental changes caused by the introduction of drones, helps to identify changes that are specific to drones – and thus likely to happen in other countries that introduce UAVs into their military arsenal – and

[1140] Roadmap 2007-2032, p.48.
[1141] "The UK Approach to Unmanned Aircraft Systems, Joint Doctrine Note 2/11."p.2-1/2-2.
[1142] "Argumentationslinien zum Thema: Unbemannte Luftfahrzeugsysteme/Unmanned Aerial Systems (UAS)." p.52.
[1143] "Joint Doctrine Publication 0-30. UK Air and Space Doctrine ".p.3-11.

those changes that are country-specific, linked to the particular circumstances of the country.[1144]

2.1. The impact of drones on the individual soldiers' experience of warfare is a fundamental change caused by the introduction of drones

The above shows that the one change that was prevalent in all three countries was the fundamentally different experience of warfare by drone operators and those privy to the intelligence collected by drones. It can thus be assumed that this change is present in other drone-using armed forces. It appears likely that this change is also context-independent, meaning that it does not matter in which type of operation drones are being used.[1145]

The drone literature predicted this change in part, but underestimated some of its elements. The literature's focus has been on remote-split operation pilots, in particularly those that fly armed systems. But my research suggests that the increased battlespace awareness and the independence smaller ISR drones provide to Army soldiers are equally crucial. Thus, despite the big difference between the different types of systems, noted in chapter II, military drones in general appear to have a revolutionary impact on soldiers' combat experiences. The in-depth study of the use of drones has furthermore unearthed

[1144] There is no clearly formulated view in the RMA literature that changes need in fact to be transferable, or adopted by other countries, to be considered revolutionary, though Kagan suggests that RMAs tend to eventually be emulated by other actors. See Kagan, *Finding the target : the transformation of American military policy*. p.210. On the other hand, several past RMAs are country-specific.

[1145] There has been some speculation about whether drones are revolutionary in all contexts. Megan Braun has argued that drones do not represent a revolutionary change in warfare as their use and success is linked to the specific context and circumstances of the War on Terror. (See Megan Braun, "Predator Effect," in *Drone Wars*, ed. Peter Bergen and Daniel Rothenberg (New York: Cambridge University Press, 2014)). Sarah Kreps, Michael Horowitz and Matthew Fuhrmann have also tried to answer this question by looking at whether drones are transformative in four contexts: counterterrorism, interstate, intrastate, and nonstate actors. See Horowitz, Kreps, and Fuhrmann, "Separating Fact from Fiction in the Debate over Drone Proliferation."

some overlooked elements, such as the institutional memory provided by drone operators stationed outside the battlefield.

While the impact of drone operation on operators is a change present in all three case studies, there were country-specific elements to it. Most notably, in the US, the combination of long working hours, pressure due to psychologically taxing operations (most importantly targeted killings) and the perceived low level of recognition among the public and colleagues, shown most clearly by the debate on the drone pilots' medal, created a particularly difficult situation. US remote-split operators' experiences were also unique in the sense that they were flying over several different conflict zones, as Predators and Reapers were in use in several countries. This situation may become more usual for British pilots in the future as well. British pilots also worked long hours: "We flew the arses off these systems – they were in the air all the time", a Reaper operator noted.[1146] As British Reaper pilots were permanently in contact with groups on the ground, providing important support, there were fewer reports about internal criticism. German Air Force operators, who were deployed to Afghanistan, flying their systems by line-of-sight, spoke of the beneficial impact of being in country, both with regard to their work, and their acceptance within the troops.

2.2. Drones capture public imagination

The analysis of the media coverage and public debate on drone technology in the three countries has shown that there is something about drones that is capturing public imagination. 'Robotic weapons' are clearly fascinating to a public accustomed to science fiction about robot warfare. The media has been more than happy to speculate about

[1146] Interview anonymous Reaper pilot. April 2017. Also see Lee, "Submission to the APPG on Drones 12 June."

'Terminator weapons' – an approach admittedly made easy by drone names like 'Predator' or 'Reaper'. The focus on these two systems, "the glamorous face of UAVs",[1147] and (armed) Air Force systems in general, has been striking. In none of the countries did smaller, Army systems receive the same level of attention, despite having been used more widely. While there was interest in drones in all three countries, Germany has been the outlier with an extremely high level of interest and a particularly forceful debate.

2.3. The US drone use had a crucial impact on other countries' debates

The impact of the US targeted killings by drones on the debate and perception of drones in the other two countries cannot be overemphasised. The media analysis has shown that in Germany and the UK, the broader public got to know drones amidst the controversy of their use by the US for targeted killings, meaning that the technology was by many seen exclusively through these lenses. US drone use and the US debate was essential for Germany and the UK, albeit in different respects. While the German approach defined itself as much as possible in opposition to the US (the Ramstein cooperation notwithstanding), for the UK, the US was in many respects also the standard to measure itself against, despite its criticism of the US policy.

2.4. Drones are useful military tools

The study of the operations in Afghanistan and Pakistan confirms that drones – small and large, surveillance and armed – are useful military tools. Most systems that were introduced as urgent operational requirements stayed on considerably longer than planned. The ISR provided by drones has been extensive and exceptional. Larger systems have provided long-term surveillance as never seen before, which has allowed establishing

[1147] "Fear the Reaper: operators look beyond the current iconic UAV."

detailed pattern-of-life analyses. That remote-split operation pilots could remain 'deployed' for years while soldiers on the ground rotated every 6-9 months, helped establish an unusual kind of local knowledge. Smaller systems have provided valuable over-the-next-hill and over-the-compound-wall views, and helped troops to navigate in urban environments or close combat situations. This new ISR was most useful when it was received directly by troops on the ground. The deployment of small tactical teams, and the use of terminals that allowed ground troops to access these images were highly effective. While it is difficult to prove, it appears likely that this ISR has helped to save lives, not only of own troops but also civilians. The (bureaucratic) flexibility of operational-level drone systems has been emphasised by both German and British operators. Ultimately, the fact that smaller drones have generally attracted less attention appears to have benefited them: "Perhaps the real secret of the small drone's success is that it is not seen as an aircraft at all, just as an instrument for seeing over the hill. Big drones compete with the manned aircraft that they resemble, but for once, looking like a toy may be an advantage".[1148] It appears certain that in any future conflict, there will be a need for the type of ISR provided by drones.

An interesting finding was that, as it has been suggested by anti-drone activists, it appears indeed as if having ISR drones creates an interest in procuring armed systems, as shown in the German case.

2.4.1. Lessons for procurement und development

The research suggests that each of the three broad drone types (small, personal drones; tactical systems; MALE UAVs) have a role to play in a military operation. While the German

[1148] Hambling, *Swarm Troopers*. p.60.

case suggests that bigger systems, mainly thanks to their long endurance, can take on some of the role of tactical systems, the importance of bureaucratic flexibility of smaller, Army systems has been emphasised, thus giving tactical systems a raison d'être beyond the ISR they provide. Endurance is one of the most valuable characteristics of drones as it makes them more versatile. Manufacturers should focus on prolonging endurance even further, particularly in smaller systems.

An important finding emerging from the case studies is that a comparatively high number of UAVs are needed in order to have a meaningful military impact. Out of several hundred German and British UAVs, only a fraction was employed in Afghanistan at any one time due to the need for training and maintenance. Furthermore, many vehicles were destroyed in accidents or lost. This finding puts into perspective some of the concerns about current UAV proliferation, considering that many countries which currently procure UAVs do so in small numbers. The studies also showed that crashes and losses of drone vehicles are a problem even in an uncontested airspace. Incidents leading to loss of life during drone recovery missions reveal an understudied risk associated with drone operations.

2.5. More doctrinal and strategic thinking on drones is needed

The doctrinal documents studied in this thesis were all written whilst drones were already in operation. This is unusual: doctrine is typically written in peace time to prepare for war, and most military organisations spend years without reliable tests of their doctrinal capabilities.[1149] And yet, the documents appeared strangely removed from the actual drone use by the countries' armed forces. In all three countries, the available doctrinal

[1149] Barry Posen, "Foreword: Military doctrine and the management of uncertainty," *Journal of Strategic Studies* 39, no. 2 (2016). p.166.

and strategic writing was disappointing. In the US, the wealth of doctrinal writing appears to have hindered its implementation. The US' development of a revolutionary strategy for drone use appears to have been more incidental than deliberate,[1150] supporting Barry Posen's statement that doctrine is what is done rather than what is written. The British MoD seemed more comfortable theorising about autonomy and future use rather than today's systems, which may have been influenced by their aforementioned concern about public opinion. In Germany, there was little doctrinal and strategic thinking, which is likely both a result of the "doctrinal stagnation" and the heated public debate. While it was to be expected that US doctrinal and strategic documents would not draw lessons from the covert Pakistan operations, it is surprising how little lessons learnt in Afghanistan appeared in both German and British writing.

As of 2017, no drone doctrine similar to the 'Blitzkrieg' doctrine for tanks is in sight. But previous RMA experiences suggest that armed forces have much to gain from developing innovative UAV doctrines. Yet, there is a risk of complacency due to the overall positive operational experiences with drones. Whereas bad performances can create incentives for new uses,[1151] good experiences may create a level of contentment inhibiting doctrinal thinking.

2.6. Policy matters

2.6.1. Policy can reduce civilian casualties

Although more research is needed on this topic, and all insights into the US operations should be understood under the caveat the fact that the US operations were covert the

[1150] This statement can be mitigated by the fact that these operations were covert and there may have been more secret thinking.

[1151] Gilli and Gilli note that "Israeli truly devised how to fully exploit their drones only after their poor performance against Hezbollah in 2006." Gilli and Gilli, "The Diffusion of Drone Warfare? Industrial, Organizational, and Infrastructural Constraints."p.75.

study of the UK and US operations suggests that civilian casualties caused by drones are first and foremost a result of policy. The British zero-civilian-casualty policy appears to have resulted in considerably lower rates of civilian casualties than the US policy in Pakistan – although the different context, in particular with regard to the available intelligence needs to be taken into account. This finding is supported by the change in ISAF policies from 2007 onwards, which led to lower civilian casualty rates, including by US strikes.

2.6.2. Policy influences drone pilots

The way drones are used influences the pilot's experience. The difference in British and US Reaper pilots' experiences suggests that policy can mitigate occurrences of PTSD and other emotional stress. This is an important lesson for armed forces planning to employ drone pilots in remote-split operations and should be researched further.

3. Implications for the balance of power and International Relations more broadly

This PhD thesis has addressed the question of whether drones are revolutionising warfare and discussed the role that public opinion has played in this process. But beyond this specific question, the thesis's findings can help to discuss the impact that the introduction of military UAVs and their widespread use in conflicts around the world is having on the balance of power between international actors, and on international relations and its concepts more broadly.

3.1 Drones and the balance of power

Past RMAs have impacted the international balance of power in highly diverse ways. The tank and Blitzkrieg gave Germany only a temporary military advantage which did not last

even until the end of WWII. The introduction of nuclear weapons in the 1940s on the other hand is shaping the international system to this day, dividing the world into 'haves' (nuclear states, with NPT states having a seat in the Security Council of the United Nations) and 'have nots' (non-nuclear states). The continuous relevance of this division has been illustrated most recently by the conflicts between the US and Iran and North Korea.

Contrary to nuclear weapons, drones are likely to continue to proliferate, to the point where soon all militaries around the world will have some unmanned capability. The ISR advantages described in the German and UK case studies will thus be widely available to most armed forces, which means, ultimately, a levelled military playing field. It is also to be expected that it will become easier to arm smaller and less sophisticated systems. As of 2017, there are several initiatives to limit armed drone proliferation, and increase the transparency of their export,[1152] however, none of them is likely to substantially limit proliferation.

In addition to armament, drones carry a variety of payloads. As new impetuses from the civilian drone sector are likely, it is to be expected that military UAVs will also carry more diverse payloads and take on more roles. New developments can be expected in particular in the area of transport and logistics. In 2016, General Mark Milley, former commanding General of US Army Forces Command suggested that the future role for drones would be

[1152] Aaron Metha, "White house rolls out Armed Drone Declaration," *DefenseNews*, 5 October 2016.

in logistics,[1153] and the US Army Research Laboratory is working on an unmanned Joint Tactical Aerial Resupply Vehicle.[1154]

This suggests that the further proliferation of drones will in the medium-term lead to a re-balancing of the asymmetries that were caused by the initial introduction of drones by some armed forces. However, because of the proliferation of armed drones, more sophisticated anti-drone technology will be developed and deployed. Drones are vulnerable, and have been shot down by missiles[1155] and machine guns[1156] in the past, or brought down by hacking.[1157] The British MoD has cautioned that the drone lessons from the Afghanistan conflict might not be universally applicable, because Afghanistan had a permissive air space and a technologically unsophisticated adversary.[1158] Even in the uncontested Afghan air space, the British forces lost a significant number of drones. With increasing drone proliferation, anti-drone technology will equally rise. Today, almost 10% of US drone defence research and development funds already being invested in anti-drone technology.[1159] Future battlefields are likely to be littered with shot-down drones, and sophisticated anti-drone equipment will cause new military power asymmetries.

It is to be expected that the arming of drones will become easier, as already demonstrated by private individuals' arming of commercial drones.[1160] But while many countries will

[1153] Future of War Conference, New America Foundation, 10 March 2016, own notes.
[1154] David McNally, *Army flies 'hoverbike' prototype* (17 January 2017 [cited 22.12 2017]); available from https://www.army.mil/article/180682.
[1155] "Unmanned aerial vehicles: current developments and future utility," in *Military Balance 2008*, (International Institute for Strategic Studies, London 2008).p.455.
[1156] Ripley, "UAVs over Kosovo - did the Earth move?"
[1157] Adam Rawnsley, "Iran's alleged drone hack: tough, but possible," *Wired*, 16 December 2011.
[1158] "Remote Control: Remotely Piloted Air Systems – current and future UK use. Volume II Written evidence." p.Ev.w5.
[1159] Poponak et al., "Drones. Flying into the Mainstream."
[1160] Alex Lockie, "An 18-year-old mounted a gun to a drone and fired shots in the middle of the woods", Business Insider, 22 July 2015.

hence have access to some kind of armed drones, there are likely limits to the number of countries that will be willing and able to invest the necessary effort and money to acquire sophisticated drone systems.[1161] Thus, the difference between the 'have', and 'have nots' in the drone world, will not primarily between those that have drones and those that do not, or between those countries with armed drones, and those without, but between those states with the infrastructure and capabilities to carry out global UAV operations and those without. These states will be able to project power on a global scale – a capability most likely available primarily to the already leading military powers such as the US or China.

One type of player, however, is likely to benefit disproportionately from the availability of drones. Already today, non-state actors are enabled by highly capable yet cheap, off-the-shelf consumer drones. While groups such as Hezbollah have been using drones for over a decade, the instances of non-state drone use, including crudely armed systems ('drone IEDs'),[1162] have grown exponentially over the last two years. As of 2017, drones are being flown by non-state actors across the world's hotspots, from Ukrainian separatists to Daesh. It is for these non-state actors that drones represent the biggest game changer. Even well-equipped terrorist groups have generally lacked an air force; UAVs open a new sphere of operation by providing airborne capabilities. Given that threats from the air have been largely absent in the wars that Western troops have fought since 9/11, this adds a new psychological element and makes life for deployed troops more perilous. We are likely to see a series of action-reaction-counter-reactions: counter-UAV technology

[1161] As argued by Gilli and Gilli, "The Diffusion of Drone Warfare? Industrial, Organizational, and Infrastructural Constraints."
[1162] This is partly adapted from Ulrike Franke, "The bad with the good," *Drone360 Magazine* (2017). and Franke, "Flying IEDs: The next big threat."

and doctrines will be developed and fielded. Insurgents will find a way around them, and then the technology and doctrine will adapt once more.

Stopping a terrorist attack by drones in the civilian space is a particular challenge that goes beyond developing anti-drone technology for the military sphere. Drones carrying explosives can be sent to areas that have the highest potential for maximum destruction and detonated at the most opportune moment, with drones being even more mobile than suicide bombers. There is rising concern about attacks on civilian airliners.[1163] Drones may also become an assassination tool for high-value targets. In 2013, when a small Parrot AR drone crashed on a stage in front of German chancellor Angela Merkel, most observers found the incident amusing. Today, the reaction would likely be different.[1164]

Accordingly, 'No-Drone Zones' are being established around airports, sports stadiums, prisons, and during mass events.[1165] Some of these zones are merely legal barriers, to make it easier for law enforcement to interdict private drone use, others employ jammers or other interference technology.[1166] But countering small drones, particularly in urban areas, is difficult; even their detection is a challenge. In January 2015, a drunken hobbyist drone pilot crashed his drone on the White House lawn — undetected by a radar system designed to spot airplanes and missiles. Defence companies are working intensely on radars capable to sense and shoot down drones. Currently tested systems include lasers, jamming frequencies, microwave guns, deploying other drones armed with nets, and even trained eagles. Although high-casualty attacks are a possibility, the biggest threats from

[1163] David Hambling, "What Really Happens When a Drone Strikes an Airplane," *Popular mechanics*, 22 December 2016.
[1164] The drone had been sent by the Pirate Party to protest German military drone projects.
[1165] John Goglia, "FAA Announces Ridiculous 34.5 Mile Drone Restrictions For Super Bowl," *Forbes*, 3 February 2017.
[1166] "Anti-drone fence used in Guernsey prison," *BBC*, 13 May 2017.

terrorist drones will most likely be high costs and public terror. When a Hezbollah drone was sighted in Israel in April 2013, the country closed its airspace, sent up F-16 fighter jets, and shot the drone down using guided missiles. Such reactions against devices that non-state actors can procure cheaply are extremely costly.

3.2 Challenges to International Relations concepts

Drones are already contributing to a blurring of the boundaries between war and peace, a development that is likely to increase further. This is a development that has been observed in the international relations scholarship more broadly, and not solely linked to drones: Lucas Kello for instance speaks of "Unpeace" to describe the space in which most cyber-attacks take place, to emphasise the difficulty of clearly identifying attacks as acts of war.[1167]

Drones contribute to this in two ways. First, drone make warfare sustainable for a long time. At the time of writing, the US drone operations in Pakistan are entering into their fourteenth year, and the current US administration does not appear to have plans to end the programme.[1168] Because of their relative cheapness, these drone operations can be sustained almost indefinitely, leading to the possibility of low-level 'forever wars'. Drones also allow democracies – which tend to care more about casualties among their own forces than autocratic systems – to fight such unending wars. But if wars can be fought forever at little cost, the distinction between a state of war and a state of peace becomes meaningless.

[1167] Lucas Kello, *The Virtual Weapon and International Order,* Yale University Press, 2017. Also see Rosa Brooks, *How Everything Became War and the Military Became Everything*, Simon and Schuster, 2016.
[1168] Rebecca Gordon, "Forget 'America First'—Donald Trump's Policy Is Drones First", The Nation, 25 May 2018. Of course, as noted in the US case study, these operations are not fully-fledged military operations, but aerial operations only.

As discussed in chapter II, it is also possible that this will lead to an overall increased number of military operations. However, as proposed by the drone literature, this could also include an increase in humanitarian missions.[1169]

Drones contribute secondly to the blurring of the lines between war and peace by increasing plausible deniability of military operations. This is another parallel to cyber, where this phenomenon is even more pronounced. Because the drone's pilot(s) are not with the drone, its provenance, when shot down, is harder to determine, and harder to prove. This is further exemplified by the fact that, as in the US, drones' characteristics make them attractive for use by intelligence organisations and in covert operations. In this respect, drones are again part of a broader development that can be observed at the moment, from Russia's 'little green men' in Ukraine, to cyber-attacks and the debate over responsibility for the shooting down of flight MH17.

These developments in turn has implications for deterrence. As it becomes harder to identify the guilty parties/ the aggressors, fighting back is difficult. But deterrence is based on the ability to punish an aggressor. Also, it is difficult to find appropriate answers to aggressions short of war – such as cyber-attacks, but also territorial incursions with drones or drone attacks – which thus further undermines effective deterrence. It thus appears likely that international relations will be characterised increasingly by continuous, low-level conflicts of a growing number – not excluding, however, the danger of sudden escalation.

[1169] Zack Beauchamp and Julian Savulescu, "Robot Guardians: Teleoperated Combat Vehicles in Humanitarian Military Intervention," in *Killing by Remote Control. The Ethics of an Unmanned Military*, ed. Bradley Jay Strawser (Oxford: Oxford University Press 2013).

It is important to note that these developments are not primarily caused by drones. As discussed in chapter II, the stars aligned for drones around the turn of the millennium – because of technological breakthroughs, but also because the context of 9/11 and the ensuing Wars on Terror gave drones a particular importance and usefulness. Without this context, drones' development would likely have been different, while at the same time, without drones, these military operations would have been conducted differently. In the same way, drones are one element of the broader development that is leading to the aforementioned changes in international relations, from the increasing blurring of the difference between war and peace, to a weakening of deterrence. Drones contribute to these developments but are not the sole determining factor.

4. The future of military drones

Given the pace of technological changes, making predictions with regard to the long-term future for military drones is difficult. Adam Rothstein notes, "as different as the Lightning Bug is from the Predator, will the Predator be from future drones".[1170] Technologically, the next major technological step in drone technology is expected to be increasingly autonomous systems. A range of research and development projects (R&D) exist, from BAE's Taranis, Dassault's nEUROn to DARPA's latest research project on swarming.[1171] Many possibly revolutionary military developments – from swarms, to kill webs,[1172] and flying minefields – are imaginable. Accordingly, and unsurprisingly, many of the RMA claims made about drones are now being made about autonomous weapons. Activist groups work to halt the development of lethal autonomous weapon systems (LAWS).

[1170] Rothstein, *Drone*. p.72.
[1171] *Establishing the CODE for unmanned aircraft to fly as collaborative teams*, (2015 [cited 22.12 2017]); available from https://www.suasnews.com/2015/01/establishing-the-code-for-unmanned-aircraft-to-fly-as-collaborative-teams/.
[1172] Heather Roff, "Kill Webs: The Wicked Problem of Future Warfighting," *Duck of Minerva*, 21 June 2016.

Whether LAWS will indeed revolutionise warfare, and what role the increasing public interest is playing, should be the subject of further research.

5. Concluding remarks

The historian Daniel Boorstin once noted that "the true watersheds in human affairs are seldom spotted amid the tumult of headlines broadcast on the hour".[1173] Assessing the true importance of changes while they are happening is difficult, and errors of judgment are likely. This is particularly true with technology, which can sometimes be so awe-inspiring that the imagination runs away with it. With regard to drones, there has been so much fascination with the technology that few have taken the time to examine what changes drones have actually caused in the real world. This thesis has done just that. It cannot provide a definitive answer to whether drones are revolutionary, but has provided key elements to answer this question. Namely, it suggests that the most important, and possibly revolutionary changes, the introduction of drones has caused are social and consist in the change perception of warfare and combat by soldiers because of UAVs.

It is possible that it is still too early to make definitive statements about drones' revolutionary character. The major changes that have been observed appear to have been caused mainly by drones' existence, rather than by deliberate actions. It is possible that this observation is coloured by the fact that in hindsight, changes look more deliberate and thought-through than they appear to the contemporary observer. It is however also possible that more revolutionary drone use is yet to come.

This thesis has contributed to the drone literature, by studying elements of drone use that had previously been neglected, in particular the use of ISR drones in conventional conflicts

[1173] Quoted in Fuller, "The Eagle Comes Home to Roost: The Historical Origins of the CIA's Lethal Drone Program." p.769.

by countries other than the US. Several hypotheses and arguments formulated in the drone literature have been confirmed. Namely, as noted in chapter III, the drone literature considered two elements most important: the strategic and societal aspects, while neglecting operational and doctrinal change. It was indeed in these two areas that my research suggests the most fundamental changes have taken place.

In many areas, future research is needed. First and foremost, more work on other countries' experiences with UAVs would help to confirm this thesis' findings and further contribute to filling the gaps in the literature. It may also reveal other, country-specific, revolutionary changes caused by drone use. This thesis has found that the most important element of change caused by drones pertains to the experience of drone operators. More research on this topic is needed to establish the extent and further details of this change.

Thirteen years ago, Tim Benbow wondered whether the RMA had "transcended the status of buzz word and entered the 'done to death' category".[1174] This thesis serves as proof that the RMA remains a relevant concept and that there is value in applying the RMA concept when studying the introduction of a new – allegedly revolutionary – technology. The RMA concept has allowed to study not only the operational consequences of drone use, but allowed to look more broadly. As this study shows that the most fundamental changes of the introduction of military drone technology so far are social rather than military, this proves the value of the approach.

Ultimately, it does not matter if the reader comes to a different conclusion about the existence or otherwise of an Unmanned Revolution. But, based on the evidence gathered in this thesis, it is possible to state that drones are indeed causing revolutionary changes.

[1174] Benbow, *The Magic Bullet? Understanding the Revolution in Military Affairs*. p.9.

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Appendix

List of abbreviations

List of Abbreviations

ALADIN – *Abbildende Luftgestützte Aufklärungsdrohne im Nächstbereich* (German airborne reconnaissance drone for close area imaging)

ANG - Air National Guard (US)

APPG – All Party Parliamentary Group (British Parliament)

BIJ – Bureau of Investigative Journalism (UK)

BMVg – *Bundesministerium der Verteidigung* (German Ministry of Defence)

CAP – Combat Air Patrol

CCW – United Nations Convention on Certain Conventional Weapons

CIA – Central Intelligence Agency

DAR – *Drohne Anti-Radar* (Germany)

DARPA – Defense Advanced Research Project Agency (US)

DCDC – Development, Concepts, and Doctrine Centre (DCDC), UK Ministry of Defence think tank

DERA – Defence Evaluation and Research Agency (UK)

DoD – Department of Defence (US)

EADS – European Aeronautic, Defence and Space Company

EU – European Union

FOB – Forward Operating Basis

FOIA – Freedom of Information Act

FY – Financial Year

GCS – Ground Control Station

GSG9 – *Grenzschutzgruppe 9* (German counter-terrorism and special operations unit)

HALE – High Altitude Long Endurance UAV

HAT – Heeresaufklärungstruppe

IAI – Israel Aerospace Industry (Israeli defence company)

ICBM – Intercontinental Ballistic Missiles

IED – Improvised Explosive Device

IFOR/SFOR – Implementation Force, Stabilisation Force, Bosnia and Herzegovina

ISAF – International Security Assistance Force (NATO-led security mission in Afghanistan)

ISR – Intelligence, Surveillance, and Reconnaissance

ISTAR – Intelligence, Surveillance, Target Acquisition, and Reconnaissance

JDN – Joint Doctrine Note (UK)

JSOC – Joint Special Operations Command (US)

KDH – *Kampfdrohne Heer*

KFOR – Kosovo Force (since 1999)

KSK – *Kommando Spezialkräfte* (German Special Forces)

KZO – *Kleinfluggerät Zielordnung* (German small unmanned aircraft for target location)

LAWS – lethal autonomous weapon systems

LUNA – *Luftgestützte Unbemannte Nahaufklärungsausstattung* (German unmanned airborne reconnaissance system)

MALE – Medium Altitude Long Endurance UAV

MIKADO – *Mikroaufklärungsdrohne für den Ortsbereich* (German micro-drone for short range urban reconnaissance)

MoD – Ministry of Defence

NATO – North Atlantic Treaty Organisation

NGO – Non-governmental Organisation

PTSD – Posttraumatic Stress Syndrome

R&D – Research and Development

RAF – Royal Air Force

RCN – Regional Command North (Afghanistan)

RMA – Revolution in Military Affairs

RoE – Rules of Engagement

ROVER – Remotely Operated Video Enhanced Receiver

RPAS – Remotely Piloted Aerial System

RPV – Remotely Piloted Vehicle

SDSR – Strategic Defence and Security Review (UK)

SIGINT – Signals Intelligence

SIPRI – Stockholm International Peace Research Institute

SOCOM – Special Operations Command (US)

SOP – Standard Operating Procedures

SPON – *Spiegel Online*, German news website

TIC – Troops in Contact

UAS – Unmanned Aerial System

UAV – Unmanned Aerial Vehicle

UCAV – Unmanned Combat Air Vehicle

UGV – Unmanned Ground Vehicle

UN – United Nations

UNAMA – UN Assistance Mission in Afghanistan

UOR – Urgent Operational Requirement

USAF – US Air Force

USSR – Union of Soviet Socialist Republics

VTOL – Vertical take-off and landing systems

WoT – War on Terror